MDOT Use Only
Checked _____
Loaded _____
Keyed _____

SM No. CBWO9018250051

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

(EXEMPT)

6
Construction necessary for HVAC System upgrades at the Jackson Shop Complex and the MDOT Administration Building, known as State Project Nos. BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301, in the County of Hinds, State of Mississippi.
Project Completion: February 28, 2010

NOTICE

BIDDERS MUST PURCHASE A BOUND PROPOSAL
FROM MDOT CONTRACT ADMINISTRATION DIVISION
TO BID ON THIS PROJECT.

Electronic addendum updates will be posted on www.goMDOT.com

SECTION 900

OF THE CURRENT
(2004) STANDARD SPECIFICATIONS
FOR ROAD AND BRIDGE CONSTRUCTION
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
JACKSON, MISSISSIPPI

BIDDER CHECK LIST
(FOR INFORMATION ONLY)

_____ All unit prices and item totals have been entered in accordance with Subsection 102.06 of the Mississippi Standard Specifications for Road and Bridge Construction.

_____ If the bid sheets were prepared using MDOT's Electronic Bid System, proposal sheets have been stapled and inserted into the proposal package.

_____ First sheet of SECTION 905--PROPOSAL has been completed.

_____ Second sheet of SECTION 905--PROPOSAL has been completed and signed.

_____ Addenda, if any, have been acknowledged. Second sheet of Section 905 listing the addendum number has been substituted for the original second sheet of Section 905. Substituted second sheet of Section 905 has been properly completed, signed, and added to the proposal.

_____ DBE/WBE percentage, when required by contract, has been entered on last sheet of the bid sheets of SECTION 905 - PROPOSAL.

_____ Form OCR-485, when required by contract, has been completed and signed.

_____ The last sheet of the bid sheets of SECTION 905--PROPOSAL has been signed.

_____ Combination Bid Proposal of SECTION 905--PROPOSAL has been completed for each project which is to be considered in combination (See Subsection 102.11).

_____ Equal Opportunity Clause Certification, when included in contract, has been completed and signed.

_____ The Certification regarding Non-Collusion, Debarment and Suspension, etc. has been executed in duplicate.

_____ A certified check, cashier's check or bid bond payable to the State of Mississippi in the principal amount of 5% of the bid has been included with project number identified on same. Bid bond has been signed by the bidder and has also been signed or countersigned by a Mississippi Resident Agent for the Surety with Power of Attorney attached.

_____ Non-resident Bidders: ON STATE FUNDED PROJECTS ONLY, a copy of the current laws regarding any preference for local Contractors from State wherein domiciled has been included. See Subsection 103.01, Mississippi Standard Specifications for Road and Bridge Construction, and Section 31-7-47, MCA, 1972 regarding this matter.

Return the proposal and contract documents in its entirety in a sealed envelope. DO NOT remove any part of the contract documents; exception - an addendum requires substitution of second sheet of Section 905. A stripped proposal is considered as an irregular bid and will be rejected.

Failure to complete any or all of the applicable requirements will be cause for the proposal to be considered irregular.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

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PROJECT: **HVAC UPGRADES TO SHOP COMPLEX AND ADMINISTRATION BUILDING AT JACKSON, HINDS COUNTY, MISSISSIPPI**

PROJECT NUMBERS: **BWO-9018-25(005) 501918**
BWO-9021-25(006) 501919

DATE: **OCTOBER 6, 2008**

DESCRIPTION A: This Work shall consist of minor site work and all construction work necessary in constructing HVAC Upgrades to Shop Complex at Jackson, Hinds County, Mississippi, Project No. BWO-9018-25(005) 501918, in accordance with these Specifications and conforming to the Drawings.

DESCRIPTION B: This Work shall consist of all construction work necessary in constructing HVAC Upgrades to Administration Building at Jackson, Hinds County, Mississippi, Project No. BWO-9021-25(006) 501919, in accordance with these Specifications and conforming to the Drawings

It is the intention of these Specifications to provide the necessary items and instruction for a complete HVAC System Upgrades including all code compliance. Omission of items or instruction necessary or considered standard good practice for the proper installation and construction of the HVAC System Upgrades shall not relieve the Contractor of furnishing and installing such items and conforming to the building codes having jurisdiction.

(REVISIONS TO THE ABOVE WILL BE INDICATED ON THE SECOND SHEET OF SECTION 905 AS ADDENDA)

END OF SECTION

LIST OF DRAWING SHEETS
SECTION 00 01 15

WORKING NUMBER	SHEET NUMBER	DESCRIPTION
-----	1	TITLE SHEET
DI-1	2	DETAILED INDEX
A1.1	3	SITE PLAN
AS1.2	4	EQUIPMENT SHED PLAN, SECTION AND DETAILS
AS2.1	5	EQUIPMENT SHED ELEVATIONS
AW1.2	6	WAREHOUSE FLOOR PLAN
AW2.1	7	WAREHOUSE BUILDING ELEVATIONS – SOUTH AND WEST
AW2.2	8	WAREHOUSE BUILDING ELEVATIONS – NORTH AND EAST
AW3.1	9	WAREHOUSE BUILDING SECTION
A5.1	10	DOOR AND LOUVER DETAILS
A6.1	11	SCHEDULE
SW1.1	12	WAREHOUSE FOUNDATION PLAN
SW5.1	13	WAREHOUSE FOUNDATION DETAILS
M0.1	14	MECHANICAL LEGEND, ABBREVIATIONS, AND GENERAL NOTES
M1.0	15	SITE PLAN - MECHANICAL
M2.1	16	WAREHOUSE FLOOR PLAN – MECHANICAL
M3.1	17	MECHANICAL SCHEDULES AND DETAILS
E0.1	18	ELECTRICAL LEGEND, ABBREVIATIONS, AND GENERAL NOTES
E1.0	19	SITE PLAN – ELECTRICAL
E2.1	20	WAREHOUSE FLOOR PLAN – ELECTRICAL
E2.2	21	EQUIPMENT SHED – ELECTRICAL
E3.1	22	ELECTRICAL DETAILS, POWER RISER & SCHEDULES

END OF SECTION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

ADVERTISEMENT FOR BIDS
SECTION 00 11 13

Sealed bids will be received by the Mississippi Transportation Commission in the Office of the Contract Administration Engineer, Mississippi Department of Transportation Office Building, Jackson, Mississippi, until 9:30 o'clock A.M., Tuesday, March 24, 2009. Thereafter bids will be received in the First Floor Auditorium of the Mississippi Department of Transportation Office Building, Jackson, Mississippi, until 10:00 o'clock A.M., Tuesday, March 24, 2009, and shortly thereafter publicly opened for

Construction necessary in constructing HVAC Upgrades to Jackson Shop Complex in Jackson, Hinds County, Mississippi, known as Project No. BWO-9018-25(005) 501918 and HVAC Upgrades to MDOT Administration Building in Jackson, Hinds County, Mississippi, known as Project No. BWO-9021-25(006) 501919.

The attention of bidders is directed to the Contract Provisions governing selection and employment of labor. Minimum wage rates have been predetermined by the Secretary of Labor and are subject to Public Law 87-581, Work Hours Act of 1962, as set forth in the Contract Provisions.

The Mississippi Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, sex, religion or national origin in consideration for an award.

Drawings and Specifications are on file in the offices of the Mississippi Department of Transportation at Newton and Jackson.

Bid or specimen proposals must be acquired from the Contract Administration Engineer Division, First Floor of Mississippi Department of Transportation Office Building, Telephone (601) 359-7744. These proposals are available at a cost of Ten Dollars ($10.00) per proposal.

Plans may be acquired on a cost per sheet basis from MDOT Shop Complex, 2567 North West Street, Building C, Room 114, Jackson, Mississippi 39216, Telephone (601) 359-7460, FAX (601) 359-7461, E-mail plans@mdot.state.ms.us.

Bid Bond, signed or countersigned by a Mississippi Resident Agent, with Power of Attorney attached or on file with the Contract Administration Engineer of the Department, a Cashier's check or Certified Check for five (5%) percent of bid, payable to STATE OF MISSISSIPPI, must accompany each proposal.

The attention of bidders is directed to the provisions of Document 00200 - Instructions to Bidders pertaining to irregular proposals and rejection of bids.

LARRY L."BUTCH" BROWN
EXECUTIVE DIRECTOR

(SPWP)

END OF SECTION

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS
SECTION 00 22 13

Part 1 GENERAL

1.01 **WORK IN PROXIMITY OF HIGH VOLTAGE POWER LINES:** Bidders are hereby advised of Section 45-15-1, et seq., Mississippi Code of 1972, regarding the performance of work in the proximity of high voltage overhead power lines. It is the Contractor's responsibility to comply with those statutory requirements.

1.02 **AGENCY, COMMISSION AND OFFICER NAME CHANGES**

A. Whenever the term "Mississippi State Highway Department", the word "Department", or variations thereof meaning the Mississippi State Highway Department appears in the plans, proposal, contract documents, and specifications for highway construction projects, in accordance with the laws of the State of Mississippi, it shall mean the "Mississippi Department of Transportation.

B. Whenever the term "Mississippi State Highway Commission", the word "Commission", or variations thereof meaning the Mississippi State Highway Commission appears in the plans, proposal, contract documents, and specifications for highway construction projects, in accordance with the laws of the State of Mississippi, it shall mean the "Mississippi Transportation Commission".

C. Whenever the term "Director", or variations thereof meaning the Chief Administrative Officer of the State Highway Department appears in the plans, proposal, contract documents, and specifications for highway construction projects, in accordance with the laws of the State of Mississippi, it shall mean the "Executive Director of the Mississippi Department of Transportation."

1.03 **PLANT PEST QUARANTINES INFORMATION:** AT the request of the U. S. Department of Agriculture, Plant Pest Control Information Concerning Domestic Quarantines is cited as follows:

A. The entire state of Mississippi has been quarantined for the Imported Fire Ants. Soil and soil-moving equipment operating in the state will be subject to plant quarantine regulations. In general, these regulations provide for cleaning soil from equipment before it is moved from the state. Complete information may be secured from the State of Mississippi Department of Agriculture and commerce, Bureau of Plant Industry, P.O. Box 5207, Mississippi State, Mississippi 39762-5207 – Telephone 325-3390.

IMPORTED FIRE AN QUARANTINES

THE FOLLOWING REGULATED ARTICLES REQUIRE A CERTIFICATE OR PERMIT FOR MOVEMENT:

1. Soil, separately or with other things, except soil samples shipped to approved laboratories*. Potting soil is exempt, if commercially prepared, packaged and shipped in original containers.
2. Plants with roots with soil attached, except houseplants maintained indoors and not for sale.
3. Grass sod.
4. Baled hay and straw that have been stored in contact with the soil.
5. Used soil-moving equipment.

6. Any other products, articles, or means of conveyance of any character whatsoever not covered by the above, when it is determined by an inspector that they present a hazard of spread of the imported fire ant and the person in possession thereof has been so notified.

* Information as to designated laboratories, facilities, gins, oil mils, and processing plants may be obtained from an inspector.

Consult your State or Federal plant protection Inspector or your county agent for assistance regarding exact areas under regulation and requirements for moving regulated articles. For detailed information see 7 CFR 301.81 for quarantine and regulations.

1.04 **FEDERAL BRIDGE FORMULA**

A. Bidders are hereby advised that Federal Highway Administration Publication No. FHWA-MC-94-007, **BRIDGE FORMULA WEIGHTS**, dated January 1994, is made a part of this contract when applicable.

Prior to the preconstruction conference, the Contractor shall advise the Engineer, in writing, what materials, if any, will be delivered to the jobsite via Interstate route(s).

Copies of the **BRIDGE FORMULA WEIGHTS** publication may be obtained by contacting:

Federal Highway Administration
400 7th Street, SW
Washington, DC 20590
(202) 366-2212
or
http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm

1.05 **FUEL TAX APPLICABILITY TO BIDDERS AND CONTRACTORS:** Bidders are hereby advised that the Mississippi Code of 1972, section 27-55-301 et seq. requires the use of taxed diesel fuel used in performing contracts for construction, reconstruction, maintenance, or repair where such contracts are entered into with the State of Mississippi, any agency, department, institution, or political subdivision thereof. Section 27-55-313 reads as follows:

A. A tax at the rate of Eighteen Cents (18¢) per gallon until the date specified in Section 65-39-35, and Fourteen and Three-fourths Cents (14.75¢) per gallon thereafter, is levied upon any delivering other motor fuel to a retail dealer, user or any other person for use in propelling motor vehicles on the highways of this state and/or for the privilege of engaging in the business of selling and delivering other motor fuel to any other person who purchases or uses other motor fuel in performing contracts for construction, reconstruction, maintenance or repairs, where such contracts are entered into with the State of Mississippi, any political subdivision of the State of Mississippi, or any department, agency or institution of the State of Mississippi or any political subdivision thereof.

B. A tax at the rate described in this section is hereby levied upon any person who purchases, receives or acquires any other motor fuel upon which the tax has not been paid when such other motor fuel is used for any taxable purpose as set forth in this article. A tax at the rate described in this section is hereby levied upon any retailer who purchases, receives, or acquires any other motor fuel upon which the tax has not been paid when such other motor fuel is sold for use or used for any taxable purpose as set forth in this article.

C. The commission may adopt rules and regulations providing for the issuance of permits to persons performing contracts as hereinabove provided, allowing or requiring said persons to purchase other motor fuel for use in performing said contracts without the payment to the distributor of the tax imposed hereunder, and providing for such persons to report and pay such tax directly to the commission in instances where the commission determines that such payment will facilitate and expedite the collection of the tax which may be due on such purchases by the permittee. The distributor is relieved of collecting and remitting the taxes specified hereunder, when furnished with a copy of said permit, and the person holding the permit shall become liable for such taxes instead of the seller, and the full enforcement provisions of this article shall apply in the collection of the tax from the permittee. The commission may require said person to execute and file with the commission a good and valid bond in a surety company authorized to do business in this state, or with sufficient sureties to be approved by the commission, conditioned that all taxes which may accrue to the State of Mississippi under the provisions of this chapter will be paid when due. Provided further, the commission may accept a bond filed under the provision of Section 27-65-21, when such bond is conditioned upon the payment of taxes hereunder.

D. Any person who shall, while not licensed as a distributor of other motor fuel or retail dealer, sell or deliver to other persons any other motor fuel upon which the tax levied by this article has not been paid shall be liable for the tax and penalties imposed by this article if the person selling or delivering such fuel knows or has reason to know that it will be used or sold for a taxable purpose.

E. A retail dealer may, with the approval of the commission, sell or dispense tax free other motor fuel. Said retailer shall comply with all rules and regulations pertaining to retailers selling or dispensing tax free other motor fuel. The commission may require said retailer to execute and file with the commission a good and valid bond, in a surety company authorized to do business in the state, conditioned that all taxes which may accrue to the State of Mississippi under the provisions of this chapter will be paid when due. Storage tanks or pumps located at all such retail dealers' place of business which are used or to be used in storing and dispensing kerosene for lamps, stoves, heaters and domestic purposes shall bear the label "not for highway use" of letters of not less than four (4) inches in height.

F. When other motor fuel on which the full tax under this section has been paid has been Delivered to a retail dealer for sale or to a consumer for use as motor fuel for operating a motor vehicle upon the highways of this state, the distributor of other motor fuel who made said tax payments and deliveries may pick up and return to his bulk storage facility any portion of such other motor fuel which may be unused and claim credit for the amount of tax paid on the quantity so returned. In order to claim credit for the tax on the quantity of other motor fuel to be so returned, such distributor shall notify the commission of his desire to so return it. Such transaction shall only be made under the supervision of the commission.

G. When dyed diesel fuel and clear diesel fuel are accidentally mixed and the mixture is converted to nonhighway use diesel fuel, the distributor or other person owning such mixture may claim credit for the highway portion of the tax paid on such mixture. Proof satisfactory to the distributor or other person owning such mixture shall notify the commission immediately after gaining knowledge that such accidental mixture has occurred.

Bidders/Contractors are required to comply with the provisions of said section, and any revisions or amendments thereto, for all work performed under this contract; and be able to substantiate compliance when requested by the Mississippi Department of Transportation or the Mississippi State Tax Commission.

1.06 **PROMPT PAYMENT**

A. Bidders are hereby advised that the Prime Contractor must pay their subcontractor(s) for satisfactory performance of their contracts no later than a specific number of days from receipt of payment from the Department. Therefore, Prime Contractors are hereby advised of the following:

1. Within 15 calendar days after receiving payment from the Department for work satisfactorily performed, the Prime Contractor shall make prompt payment to all sub-contractors or material suppliers for all monies due.
2. Within 15 calendar days after receiving payment from the Department for work satisfactorily completed, the Prime Contractor shall promptly return all retainage monies due to all sub-contractors or material suppliers.
3. The Engineer will have the authority to suspend the Work wholly or in part and to withhold payments because of the Contractor's failure to make prompt payment within 15 calendar days as required above, or failure to submit the required OCR-484 Form, "Certification of Payments to Subcontractors", which is also designed to comply with prompt payment requirements.

1.07 **ALTERATIONS IN BIDDING PROCESS**

A. Bidders are hereby advised that they may either use the traditional method of entering their Bid information by hand on Section 905--Proposal or may insert printed information obtained from the available Electronic Bid System (EBS).

B. It is the responsibility of every bidder to check for any addendum or modification to the contract document(s) for which they intend to submit a response. It shall be the bidder's responsibility to be sure they are in receipt of all addenda, pre-bid conference information, and/or questions and answers provided at, or subsequent to, the pre-bid conference, if any are issued.

The Mississippi Transportation Commission assumes no responsibility for defects, irregularities or other problems caused by the use of electronic media. Operation of this electronic media is done at the sole risk of the user.

1.08 **CONTRACT TIME**

A. It is anticipated that the Notice to Award will be issued by not later than April 14, 2009, and the date for Notice to Proceed and Beginning of Contract Time will be May 7, 2009.

B. The calendar date for completion of this Contract shall be February 28, 2010 which date or extended date as provided in Article 8 – TIME shall be the end of contract time.

C. A Construction Schedule as described in Section 01 32 00-Construction Progress Documentation of these Specifications will be required.

1.09 **SUBCONTRACTING**

The Bidder is specifically advised that any person, firm or other party to whom it proposes to award a subcontract must be acceptable to the Owner. The total allowable subcontract amount shall not exceed **sixty percent (60%) of the Contract Sum.**

END OF SECTION

PROPOSAL
SECTION 00 42 00

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, SECTION 905 PROPOSAL for the Proposal Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 .Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

BID SECURITY FORM
SECTION 00 43 13

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, BOND FORM, for Bid Bond Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 - Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

STATE NON-COLLUSION CERTIFICATE
SECTION 00 45 19

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, CERTIFICATION, for State Non-Collusion Certificate Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 .Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

STATE BOARD OF CONTRACTORS REQUIREMENTS
SECTION 00 45 47

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, CERTIFICATE, for State Board of Contractors Requirements Certificate Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 .Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

AGREEMENT
SECTION 00 52 00

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, SECTION 902 CONTRACT FORM, for Contract (Agreement) Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 - Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

BOND FORMS
SECTION 00 61 00

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 50, SECTION 903 CONTRACT BOND FORM, for Contract Bond Form. The form is bound in the back of the Project Manual.

B. Comply with requirements in Section 00 21 13 - Instructions to Bidders.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

GENERAL CONDITIONS
SECTION 00 72 00

Part 1 GENERAL

1.01 DESCRIPTION.

A. The American Institute of Architects **AIA DOCUMENT A201-1997**, "General Conditions of the Contract for Construction", 1997, Fifteenth Edition, Articles 1 through 14 inclusive, except as may be added to or modified herein, is hereby made a part of the Contract Documents. For brevity, **AIA DOCUMENT A201-1997** is also referred to in the Contract documents as the "General Conditions".

B. All persons intending to provide goods or services in connection with this Work are required to read and understand the referenced document prior to proceeding.

C. See Document 00800-*Supplementary Conditions.* In the event of a conflict between the **AIA DOCUMENT A201-1997,** "General Conditions of the Contract for Construction", 1997, Fifteenth Edition and Document 00800-*Supplementary Conditions,* Document 00800 shall control even if the conflicting provision in the **AIA DOCUMENT A201-1997** "General Conditions of the Contract for Construction" is not expressly deleted or revised by reference in Document 00800.

GENERAL CONDITIONS
SECTION 00 72 00

Part 1 GENERAL

1.01 DESCRIPTION.

A. The American Institute of Architects **AIA DOCUMENT A201-1997**, "General Conditions of the Contract for Construction", 1997, Fifteenth Edition, Articles 1 through 14 inclusive, except as may be added to or modified herein, is hereby made a part of the Contract Documents. For brevity, **AIA DOCUMENT A201-1997** is also referred to in the Contract documents as the "General Conditions".

B. All persons intending to provide goods or services in connection with this Work are required to read and understand the referenced document prior to proceeding.

C. See Document 00800-*Supplementary Conditions.* In the event of a conflict between the **AIA DOCUMENT A201-1997,** "General Conditions of the Contract for Construction", 1997, Fifteenth Edition and Document 00800-*Supplementary Conditions,* Document 00800 shall control even if the conflicting provision in the **AIA DOCUMENT A201-1997** "General Conditions of the Contract for Construction" is not expressly deleted or revised by reference in Document 00800.

AIA® Document A201™ – 1997

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address):
BWO-9018-25(005) 501918 & BWO-9021-25(006) 501919
HVAC UPGRADES TO SHOP COMPLEX AND ADMINISTRATION BUILDING
JACKSON, HINDS COUNTY, MISSISSIPPI

THE OWNER:
(Name and address):

THE ARCHITECT:
(Name and address):

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document has been approved and endorsed by The Associated General Contractors of America

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(Numbers and Topics in Bold are Section Headings)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume

the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be

required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may

be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that

the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a separate contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect,

stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the

Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations; and

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction

of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the

Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an

additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

Additions and Deletions Report for
AIA® Document A201™ – 1997

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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PAGE 1

BWO-9018-25(005) 501918 & BWO-9021-25(006) 501919
HVAC UPGRADES TO SHOP COMPLEX AND ADMINISTRATION BUILDING
JACKSON, HINDS COUNTY, MISSISSIPPI

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, JAMES W. VINSON, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:25:36 on 10/15/2008 under Order No. 1000358679_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 1997 - General Conditions of the Contract for Construction, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

James W Vinson

(Signed)

MDOT Architect

(Title)

10-06-08

(Dated)

SUPPLEMENTARY CONDITIONS
SECTION 00 73 00

SUMMARY

1.01 DESCRIPTION

A. **Owner:** These supplements are necessary because the Owner is an agency, or political subdivision, of the State of Mississippi and occupies a different position from that of the usual Owner.

B. **Document:** The following supplements modify, change, delete from, or add to the **AIA DOCUMENT A201-1997**, "General Conditions of the Contract for Construction", 1997, Fifteenth Edition. When any Article of the General Conditions is modified, or deleted, by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause will remain in effect. The "General Conditions of the Contract for Construction" may also be supplemented or amplified elsewhere in the Contract Documents by provisions located in, but not necessarily limited to, Division 1 of the Specifications.

1.02 Verification Of Dimensions: Before ordering any materials or doing any work, the Contractor shall verify the dimensions and shall be responsible for the accuracy of such dimensions as they affect the Work. No extra compensation will be allowed on account of differences between the dimensions shown on the Drawings and actual dimensions.

1.03 Plans And Specifications: The Specifications and the Drawings are intended to be in agreement with each other, and to be mutually explanatory. They are also intended to be complementary and any Work or material called for by either shall be provided as if called for by both.

1.04 Execution Of The Work: Sections of Division 1 General Requirements govern the execution of the Work of all Sections 2-16 of the Specifications.

1.05 Workmanship: All Work as described or required shall be executed in a neat, skillful manner, in accordance with the best-recognized trade practice. Only competent workmen (including the superintendent), who work and perform their duties satisfactorily shall be employed on the Project. When requested by the Project Engineer, the Contractor shall discharge and shall not re-employ on the Project, any person who commits trespass or who is, in the opinion of the Project Engineer, dangerous, disorderly, insubordinate, incompetent, or otherwise objectionable.

1.06 Use Of Site And Facilities: Contractor shall not allow tradesman, technicians and laborers to enter other portions of existing facilities except as predetermined and approved by the Project Engineer. Existing utilities shall not be interrupted unless pre-approved by the Project Engineer. Parking for construction vehicles shall be in areas designated by the Owner at the Pre-construction Conference.

1.07 Utilities: The Owner will furnish utilities for construction (electricity and water). Contractor must use "as- is" or pay for any necessary modifications.

1.08 Inspection Of Work: All materials and each part or detail of the Work are subject to inspection by the Project Engineer. Work performed or materials used by the Contractor without supervision, inspection, or written approval by an authorized Department representative may be ordered removed and replaced, at Contractor's expense, if found to be defective or noncompliant with the Contract Documents. No Work shall be preformed on Legal Holidays, Sundays or after 5:00 P.M. on week days without prior written approval from the Project Engineer.

Article 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 **The Contract Documents**: Delete the last sentence of this Subparagraph and substitute following sentence:

The Contract Documents include the Advertisement for Bids, Instructions to Bidders, Notice to Bidders, Proposal Form, sample forms and all portions of addenda issued prior to execution of the Contract.

1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATION AND OTHER INSTRUMENTS OF SERVICE

1.6.1 Add a new sentence at the end of this Subparagraph:

This Paragraph in no way supersedes the Owner's document rights set forth in the "Engineering Services Contract" Agreement Between the Owner and the Professional.

Article 2 OWNER

2.1 GENERAL

2.1.1 Change this Subparagraph to read as follows:

The Owner, as used in these Documents, refers to the Mississippi Transportation Commission, a body Corporate of the State of Mississippi, acting by and through the duly authorized Executive Director of the Mississippi Department of Transportation for the benefit of the Department for which the Work under this Contract is being performed. The Owner is the entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner's representative, who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization, is the individual who signed the Construction Contract for the Owner. The term "Owner" means the Owner or the Owner's authorized representative.

2.2.5 Change this Subparagraph to read as follows:

After the Contract is executed by the Executive Director, the Contractor will receive free of charge two bound copies of the Project Manual (Proposal and Contract Documents) (one executed and one blank), and five full-scale copies of the Drawings and two half-scale copies. The Contractor shall have available on the Project Site at all times one copy each of the Contract Drawings and the Project Manual (Proposal).

Article 3 CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 Change the last sentence to read as follows:

If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner and Professional shall be responsible for any resulting loss or damage.

3.18 INDEMNIFICATION

3.18.3 Add a new Subparagraph as follows:

The Contractor agrees to defend, hold harmless and indemnify the Owner against all claims or demands caused by the Contractor's acts or omissions.

Article 4 ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

4.1.4 Add a new Subparagraph as follows:

The term "Architect," "Engineer," "Professional", or "Consultant" as used in these Documents refers to the Professional firm who has been directed by the Owner to design and inspect construction of this Project.

4.1.5 Add a new Subparagraph as follows:

The term "Project Engineer" as used in these Documents refers to the Mississippi Department of Transportation Executive Director's authorized representative. The term "MDOT Architect" is the representative for the MDOT Architectural Services Unit and is an advisor to the Project Engineer.

4.5 MEDIATION

4.5.1 Delete this Subparagraph in its entirety.

4.5.2 Delete this Subparagraph in its entirety.

4.5.3 Delete this Subparagraph in its entirety.

4.6 ARBITRATION

4.6.1 Delete this Subparagraph in its entirety.

4.6.2 Delete this Subparagraph in its entirety.

4.6.3 Delete this Subparagraph in its entirety.

4.6.4 Delete this Subparagraph in its entirety.

4.6.5 Delete this Subparagraph in its entirety.

4.6.6 Delete this Subparagraph in its entirety.

4.7 Add a new Paragraph as follows:

ARBITRATION PROCEDURES FOR THE MISSISSIPPI TRANSPORTATION COMMISSION

All matters of dispute arising out of any agreement with the Mississippi Transportation Commission for planning, design, engineering, construction, erection, repair, or alteration of any building, structure, fixture, road, highway, utility or any part thereof, or any agreement with the Mississippi Transportation Commission for architectural, engineering, surveying, planning, and related professional services which provides for mediation or arbitration, shall comply with the following course for resolution. No arbitration hearing shall be granted on any claim in excess of One Hundred Thousand Dollars ($100,000.00).

4.7.1 Add a new Subparagraph as follows:

CONDITIONS PRECEDENT TO ARBITRATION

.1 The aggrieved party must first notify opposing party in writing in detail of the matter(s) in dispute, the amount involved and the remedy sought. Such writing shall include copies of any documents, writings, plans, or other matter pertinent to the resolution of the dispute. The Chief Engineer of the Mississippi Department of Transportation, or his authorized representative, and a principal of the opposing party shall be the proper parties for such notice and shall be active parties in any subsequent dispute resolution.

.2 If the dispute cannot be satisfactorily resolved, within thirty (30) days of the complaint being rejected in writing by either party, notice by certified mail shall be given to the Project Engineer. A copy of the notice shall be sent by certified mail to the opposing party. Such notice shall be in writing setting forth in detail the matter(s) in dispute, the amount involved, the remedy sought and state that informal resolution between the parties cannot be reached. Such writing shall include copies of any documents, writings, plans, or other matter pertinent to the resolution of the dispute. Opposing party shall have the opportunity to set forth in writing a rebuttal with pertinent documents attached. At the sole discretion of the Project Engineer, oral testimony may be had on the matter.

4.7.2 Add a new Subparagraph as follows:

REQUESTS FOR ARBITRATION: Within thirty (30) days of a claim being rejected in writing by the Project Engineer, either party may request arbitration. Notices for requests for arbitration shall be made in writing to the Chief Engineer of the Mississippi Department of Transportation, P. O. Box 1850, Jackson, Mississippi 39215-1850. Such notice shall set forth in detail the matter(s) in dispute, the amount involved, and the remedy sought. A copy of the request shall be mailed to the opposite party. The party requesting arbitration must deposit the sum of two hundred dollars ($200.00) with its request as a deposit against costs incurred by the arbitrators. Each party will be notified in writing in any manner provided by law of certified mail not less than twenty (20) days before the hearing of the date, time and place for the hearing. Appearance at the hearing waives a party's right to notice.

4.7.3 Add a new Subparagraph as follows:

SELECTION OF ARBITRATORS: Upon request for arbitration, a panel of three (3) arbitrators shall be chosen. The Chief Engineer of the Mississippi Department of Transportation shall appoint one (1) member. One (1) member shall be appointed by the Executive Director of a professional or trade association that represents interests similar to that of the non-state party. The first two shall appoint the third member.

4.7.4 Add a new Subparagraph as follows:

HEARINGS: All hearings shall be open to the public. All hearings will be held in Jackson, Mississippi, unless the parties mutually agree to another location. The hearings shall be conducted as prescribed by **Mississippi Code 1972, Annotated**, Sections 11-15-113, 11-15-115, and 11-15-117. A full and complete record of all proceedings shall be taken by a certified court reporter. The scheduling and cost of retaining the court reporter shall be the responsibility of the party requesting arbitration. The costs of transcription of the record shall be the responsibility of the party requesting such transcript. No arbitration hearing shall be held without a certified court reporter. Deliberations of the arbitrators shall not be part of the record.

4.7.5 Add a new Subparagraph as follows:

AWARDS: Awards shall be made in writing and signed by the arbitrators joining in the award. A copy of the award shall be delivered to the parties by certified mail.

4.7.6 Add a new Subparagraph as follows:

FEES AND EXPENSES: Reasonable fees and expenses, excluding counsel fees, incurred in the conduct of the arbitration shall be at the discretion of the Arbitrator except each party shall bear its own attorney's fees and costs of expert witnesses.

4.7.7 Add a new Subparagraph as follows:

MODIFICATIONS, CONFIRMATIONS, AND APPEALS: All modifications, confirmations and appeals shall be as prescribed by **Mississippi Code 1972, Annotated**, Section 11-15-123 et seq. All awards shall be reduced to judgment and satisfied in the same manner other judgments against the State are satisfied.

4.7.8 Add a new Subparagraph as follows:

SECRETARY FOR THE ARBITRATORS: All notices, requests, or other correspondence intended for the arbitrators shall be sent to the Chief Engineer, Mississippi Department of Transportation, P. O. Box 1850, Jackson, Mississippi 39215-1850.

Article 5 SUBCONTRACTORS

No supplementary conditions.

Article 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

No supplementary conditions.

Article 7 CHANGES IN THE WORK

7.1 GENERAL

7.1.1 Replace the words "Change Order" with the words "Supplemental Agreement".

7.2 CHANGE ORDERS

7.2.3 Add a new Subparagraph as follows:
The maximum cost included in a Change Order (Supplemental Agreement) for profit and overhead is limited to twenty percent (20%) of the total of the actual cost for materials, labor and subcontracts. Profit and overhead include: all taxes, fees, permits, insurance, bond, job superintendent, job and home office expense. All Subcontractors shall acquiesce to the same requirements when participating in a Change Order (Supplemental Agreement).

Article 8 TIME

8.1 DEFINITIONS

8.1.1 Change this Subparagraph to read as follows:

Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Completion of the Work.

8.1.3 Change this Subparagraph to read as follows:

The Date of Completion is the date certified by the Project Engineer and approved by the Owner in accordance with Paragraph 9.8 entitled “Substantial Completion.”

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 Change this Subparagraph to read as follows:

If the Contractor is delayed at any time in the commencement or progress of the Work by any act of neglect of the Owner or Project Engineer, or by any employee or either, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or any causes beyond the Contractor’s control, or by any other causes which the Project Engineer determines may justify the delay, then the Contract time may be extended by Change Order for such reasonable time as the Engineer may determine, subject to the Owner’s approval. Any claim for loss or any delay occasioned by any separate Contractor, or Subcontractor, shall be settled between the Contractor and such other separate Contractor, or Subcontractors.

Article 9 PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Add a new sentence to the end of this Subparagraph:

The form of Application for Payment will be AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet, or a computer generated form containing similar data.

9.3.1.3 Add a new Clause to Subparagraph 9.3.1 as follows:

The Owner will retain five percent (5%) until the Work is at least fifty percent (50%) complete, on schedule, and satisfactory in the Project Engineer’s opinion, at which time fifty percent (50%) of the retainage held to date shall be returned to the Contractor for distribution to the appropriate Sub-Contractors and Suppliers. Future retainage shall be withheld at the rate of two and one half percent (2 1/2%) of the amount due the Contractor on account of progress payments.

9.3.1.4 Add a new Clause to Subparagraph 9.3.1 as follows:

The Contractor must submit each month with this Application for Payment a separate letter stating that he is requesting an extension of time or that he had no need for an extension for that period of time. No payment on a monthly application will be made until the letter is received. Complete justification such as weather reports or other pertinent correspondence must be included for each day's request for extension. A Contractor's letter, or statement, will not be considered as adequate justification. The receipt of this request and data by the Owner will not be considered as Owner approval in any way.

9.3.2.1 Add a new Clause to Subparagraph 9.3.2 as follows:

Payment on materials stored at some location other than the building site, may be approved by the Project Engineer and the Owner after the Contractor has submitted the following items:

.1 An acceptable Lease Agreement between the General Contractor and the owner of the land, or building, where the materials are located.

.2 Consent of Surety, or other acceptable Bond, to cover the materials stored off-site.

.3 All Perils Insurance coverage for the full value of the materials stored off-site.

.4 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.

.5 A complete list and inventory of materials manufactured, stored and delivered to the storage site and of materials removed from the storage site and delivered to the job site.

.6 A review by the Project Engineer of the materials stored off-site prior to release of payment.

.7 Guarantee no storage costs, additional delivery fees, or subsequent costs to the Owner.

. 8 List of stored items shall be sent to the Chief Engineer for his approval prior to payment of stored materials.

9.3.2.2 Add a new Clause to Subparagraph 9.3.2 as follows:

Payment for materials stored at the building site, may be approved by the Project Engineer and the Owner after the Contractor has submitted the following items:

.1 A Bill of Sale from the Manufacturer to the General Contractor for the stored materials.

.2 List of stored items shall be sent to the Chief Engineer for his approval prior to payment of stored materials.

.3 List of stored items shall be sent to the Chief Engineer for his approval prior to payment of stored materials.

9.6 PROGRESS PAYMENTS

9.6.8 Add a new Subparagraph as follows:

The amount retained by the Contractor from each payment to each Subcontractor and material supplier will not exceed the percentage retained by the Owner from the Contractor.

9.7 FAILURE OF PAYMENT

9.7.1 Change this Subparagraph to read as follows:

The Contractor and the Owner shall be subject to the remedies as prescribed in Section 31-5-25 of the **Mississippi Code 1972, Annotated.**

9.8 SUBSTANTIAL COMPLETION

9.8.4 Add a new sentence at the end of this Subparagraph:

Substantial Completion shall not be recognized under this Contract. The Project Engineer shall determine when the building is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion. All Warranties and Extended Warranties shall use this date as the starting date of Warranty Period.

9.11 LIQUIDATED DAMAGES

9.11.1 Add a new Paragraph as follows:

Time being of the essence and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner liquidated damages for each calendar day of delay until the work is substantially complete as follows:

For More Than	To and Including	Per Calendar Day
$ 0	$ 100,000	$ 140
100,000	500,000	200
500,000	1,000,000	300
1,000,000	2,000,000	400
2,000,000	5,000,000	650
5,000,000	10,000,000	750
10,000,000	--------	1,400

Article 10 PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.5 Change this Subparagraph to read as follows:

The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clause 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible for Clauses 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Project Engineer and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.3 HAZARDOUS MATERIALS

10.3.2 Delete this Subparagraph in its entirety.

10.3.3 Delete this Subparagraph in its entirety.

10.4 Delete this Subparagraph in its entirety.

10.5 Delete this Subparagraph in its entirety.

Article 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.4 Add a new Subparagraph as follows:

The Contractor's limits of liability shall be written for not less than the following:

.1 GENERAL LIABILITY:

Commercial General Liability (Including XCU)		
General Aggregate…….$	1,000,000.00	Aggregate
Products & Completed Operations……..$	1,000,000.00	Aggregate
Personal & Advertising Injury…….. $	500,000.00	Per Occurrence
Bodily Injury & Property Damage…….$	500,000.00	Per Occurrence
Fire Damage Liability……..$	50,000.00	Per Fire
Medical Expense……$	5,000.00	Per Person

.2 OWNERS & CONTRACTORS PROTECTIVE LIABILITY:

Bodily Injury & Property Damage…….$	1,000,000.00	Aggregate
Bodily Injury & Property Damage…….$	500,000.00	Per Occurrence

.3 AUTOMOBILE LIABILITY:

(Owned, Non-owned & Hired Vehicle

Contractor Insurance Option Number 1:

Bodily Injury & Property Damage…….$	500,000.00	Per Occurrence

(Combined Single Limit)

Contractor Insurance Option Number 2:

Bodily Injury……$	250,000.00	Per Person
Bodily Injury……$	500,000.00	Per Accident
Property Damage……..$	100,000.00	Per Occurrence

.4 EXCESS LIABILITY:

(Umbrella on projects over $500,000)

Bodily Injury & Property Damage …….$	1,000,000.00	Aggregate

(Combined Single Limit)

.5 WORKERS' COMPENSATION:

(As required by Statute)

EMPLOYERS' LIABILITY:

Accident ……$	100,000.00	Per Occurrence
Disease ……$	500,000.00	Policy Limit
Disease ……$	100,000.00	Per Employee

.6 PROPERTY INSURANCE:

Builder's Risk……$	Equal to Value of Work
Or	
Installation Floater……$	Equal to Value of Work

11.1.5 Add a new Subparagraph as follows:

Furnish one (1) copy of the Standard Construction Contract Certificate of Insurance Form for each copy of the Standard Form of Agreement Between Owner and Contractor specifically setting forth evidence of all coverage required by Subparagraphs 11.1.1, 11.1.2 and 11.1.3. Furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

11.1.6 Add a new Subparagraph as follows:

If the coverages are provided on a claims-made basis, the policy date or retroactive date shall predate the Contract: the termination date, or the policy, or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment.

11.2 OWNER'S LIABILITY INSURANCE

11.2.1 Delete this Subparagraph in its entirety and substitute the following:

The Contractor shall purchase and maintain such insurance as will protect the Owner from his contingent liability to others for damages because of bodily injury, including death, and property damage, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provision of this Contract. Certificate of this insurance will be filed with the Owner and will be the same limits set forth in 11.1.4.

11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

Delete this Paragraph in its entirety.

11.4 PROPERTY INSURANCE (BUILDER'S RISK OR INSTALLATION FLOATER)

11.4.1 Change the first line in this Subparagraph to read as follows:

The Contractor shall purchase…

11.4.1.2 Delete this Clause under Subparagraph 11.4.1 in its entirety.

11.4.1.3 Change the following Clause in Subparagraph 11.4.1.3 to read as follows:

If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

11.4.2 Delete this Subparagraph in its entirety.

11.4.3 Delete this Subparagraph in its entirety.

11.4.4 Delete this Subparagraph in its entirety.

11.4.5 Delete this Subparagraph in its entirety.

11.4.6 Delete this Subparagraph in its entirety.

11.4.10 Change this Subparagraph to read as follows:

The Owner as fiduciary shall have power to adjust and settle a loss with Insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss.

Article 12 UNCOVERING AND CORRECTION OF WORK

No supplementary conditions.

Article 13 MISCELLANEOUS PROVISIONS

No supplementary conditions.

Article 14 TERMINATION OR SUSPENSION OF THE CONTRACT

No supplementary conditions.

END OF DOCUMENT

SECTION 00 91 13 ADDENDA

PART 1- GENERAL

1.01 DESCRIPTION

A. Addenda issued on this Project will be included in Section 00 91 13 and become part of the Standard Form of the Agreement Between the Owner and the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered by the Contract Documents shall be provided by one (1) General Contractor as one (1) Contract to improve the Mississippi Department of Transportation site at Jackson, Hinds County, Mississippi. Separate Lump Sums as described in these Specifications and Drawings are to be given for each of the following separate descriptions and combined to total one (1) lump sum for the Contract Sum.

1. Description A: HVAC Upgrades to Jackson Shop Complex.
2. Description B: HVAC Upgrades to MDOT Administration Building.

B. Time of Completion: The completion of this Work is to be on or before the time indicated on the Owner and Contractor Agreement.

C. Contractor's Duties:

1. Except as specifically noted, provide and pay for:
   a. Labor, materials, equipment.
   b. Tools, construction equipment, and machinery.
   c. Other facilities and services necessary for proper execution and completion of the Work.
2. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
3. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids:
   a. Permits
   b. Government Fees
   c. Licenses
4. Give required notices.
5. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of Work.
6. Promptly submit written notice to Project Engineer of observed variance of Contract Documents from legal requirements. Appropriate modifications to Contract Documents will adjust necessary changes. Assume responsibility for Work known to be contrary to such requirements, without notice.
7. Enforce strict discipline and good order among employees. Do not employ on Work, unfit persons or persons not skilled in assigned task.
8. Schedule of Values: Submit 8 copies to the MDOT Architectural Services Unit a Schedule of Values as described in Section 01 29 73 of these Specifications. This submittal will be recorded as submittal number one for this Project. When this submittal is approved, a copy will be transmitted to Construction Administration to be used to review and compare to amounts submitted on the CAD-720 form. Other copies will be kept by Architectural Services Unit and distributed to Project Engineer, MDOT Consultants, and Contractor.

9. Sub-Contractors List: Submit 8 copies of a list, acceptable to the MDOT, of all subcontractors to be used on the Project within seven (7) days after written notice of Contract award by the MDOT. The list shall include the Firm's name, contact person, street address, e-mail address, telephone and fax numbers. Submit original to Contract Administration Division and one copy to the Project Engineer and to the MDOT Architect CAD-720 form - REQUEST FOR PERMISSION TO SUBCONTRACT for each subcontractor before they are allowed to perform any Work.
10. Coordination: The Contractor is responsible for the coordination of the total Project. All subcontractors will cooperate with the Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their Work. Refer to Section 01 31 00– Project Management & Coordination.

1.02 CONTRACTOR'S USE OF PREMISES

A. Confine operations at the site to areas permitted by:

1. Law
2. Ordinances
3. Permits
3. Contract Documents
5. Owner

B. Do not unreasonably encumber site with materials or equipment.

C. Do not load structure with weight that will endanger structure.

D. Assume full responsibility for protection and safekeeping of products stored on premises.

E. Move any stored products which interfere with operations of MDOT or other Contractors.

F. Obtain and pay for use of additional storage of work areas needed for operations.

G. Limit use of site for work and storage to the area indicated on the Drawings.

1.03 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Groups, Subgroups, Divisions and Sections using CSI/CSC's "MasterFormat" 2004 Edition numbering system.

1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections 02 through 50 in the Specifications.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SCOPE

A. This Section describes the procedures for processing Change Orders (Supplemental Agreements) by the Project Engineer and the Contractor.

1.02 CHANGE ORDER PROCEDURES

A. Change Proposed by the Project Engineer: The Project Engineer may issue a Proposal Request to the Contractor which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications and a change in Contract Time for executing the change. The Contractor shall prepare and submit an estimate within 10 days.

B. Change Proposed by the Contractor: The Contractor may propose a change by submitting a request for change to the Project Engineer, describing the proposed change and it's full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01 62 14 - Product Options and Substitution Procedures.

C. Contractor's Documentation:

1. Maintain detailed records of Work completed on a time and material basis. Provide full information required for evaluation of proposed changes, and substantiate costs of changes in the Work.
2. Document each quotation for a change in cost or time with sufficient data allowing evaluation of the quotation.
3. On request, provide additional data to support computations:

    a. Quantities of products, labor, and equipment.
    b. Taxes, insurance and bonds.
    c. Overhead and profit.
    d. Justification for any change in Contract Time.
    e. Credit for deletions from Contract, similarly documented.

4. Support each claim for additional costs, and for work completed on a time and material basis, with additional information:

    a. Origin and date of claim.
    b. Dates and time work was performed and by whom.
    c. Time records and wage rates paid.
    d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

D. Construction Change Directive: The Project Engineer may issue a document, approved by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order (Supplemental Agreement). The document will describe changes in the Work, and will designate method of determining any change in the Contract Sum or Contract Time. The change in Work will be promptly executed.

E. Format: The Project Engineer will prepare 5 originals of the Change Order (Supplemental Agreement) using the Mississippi Department of Transportation's Change Order (Supplemental Agreement) Form.

F. Types of Change Orders (Supplemental Agreements):

1. Stipulated Sum Change Orders: Based on Proposal Request and Contractor's fixed price quotation, or Contractor's request for a Change Order (Supplemental Agreement) as approved by the Project Engineer and the MDOT Architect.
2. Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order (Supplemental Agreement) will be executed on a fixed unit price basis. For unit costs or quantities of units of work, which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum or Contract Time will be computed as specified for Time and Material Change Order (Supplemental Agreement).
3. Time and Material Change Order (Supplemental Agreement): Submit itemized account and supporting data after completion of change, within time limits indicated in the Standard Form of Agreement Between the Owner and the Contractor. The Project Engineer will determine the change allowable in Contract Sum and Contract Time as provided in the Contract Documents. The Contractor shall maintain detailed records of Work accomplished on Time and Material basis and shall provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

G. Execution of Change Order (Supplemental Agreement): The Project Engineer will issue Change Orders (Supplemental Agreements) for signatures of parties as provided in the Standard Form of Agreement Between the Owner and the Contractor. Final execution of all Change Orders (Supplemental Agreements) requires approval by the Owner.

H. Correlation of Contractor Submittals: The Contractor shall promptly revise Schedule of Values and the Application for Payment forms to record each authorized Change Order (Supplemental Agreement)as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of Work affected by the change and resubmit. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 METHOD OF MEASUREMENT

A. The method of measurement and payment shall conform to the applicable provisions of Article 9 of the AIA Document A201-1997 General Conditions of the Contract for Construction.

1.02 APPLICATION FOR PAYMENT

A. Format:
   1. Applications for Payments will be prepared on AIA forms G702-Application and Certificate for payment and G703-Continuation Sheet; or, a computer generated form containing similar data may be used.

B. Preparation of Application:
   1. Present required information in type written form.
   2. Execute certification by signature of authorized officer.
   3. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
   4. List each authorized Change Order (Supplemental Agreement) as an extension on continuation sheet, listing Change Order (Supplemental Agreement) number and dollar amount as for an original Item of Work.
   5. Prepare Application for Final Payment as specified in Section 01 77 00-Closeout Procedures.

C. Submittal Procedures:
   1. Submit 2 copies of each Application for Payment to the Project Engineer and one copy to the MDOT Architect.
   2. Submit an updated construction schedule with each Application for Payment as described in Section 01 32 00-Construction Progress Documentation.
   3. Submit request for payment at intervals agreed upon by the Project Engineer, Owner, and Contractor.
   4. Submit requests to the Project Engineer at agreed upon times, or as may be directed otherwise.

D. Substantiating Data:
   1. Submit data justifying dollar amounts in question when such information is needed.
   2. Provide one copy of the data with a cover letter for each submittal.
   3. Indicate the Application number, date and line item number and description.

1.03 STATEMENTS AND PAYROLLS

A. The submission by the Contractor of the actual weekly payrolls showing all employees, hours worked, hourly rates, overtime hours, etc., or copies thereof, is not required to be turned in. However, each Contractor and Subcontractor shall preserve weekly payroll records for a period of three years from the date of Contract completion. All Contractor personnel working at the project site will be paid unconditionally and not less often than once a week without subsequent deduction or rebate on any account, except such payroll deductions as are permitted by regulations, the full amounts of wages and bona fide fringe benefits due at time of payment.

B. The payroll records shall contain the name, address, social security number, classification, rate of pay, daily and weekly number of hours worked, itemized deductions and actual wages paid to each employee.

C. Upon request, the Contractor will make payroll records available at the project site for inspection by the Department Compliance Officer or authorized representative and will permit such officer or representative to interview employees on the job during working hours.

D. The Contractor and Subcontractors shall submit Form CAD-880, “Weekly Summary of Wage Rates”, each week to the Project Engineer. The forms may be obtained from the Contract Compliance Officer, Contract Administration Division, Mississippi Department of Transportation, Jackson, Mississippi. Custom forms, approved by Contract Administration Division, may be used in lieu of CAD forms.

E. The Contractor shall make all efforts necessary to submit this information to the Project Engineer in a timely manner. The Engineer will have the authority to suspend the work wholly or in part and to withhold payments because of the Contractor's failure to submit the required information. Submission of forms and payrolls shall be current through the first week of the estimate period in order for the Project Engineer to process an estimate.

1.04 BASIS OF PAYMENT

A. This Work will be paid for by Contract Sum for the construction in Hinds County. The Work includes HVAC Upgrades to Jackson Shop Complex and HVAC Upgrades to MDOT Administration Building, Hinds County, Mississippi. The Contract Sum shall be full compensation for all site work, for furnishing all materials, and all other Work and effort of whatever nature in the construction of the buildings, installation of underground and other equipment, and final clean-up of the area. It shall also be complete compensation for all equipment, tools, labor, and incidentals necessary to complete the Work.

B. Payment will be made under:

1.	DESCRIPTION A: MDOT Project No. BWO-9018-25(005) 501918 HVAC Upgrades to Jackson Shop Complex. in Jackson, Hinds County	lump sum
2.	DESCRIPTION B: MDOT Project No. BWO-9021-25(006) 501919 HVAC Upgrades to MDOT Administration Building. in Jackson, Hinds County	lump sum
	TOTAL PROJECT CONTRACT SUM	**LUMP SUM**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 73 SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Submit 6 copies of the Schedule of Values to the MDOT Architect, with a copy of the Transmittal Letter to the Project Engineer, at least 10 days prior to submitting first Application for Payment. Upon Project Engineer's request, support the values given with data substantiating their correctness. Payment for materials stored on site will be limited to those listed in Schedule of Unit Material Values (refer to Article 9 of the Supplementary Conditions for requirements). Use Schedule of Values only as basis for Contractor's Application for Payment.

B. The 6 copies of the Schedule of Values will be reviewed as Submittal #1. A copy of this submittal will be reviewed by the Architect and Mechanical / Electrical Consultants. One copy will be retained by MDOT Architectural Services, one by Mechanical / Electrical Consultants, one sent to Contract Administration for use in reviewing requests for Permission to Sub-Contract (CAD-720 Form), one sent to the Project Engineer, and two returned to the Contractor. If any extra copies are needed for the Contractor, adjust number submitted.

C. Form of Submittal: Submit typewritten Schedule of Values on AIA Document G703-1992, using Table of Contents of this Specification as basis for format for listing costs of Work for Sections under Divisions 02 - 33. Identify each line item with number and title as listed in Table of Contents of this Specification.

D. Preparing Schedule of Values:

1. Itemize separate line item costs for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, Contingency Allowance, temporary facilities and controls, and closeout documents.
2. Itemize separate line item cost for Work required by each Section of this specification. Breakdown installed cost with overhead and profit.
3. For each line item, which has installed value of more than $20,000, break down costs to list major products for operations under each item; rounding figures to nearest dollar. Make sum of total costs of all items listed in schedule equal to total Contract Sum.
4. Group line items to show subtotal of Description A and then Description B with the same amounts indicated on the Bid Forms and a total equal to the Contract amount indicated on the Bid Form.

E. Preparing Schedule of Unit Material Values:

1. Submit separate schedule of unit prices for materials to be stored on which progress payments will be made. Make form of submittal parallel to Schedule of Values with each line item identified same as line item in Schedule of Values. Include in unit prices only: Cost of material, delivery and unloading site, and sales tax.
2. Make sure unit prices (if required) multiplied by quantities equal material cost of that item in Schedule of Values.

F. Review and Re-submittal: After Project Engineer / MDOT Architect's review, if requested, revise and resubmit schedule in same manner

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope: To set forth procedures, conditions and responsibility for coordination of the total project.

B. Project Coordinator: The General Contractor shall designate one individual as Project Coordinator (Superintendent), as referred to in the General Conditions. Prior to beginning Work his name, qualifications and address shall be submitted, in writing, to the MDOT Executive Director with copies to the Construction Engineer, Contract Administration Engineer, District Engineer, Project Engineer and MDOT Architect. Upon approval, he will remain until the Project is completed and cannot be removed during construction without just cause and without the written consent of the Project Engineer.

1.02 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.03 SUBMITTALS

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

1.04 DUTIES OF PROJECT COORDINATOR (SUPERINTENDENT)

A. General:

1. Coordination: Coordinate the work of all subcontractors and material suppliers.
2. Supervision: Supervise the activities of every phase of Work taking place on the project.
3. Contractor’s Daily Job Diary: Submit copy of daily job dairy to Project Engineer and MDOT Architect each Monday for previous week.
4. Electrical: Take special care to coordinate and supervise the Work of electrical and other subcontractors.
5. Communication: Establish lines of authority and communication at the job site.
6. Location: The Project Coordinator (Superintendent) must be present on the job site at all times while work is in progress. Superintendent shall advise Project Engineer of an intended absence from the work and designate a person to be in charge of the Work during such absence.
7. Permits: Assist in obtaining building and special permits required for construction.

B. Interpretations of Contract Documents

1. Consultation: Consult with Project Engineer to obtain interpretations.
2. Assistance: Assist in resolution of any questions.
3. Transmission: Transmit written interpretations to concerned parties.

C. Cessation of Work: Stop all Work not in accordance with the requirements of the Contract Documents.

D. Division One: Coordinate and assist in the preparation of all requirements of Division One and specifically as follows:

1. Enforce all safety requirements.
2. Schedule of Values: Assist in preparation and be knowledgeable of each entry in the Schedule of Values.
3. Cutting and Patching: Supervise and control all cutting and patching of other trades work.
4. Project Meetings: Schedule with Project Engineer's approval and attend all project meetings.
5. Construction Schedules: Prepare and submit all construction schedules. Supervise Work to monitor compliance with schedules.
6. Shop Drawings, Product Data and Samples: Administer the processing of all submittals required by the Project Manual.
7. Testing: Coordinate all required testing.
8. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities.
9. Substitutions and Product Options: Administer the processing of all substitutions.
10. Cleaning: Direct and execute a continuing (daily) cleaning program throughout construction, requiring each trade to dispose of their debris.
11. Project Closeout: Collect and present all closeout documents to the Project Engineer.
12. Project Record Documents: Maintain up-to-date Project Record Documents.

E. Changes: Recommend and assist in the preparation of requests to the Project Engineer for any changes in the Contract.

F. Application for Payment: Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.

1.05 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements, supports, and installation of Mechanical and Electrical Work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy, if required.

E. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.06 SUBCONTRACTOR'S DUTIES

A. The Subcontractor is responsible to coordinate and supervise his employees in the Work accomplished under his part of the Contract.

B. Schedules: Conduct Work to assure compliance with construction schedules.

C. Suppliers: Transmit all instructions to his material suppliers.

D. Cooperation: Cooperate with the Project Coordinator and other subcontractors.

1.07 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: CSI Form 13.2A

1. Identify each page of attachments with the RFI number and sequential page number.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.

c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log the first week of each month. Use CSI Log Form 13.2B. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 19 PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions for and procedures related to the required Project Meetings which include, but not limited to, the following for each Project Phase:

1. Pre-Construction Meeting.
2. Periodic Progress Meetings.

1.02 MEETINGS

A. Purpose of Meetings: Project Meetings shall be held for the following reasons:

1. To establish an understanding of what is expected from everyone involved.
2. To enable an orderly Project review during the progress of the Work.
3. To provide for systematic discussion of problems and effect remedies and clarifications.
4. To coordinate the Work.
5. To review installation procedures and schedules.

1.03 SCHEDULING AND ADMINISTRATION

A. The Project Engineer shall schedule and preside over all meetings throughout the progress of the Work. Duties include the following:

1. Review, modify / approve minutes of the previous meeting.
2. Discuss items that have been done the previous month and anticipated work to be done within the next month.
3. Review Contractor's Pay Request and resolve questions or conflicts with Construction Documents.

B. The Contractor shall attend and administer all meetings throughout the progress of the Work. Duties include the following:

1. Preparation of agenda for meetings
2. Distribution of agenda and written notice 7 days in advance of date for each regularly scheduled meeting.
3. Make physical arrangements for meetings.
4. Record the minutes which shall include list of all participants and all significant proceedings and, in particular, all decisions, agreements, clarifications, and other data related to Project cost, time, and modifications.
5. Distribute copies of minutes within 7 calendar days to all parties affected by decisions made at the meeting.
6. Follow-up unresolved matters discussed at meetings and promptly effect final resolution, especially for work in progress. Advise all effected parties of result and include report of activities in next scheduled meeting.

C. Representatives of Contractor's, Subcontractor's, and Supplier's attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

D. Consultants may attend meetings to ascertain work is expedited consistent with Contract Documents and construction schedules.

1.04 PRE-CONSTRUCTION MEETING

A. Schedule: Schedule Pre-Construction Meeting within 10 days after Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by the Contractor and approved by the Project Engineer and the MDOT Architect.

C. Attendance: Attending shall be the Project Engineer and MDOT representatives associated with the Project, the MDOT Architect (if requested by the District), his Consultants, the General Contractor, all major Subcontractors, and any representatives of governmental or other regulatory agencies as required.

D. Minimum Agenda:

1. Distribute and discuss construction schedule prepared by Contractor.
2. Review critical Work sequencing.
3. Designate responsibilities.
4. State procedures for submittals.
5. State procedures for maintaining record documents.
6. State procedures for change orders.
7. State procedures for application of payment.
8. Coordinate use of premises, including office and storage areas.
9. List Owner's requirements.
10. Show clear understanding of Security.
11. Show clear understanding of Housekeeping procedures.

1.05 PROGRESS MEETINGS

A. Schedule: Progress Meetings will be scheduled monthly. The Project Engineer will cancel the meeting with at least 48 hours notice if a meeting is not necessary for any particular month.

B. Place of Project Meetings: Contractor’s Field Office except as otherwise agreed.

C. Attendance: Attending shall be the Project Engineer or his representative and MDOT representatives associated with the Project, the MDOT Architect or his representative (if requested by the District) and his Consultants, the General Contractor, and all Subcontractors as pertinent to the agenda.

D. Minimum Agenda:

1. Review, modify / approve minutes of the previous meeting.
2. Review work progress since last meeting.
3. Note field observations, problems and decisions.
4. Identify problems that impede planned progress.
5. Review off-site fabrication problems.
6. Revise construction schedule as indicated.
7. Plan progress during the next work period.
8. Review submittal schedules; expedite and modify as required.
9. Review proposed changes,
10. Review Request for Payment.
11. Complete other current business.

PART 2 - PRODUCTS & PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Provide projected Construction Schedules for entire Work and revise monthly to show progress through the pay period. The following is a minimum requirement and other type schedules are acceptable with Owner's approval.

B. Form of Schedules: Prepare in form of horizontal bar chart.

1. Provide separate horizontal bar column for each trade or operation.
2. Order: Table of Contents of Specifications.
3. Identify each column by major Specification section number.
4. Horizontal Time Scale: Identify first work day of each week.
5. Scale and Spacing: To allow space for updating.

C. Content of Schedules:

1. Provide complete sequence of construction by activity.
2. Indicate dates for beginning and completion of each stage of construction.
3. Identify Work of logically grouped activities.
4. Show projected percentage of completion for each item of Work as of first day of each month.

D. Updating:

1. Show all changes occurring since previous submission of updated schedule.
2. Indicate progress of each activity and completion dates.

E. Submittals:

1. Submit initial schedules to the Project Engineer / MDOT Architect within 15 days after date of Notice to Proceed.
2. Submit to the Project Engineer / MDOT Architect, periodically updated schedules accurately depicting progress to first day of each month.
3. Submit 2 copies, one to be retained by the Project Engineer and the other forwarded to the MDOT Architect.

F. If the Contractor is required to produce two revised construction schedules because of lack of progress in the Work, the Owner will notify the Contractor's surety.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Submit to the MDOT Architectural Services Unit shop drawings, product data, and samples required by Specification Sections. FAXED SUBMITTALS WILL NOT BE ACCEPTED. DO NOT submit Material Safety Data Sheets for approval. Refer to Section 01 62 14 – Product Options and Substitution Procedures, for requirements concerning products that will be acceptable on this Project.

B. Shop Drawings: Original (LEGIBLE) drawings prepared by Contractor, subcontractor, supplier or distributor which illustrates actual portions of the Work; showing fabrication, layout, setting or erection details. REPRODUCTIONS of the Contract Drawings WILL NOT BE ACCEPTABLE. Minimum requirements for shop drawings shall include the following:

1. Prepared by a qualified detailer.
2. IDENTIFY DETAILS BY REFERENCE TO SHEET AND DETAIL NUMBERS SHOWN ON CONTRACT DRAWINGS.
3. Minimum sheet size: 8-1/2 inches by 11 inches.
4. Shop drawings shall be stamped and signed by the Contractor certifying accuracy, completeness and compliance with Contract requirements prior to submitting to the MDOT Architectural Services Unit.

C. Product Data: Minimum information submitted shall include the following:

1. Manufacturer's standard schematic drawings: Modify drawings to delete information that is not applicable to the Project. Supplement standard information to provide additional information applicable to Project.
2. Manufacturer’s catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data: CLEARLY MARK each copy to identify pertinent materials, products or models. Show dimensions and clearances required. Show performance characteristics and capacities, wiring diagrams and controls.
3. Product Data shall be stamped and signed by the Contractor certifying accuracy, completeness and compliance with contract requirements prior to submitting to the MDOT Architectural Services Unit.

D. Samples: Provide physical examples to illustrate materials, equipment or workmanship and to establish standards by which completed Work is judged.

1. Provide one copy each of sufficient size and quantity to clearly illustrate functional characteristics of products or material with integrally related parts and attachment devices and full range of color samples.
2. Samples remain the property of the Architectural Services Unit until completion of construction of the Project.
3. Samples (except for color samples) will not be required when specified product is submitted.
4. If a specified product color is discontinued, Contractor shall notify Project Engineer promptly to determine if it affects other color selections.

E. Field Samples and Mock-Ups: Erect on Project Site at location acceptable to Project Engineer.

1. Construct each sample or mock-up complete, including Work of all trades required in the finished Work. Field Samples are used to determine standards in materials, color, texture, workmanship, and overall appearance.
2. Work shall not be allowed using these materials until the mock-up is approved.
3. The mock-up shall not be destroyed, until after the Work it represents is finished, without permission of the Project Engineer. This mock-up shall be used as a standard to compare to the Work it represents for color, craftsmanship, overall appearance, and how the different materials make up the whole system.

F. Contractor Responsibilities:

1. Review shop drawings, product data, and samples prior to submission.
2. Verify field measurements, construction criteria, catalog numbers and other data.
3. Coordinate each submittal with requirements of Work and Contract Documents.
4. Contractor's responsibility for errors and omissions in submittals is not relieved by MDOT Architect's / Consultant's review of submittals.
5. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by review of submittals unless written acceptance of specific deviations is given.
6. Notify the Project Engineer in writing at the time of submission, of deviations in submittals from requirements of Contract Documents.
7. Order no materials or begin no Work requiring submittals until the return of submittals bearing MDOT Architect / Consultant's stamp and initials indicating review.
8. After MDOT Architect / Consultant's review, distribute copies.

G. Submission Requirements:

1. Schedule submission with ample time given to review submittals prior to being needed.
2. Submit 8 copies of shop drawings and product data with additional number of copies, if required, by Contractor for distribution.
3. PARTIAL SUBMITTALS ARE NOT ACCEPTABLE, will be considered non-responsive, and will be returned without review.
4. Submit number of samples specified in each Specification Section.
5. Accompany submittals with transmittal letter containing data, project title and number; Contractor's name and address; the number of each Shop Drawings, product data and samples submitted; notification of deviations from Contract Documents; and other pertinent data. Submittals shall be sent to MDOT Architect for review or distribution to Consultants, with copy of Transmittal Letter sent to Project Engineer.
6. Each copy of submittal shall include a cover page with the following requirements:
   a. Date and revision dates.
   b. Project title and number.
   c. The names of Project Engineer, Contractor, Supplier, Manufacturer, and separate detailer, when pertinent.
   d. Identification of product or material.
   e. Relation to adjacent structure or materials and COMPLETE dimensions.
   f. Field dimensions, clearly identified as such.
   g. SPECIFICATION SECTION NUMBER.
   h. Applicable standards such as ASTM Number or Federal Specification.
   i. A blank space, 2 inches by 3 inches for the Reviewer's stamp.
   j. Identification to deviations from Contract Documents.

k. Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements, and compliance with Contract Documents.

H. Resubmission Requirements:

1. Shop Drawings: Revise initial Drawings as required and resubmit as specified for initial submittal. Indicate on Drawings, all changes that have been made other than those required by the Reviewer.
2. Product Data and Samples: Submit new data and samples as required for initial submittal.

I. Distribution of Submittals after Review:

1. Distribute copies of Shop Drawings and product data which carry MDOT Architect's / Consultant's stamp to: Project Engineer's File, Architectural Services Unit File, Architect's File(as required) / Electrical / Mechanical / Structural Engineer's File (as required), Materials' File (if concrete), Contractor's File, Job Site File, and Subcontractor, Supplier and/or Fabricator as necessary.
2. Distribute samples as directed. The Project Engineer, MDOT Architect and Consultant (as required) shall retain one of each.

J. MDOT Architect / Consultants' Duties:

1. Review submittals with reasonable promptness.
2. Review for design concept of Project and information given in Contract Documents.
3. Review of separate item does not constitute review of an assembly in which item functions.
4. Affix stamp and initial, or signature, certifying the review of submittal.
5. Return submittals to the Architectural Services Unit, which will retain one copy and forward one copy to the Project Engineer, one copy to the Materials Engineer (if concrete), and the remainder to the Contractor.
6. Retain one copy of reviewed submittals.

K. Delays attributable to untimely submittals, submittals not approved, or time taken to resubmit WILL NOT serve as a basis for a Contract Time extension.

L. Acceptance of submittal items will not preclude rejection of these items upon discovery of defects in them prior to final acceptance of completed Work.

M. After an item has been accepted, no change in brand, make, manufacturer's catalog number, or characteristics will be considered unless:

1. Satisfactory written evidence is presented to and approved by the Project Engineer, that manufacturer cannot make scheduled delivery of accepted item, or;
2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity, or;
3. Other conditions became apparent which indicates acceptance of such substitute item to be in the best interest of the Owner.

PART 2 - PRODUCTS & PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 16 ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDE

A. Project coordination and assignment of the work of all Parties and the scheduling of all elements of alterations and renovation work by procedures and methods to expedite completion of the Work for each Part.

B. The Work to be assigned, coordinated and scheduled includes, but is not limited to, the following:

1. The work of each Division and Section of the Specifications as shown on the Drawings and in the Specifications.
2. The procedures and activities required under the provisions of this Section.

1.02 PROJECT COORDINATION

A. Definition: Project Coordination is the process utilized to guide all participants in the Project's construction and includes assigning, scheduling, expediting, reviewing, and modifying, as appropriate, the activities required to produce the total Work to the designated quality and within the assigned time.

B. Responsibility: Except otherwise provided by the Contract Documents, all Project Coordination shall be the entire responsibility of the Contractor. The Contractor shall set forth procedures and conditions for coordination of the Work and shall personally be responsible for the implementation of the required coordination which shall include the following:

1. Communications: Establish lines of authority and communication at the Job Site.
2. General Coordination: Closely coordinate all work of Project participants to effect quality construction and steady progress in all phases and aspects of the Work with a minimum of delays and interference.
3. Special Coordination: Give additional careful attention to the work of the following:
    a. Mechanical / Electrical Subcontractors and be responsible for the following:
        1) Establishment of locations, clearances and precedence for all piping, conduit and ductwork (underground and above ceilings).
        2) Submittal of Schematic Drawings giving location and clearance information for Architect / Engineer review.
4. Supervision: Supervise the activities of every phase of the Work of the Project. Make frequent inspections of the Work to determine progress and quality; proceed immediately to remedy problems and to effect changes needed in the construction process and personnel.
5. Interpretations of Contract Documents:
    a. Consultation: Consult with MDOT Architect to obtain interpretations.
    b. Assistance: Assist in resolution of any questions.
    c. Stop all work not in accordance with the requirements of the Contract Documents.

6. Division One: Coordinate requirements of Division One and specifically as follows:
   a. Testing: Coordinate all required testing. Refer to Section 01 45 29.
   b. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities. Refer to Section 01 50 00.
   c. Cutting and Patching: Supervise and control all cutting and patching. Refer to Section 01 73 29.
   d. Cleaning: Direct and execute a continuing cleaning program throughout the construction, requiring each trade to dispose of their own debris, except as otherwise provided in the Contract Documents. Refer to Section 01 74 00.
   e. Project Record Documents: Maintain up-to-date project record documents. Refer to Section 01 78 39.
7. Enforce all safety requirements.
8. Maintain quality control of all work.

1.03 QUALITY CONTROL

A. Assign all elements of the work to trades qualified to perform each type of work.

B. Patch, repair and refinish existing work using skilled mechanics that are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

1.04 PROJECT MEETINGS

A. When required by Project Engineer / MDOT Architect or by individual Specification Sections, convene meetings to coordinate the Work and / or to review conditions at the Site and to outline procedures by which the Work will be performed. Refer to Sections 01 31 00 and 01 31 19.

B. Require attendance by all affected Parties.

1.05 CONSTRUCTION ACCESS

A. Access to construction area for construction materials and exit way for demolition debris shall be as directed by the Project Engineer.

1.06 PROTECTION – GENERAL

A. Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition Work.

B. Provide protective measures as required providing free and safe passage of Owner's personnel and general public to and from occupied portions of building.

C. Protect floors with suitable coverings when necessary.

1.07 PROTECTION OF WORK

A. Protect from damage, existing finishes, equipment, adjacent work scheduled to remain, and all new work.

1. Protect existing and new work from temperature extremes. Maintain interior work above 60 degrees F.
2. Provide heat and humidity control as needed to prevent damage to existing work and new work.
3. Provide dust partitions as needed to prevent damage to existing work and new work.

1.08 CUTTING AND PATCHING

A. Scope: Provide the necessary cutting, fitting and patching required to complete all elements of the Work including, but not limited to, the following procedures:

1. To integrate with other work, to fit properly together.
2. To uncover work to provide for installation of ill-timed work.
3. To remove and replace defective and / or non-conforming work.
4. To remove installed material for testing.
5. To provide openings for penetration of mechanical and electrical work.

B. Preparation: Prior to commencing cutting and patching, examine existing conditions (including structure and elements subject to movement) and advise Project Engineer in writing of any condition that could be adversely affected by cutting and patching.

1. Submit written request in advance of cutting or alteration that affects:
   a. Structural integrity of any element of the Project.
   b. Integrity of weather-exposed or moisture-resistant element.
   c. Efficiency, maintenance, or safety of any operational element.
   d. Visual qualities of sight exposed elements.
   e. Work of User or separate contractor.
2. Include in the request:
   a. Identification of Project.
   b. Location and description of affected work.
   c. Necessity for cutting or alteration.
   d. Description of proposed work, and products to be used.
   e. Alternatives to cutting and patching.
   f. Effect on work of User or separate contractor.
   g. Written permission of affected separate contractor.
   h. Date and time work will be executed.

C. Procedures: Perform cutting and patching as required in Part 3 Execution of this Section.

1. Proceed only when permitted and after temporary supports and other devices are in place to ensure structural integrity and to protect other portions of the Project from damage.
2. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
3. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior approval from the Project Engineer.

4. Restore work with new products in accordance with requirements of the Contract Documents.

5. Fit work air tight to pipes, sleeves, ducts, conduits and other penetrations through surfaces.
6. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
7. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

1.09 TRAFFIC

A. Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, corridors, and other adjacent occupied or used facilities.

B. Do not close, block or otherwise obstruct streets, walks, entrances, canopies, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by Owner

1.10 UTILITY SERVICES

A. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

1.11 WORK RESTRICTIONS

A. Project participants shall not perform any work on any Sunday or any Legal Holidays (as defined in Section 3-3-7, Mississippi Code of 1972, Annotated) except as required by emergency conditions and approved by the Project Engineer.

B. “No Smoking” shall be observed in the work areas.

PART 2 - PRODUCTS

2.01 SALVAGED MATERIALS

A. Coordinate with Project Engineer in identifying salvageable materials. The Owner has first right of refusal for all items.

B. Contractor shall take proper care in removing and placement where directed in designated area on Site.

C. Salvage sufficient quantities of cut or removed material to replace damaged work of existing construction, when material is not readily obtainable on current market.

1. Items not required for use in repair of existing work to remain shall be discarded if of no value to the Owner.
2. Do not incorporate salvaged or used material in new construction unless approved in writing by the Project Engineer.

2.02 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

A. Provide products or types of construction same as in existing structure, as needed to patch, extend or match existing work to make work complete and consistent to standards of quality of connected and / or similar adjacent construction. Except otherwise indicated all products shall be new.

B. Where Contract Documents do not define products or standards of workmanship in existing construction, Contractor shall determine products by inspection and any necessary testing, and upgrade by use of the existing as a sample of comparison.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that demolition is complete and areas are ready for beginning of repairing, refinishing and new construction.

3.02 PREPARATION

A. Cut, move, or remove existing construction as necessary for access to alterations and renovations work; repair, replace, and restore where existing affected construction is to remain a part of final completed work.

3.03 ADJUSTMENTS

A. Where partitions are removed, patch floors, walls, and ceilings for installation of new materials.

B. Where removal of partition(s) results in adjacent spaces becoming one space, rework floor surfaces and ceilings to provide smooth planes without breaks, steps, or bulkheads.

C. Where extreme change of plane occurs, request instructions from MDOT Architect as to method of making transition.

D. Where new work adversely affects existing conditions beyond work limits defined, new work shall extend to facilitate proper joining and finishing of work.

3.04 DAMAGED SURFACES

A. Patch and replace any portion of an existing finished surface which as a result of this construction, is found to be damaged, lifted, discolored, or shows other imperfections, with matching material.

1. Provide adequate support of substrate prior to matching the finish.
2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.

B. Where new or existing wall is patched or damaged, the wall surface shall be patched and refinished from base to ceiling and end to end, or nearest natural break, and shall match new work in quality.

3.05 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance.

B. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from renovation operations from building site. Transport and legally dispose of materials off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

D. Contractor is required to provide a dumpster for this Project and is not to use the Owners dumpster at any time. Location of the Contractor's dumpster is to be coordinated with the Project Engineer.

3.07 CLEANING – PERIODIC AND FINAL

A. General Requirements:

1. Maintain the Project Space, including areas used for passage of Project personnel and materials, in a neat, clean and orderly condition at all times.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the Work.
3. Provide adequate storage for all items awaiting removal from Site, observing all requirements for fire prevention and protection of the environment.

B. Periodic Cleaning, as follows:

1. Daily and more often if necessary, inspect the Project Space and pick up all scrap, debris, and waste material; remove to designated storage.
2. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
3. One each week, more often if necessary, remove all stored waste material and legally dispose of off the Site.

C. Final Cleaning: Under provision of Section 01 74 00.

END OF SECTION

SECTION 01 42 19 REFERENCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Identification and purpose of Reference Standards.

B. Administrative procedures and responsibility for the use of Reference Standards.

1.02 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. “Reviewed”: The term “Reviewed”, when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.

D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, 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.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The terms “provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1. Using a term such as "carpentry" does not imply that accredited or unionized individuals of a corresponding generic name, such as “carpenter”, must perform certain construction activities. It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 IDENTIFICATION AND PURPOSE

A. Identification: Throughout the Contract Documents are references to nationally known and recognized Codes, Reference Standards, Reference Specifications, and similar documents that are published by Regulatory Agencies, Trade and Manufacturing Associations and Societies, Testing Agencies and others. References also include certain Project Documents or designated portions.

B. Purpose: All named and otherwise identified “Reference Standards” are “by reference” hereby incorporated into these Specifications as though fully written and hereby serve to establish specific requirements and pertinent characteristics for materials and workmanship as well as methods for testing / reporting on compliance thereto.

1.04 PROCEDURES AND RESPONSIBILITIES

A. Compliance with Laws and Codes of governmental agencies having jurisdiction shall be mandatory and take precedence over the requirements of all other Reference Standards. For products or workmanship specified by Associations, Trade, or Federal Standards, comply with the requirements of the standard, except when supplemented instructions indicate a more rigid standard and / or define more precise requirements. Should specified reference standards conflict with regulatory requirements or the Contract Documents, request Architect’s clarification before proceeding.

B. The Contractor (including any and all Parties furnishing and / or installing any portion of The Work) shall be familiar with the indicated codes and standards. It shall be the Contractor’s responsibility to verify the detailed requirements of the specifically named codes and standards and to verify (and provide written certification, when required) that the items procured for use in this Work (and their installation, as applicable) meet or exceed the specified requirements.

C. When date of Reference Document is not specified, conform to latest edition of said Document except when earlier editions are specifically required by Codes.

D. The contractual relationship of the Parties to the Contract shall not be altered from the requirements of the Contract Documents by mention or inference otherwise in any reference document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 43 00 QUALITY ASSURANCE

PART 1 - GENERAL

1.01 WORK QUALITY

A. Shop and field work shall be performed by mechanics, craftspersons, artisans, and workers skilled and experienced in the fabrication and installation/application of the work involved. The Work of this Project shall be performed in accordance with the Drawings, reviewed and approved shop drawings, and these Specifications. Quality of work shall conform to the highest established standards and practices of the various trades involved.

B. All work shall be erected and installed plumb, level, square, and true, or true to indicated angle, and in proper alignment and relationship to the work of other trades. Finished work shall be free from defects and damage.

C. Nothing specified in these Specifications shall be construed as relieving the Contractor of any responsibility for the quality of the finished work. Surfaces on which specified finishes are to be applied shall be in proper condition in every respect for superior finished work and long life without defects.

D. The Contractor's performance of the work hereunder shall be to the satisfaction of the Architect. The Architect reserves the right to reject materials and work quality which are not considered to be up to the accepted high standards of the various trades involved. Such inferior material or work quality shall be repaired or replaced, as directed by the Architect, at no additional cost to the Owner.

1.02 MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS

A. Unless otherwise indicated or specified, manufactured materials, products, processes, equipment, systems, assemblies, and the like shall be erected, installed, or applied in accordance with the manufacturers' instructions, directions, or specifications. Said erection, installation, or application shall be in accordance with printed instructions furnished by the manufacturer of the material or equipment concerned for use under conditions similar to those at the jobsite. Two copies of such instructions shall be furnished to the Architect, and the Architect's acceptance therefore shall be obtained before work is begun.

B. Any deviation from the manufacturers' printed recommendations shall be explained and acknowledged as correct and appropriate for the circumstances, in writing, by the particular manufacturer. Any deviations must be reviewed by the Architect prior to any action by the Contractor. The Contractor will be held responsible for installations contrary to the respective manufacturers' recommendations.

1.03 SPECIALIST APPLICATOR/INSTALLER

A. Materials, equipment, systems, and assemblies requiring special knowledge and skill for the application or installation of such materials, equipment, systems, or assemblies shall be applied or installed by the specified product manufacturer or its authorized representative or by a skilled and experienced subcontractor qualified and specializing in the application or installation of the specified product with at least five years of successful experience in the type of work indicated and specified.

B. The installation subcontractor shall be approved by the product manufacturer, as applicable, and a copy of the installer's approval letter from the manufacturer shall be submitted to the Architect.

1.04 MANUFACTURER'S FIELD SERVICES

A. The manufacturer of a product, system, or assembly which requires special knowledge and skill for the proper application or installation of such product, system, or assembly shall provide appropriate field or job service at no additional cost to the Contractor or Owner. The manufacturer shall inspect and approve the application or installation work.

B. The Contractor shall make all necessary arrangements with the manufacturer of the products to be installed to provide onsite consultation and inspection services to assure the correct application or installation of the product, system, or assembly.

C. The manufacturer's authorized representative shall be present at the time any phase of this work is started.

D. The manufacturer shall inspect and approve all surfaces over which, or upon which the manufacturer's product will be applied or installed.

E. The manufacturer's representative shall make periodic visits to the site as the work proceeds as necessary for consultation and for expediting the work in the most practical manner.

1.05 TOLERANCES

A. Walls: Finished wall surfaces shall be plumb and shall have a maximum variation of 1/8 inch in 8 feet when a straightedge is laid on the surface in any direction, and no measurable variation in any 2-foot direction.

B. Ceilings: Finished ceiling surfaces shall present true, level, and plane surfaces, with a maximum variation of 1/8 inch in 8 feet when a straightedge and water level are laid on the surface in any direction and no measurable variation in any 2-foot direction.

C. Concrete floors: Tolerances for concrete floors and pavement are specified in Division 3.

D. Wood and Plywood Subfloors: Subfloor surfaces shall be level and shall have a maximum variation of plus or minus 1/8 inch in 10 feet. An additional tolerance of plus 1/4 inch per 2 feet of unsupported span will be allowed for camber.

E. Finished Floors: Level to within plus or minus 1/8 inch in 10 feet for hardwood and resilient floor coverings.

1.06 PROTECTION OF WOOD

A. Provide protection of all wood materials and products, whether or not installed, including erected and installed wood framing and sheathing, from water and moisture of any kind until completion and acceptance of the project.

B. The Contractor shall keep informed of weather conditions and forecasts, and when there is a likelihood of rain, shall protect installed and exposed framing and sheathing and stored lumber exposed to the elements with suitable water-repellent coverings, such as canvas tarpaulins and polyethylene sheeting.

C. Likewise, millwork and trim, paneling, cabinets, shelving, and products manufactured from wood shall be kept under cover and dry at the shop until time for delivery. Such materials shall not be delivered to the site until the building is roofed, and exterior walls are sheathed and protected with building paper as a minimum, the doors and windows are installed and glazed, and there is ample interior storage space for such materials and products. Delivery shall not occur during periods of rain, heavy dew, or fog.

D. Wood materials or products which become wet from rain, dew, fog, or other source will be considered to have moisture damage and will be rejected, requiring replacement by the Contractor with new, dry materials or products at no increase in the Contract Price. Excepted materials: installed exterior wood siding, exterior wood trim, exterior wood doors, and exterior wood windows, after specified treatments, such as exterior wood stain or paint, have been applied.

1.07 GROUT FILL

A. In applications where the grout installation may be subjected to moisture, the manufacturer shall submit a letter stating that the entire grout matrix does not contain any of the following:

1. Added gypsum.
2. Plaster-of-paris.
3. Sulfur trioxide levels in a portland cement component exceeding ASTM C 150's published limits.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 45 29 TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: The Contractor shall use testing laboratory services of the Mississippi Department of Transportation for all testing required in this Section. These services will be provided to the Contractor by the MDOT at no charge. Use of said services shall in no way relieve the Contractor of his obligation to perform Work in accordance with the Contract.

B. Inspection, Sampling and Testing are required for:

1. Section 31 23 12, Excavation, Fill and Grading.
2. Section 03 20 00, Concrete Reinforcing.
3. Section 03 30 00, Cast-In-Place Concrete.

1.02 LABORATORY'S DUTIES

A. Materials will be inspected and sampled in accordance with current Mississippi Department of Transportation SOP pertaining to inspecting and sampling.

B. Prepare reports of inspections and tests including:

1. Date issued.
2. Project title and number.
3. Testing laboratory, name and address.
4. Name and signature of inspector.
5. Date of inspection or sampling.
6. Record of temperature and weather.
7. Date of test.
8. Identification of product and Specification Section.
9. Location of Project.
10. Type of inspection or test.
11. Observations regarding compliance with Contract Documents requirements.

C. Distribute copies of reports of inspections and tests to Project Engineer and one copy to the MDOT Architect.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel to provide to laboratory in required quantities preliminary representative samples of materials to be tested.

B. When required, furnish copies of mill test reports. Furnish to laboratory, casual labor to obtain and handle samples at the site and to facilitate inspections and tests.

C. Provide facilities for laboratory's exclusive use for storage and curing of test samples.

D. Notify laboratory in advance of operations to allow for assignment of personnel and scheduling of tests.

1.04 MATERIAL CERTIFICATIONS AND CERTIFIED TEST REPORTS

A. All certifications shall meet the following requirements:

1. Have letterhead of the manufacturer, producer, supplier, or fabricator.
2. Include the project number.
3. Itemized list of materials covered by the certification.
4. Contain a material conformance statement, which certifies that the materials conform to the specific specification requirements.
5. Certification for all steel and steel wire products must also include a certified statement by the manufacturer that all of the manufacturing processes are of domestic origin.
6. Signature of a responsible company official.

B. All certified test reports shall meet the following requirements:

1. Have letterhead of the manufacturer, producer, supplier, fabricator, or laboratory.
2. Include name and description of material, lot, batch, or heat number, etc., as applicable.
3. Show results of each required test, and state that the test was run according to the test method specified.
4. Test reports for all steel and steel wire products must also include a certified statement by the manufacturer that all of the manufacturing processes are of domestic origin.
5. Signature of a responsible laboratory official.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 GENERAL

A. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced the need.

1.02 FIELD OFFICE AND STORAGE FACILITIES

A. The Contractor shall not be responsible for construction of a field office. The Contractor shall provide, maintain, and remove when directed, suitable substantial and watertight temporary field office and storage shed(s), in locations on the site as directed by the Project Engineer, or his authorized representative and best suited for their respective uses, as follows:

1. Field Office: The Contractor is not required to furnish a field office, but shall provide at the job site duplicates of all correspondence, shop drawings, plans, specifications, samples, etc. required to administer the Project. These duplicates will be permanently kept as reference and shall not be used in the field. Contractor shall provide the Project Engineer and the MDOT Architect with job site and emergency telephone numbers.
2. Storage Facilities: It shall be the Contractor's option to provide watertight storage facilities for storage of cement, lime, and / or other materials subject to water damage. If storage facilities are used, it shall be of sufficient size to hold all materials required for logically grouped activities on the site at one time, and shall have floors raised at least 6 inches above the ground on heavy joists or sleepers. Fully enclosed trailer is allowed, but location must be coordinated with Project Engineer.

1.03 FURNISHING AND MAINTENANCE OF EQUIPMENT

A. Furnish and maintain all equipment such as temporary stairs, ladders, ramps, scaffolds, hoists, runways, derricks, chutes, elevators, etc. as required for proper execution of the Work of all trades. All such apparatus, equipment and construction shall meet all the requirements of the Labor Law and other applicable State or local laws

1.04 ELECTRIC LIGHTS AND POWER

A. Supply lights and power when necessary for the progress of the Work. The operating costs shall be borne by the Owner. Temporary wiring, where required, shall be run in conduits.

1.05 WATER

A. Supply water service. The operating costs shall be borne by the Owner.

1.06 ROADS AND ACCESS

A. The drive is to remain open at all times. A flagman will be required to control traffic when construction vehicles are present.

1.07 TOILETS FOR WORKMEN

A. Provide and maintain all necessary toilets for workmen. Toilets are to be maintained in strict accordance with the regulations of the State Board of Health. The toilets are to be located on the site as directed by the Project Engineer or his authorized representative.

1.08 SECURITY / PROTECTION PROVISIONS

A. The types of temporary security and protection provisions required include, but are not limited to, fire protection, barricades, warning signs / lights, personnel security program (theft prevention), environmental protection, and similar provisions intended to minimize property losses, personal injuries and claims for damages at Project Site(s).

B. Barricades and Construction Fence: Provide and erect all necessary barricades and any other protection required. Provide all necessary warning and danger lights from twilight to sunrise.

C. Fire Extinguishers: Provide types, sizes, numbers and locations as would be reasonably effective in extinguishing fires during early stages, by personnel at project site. Provide Type A extinguishers at locations of low potential for either electrical or grease/oil flammable liquid fires: provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10. Post warning and quick-instructions at each extinguisher location, and instruct personnel at Project Site, at time of their first arrival, on proper use of extinguishers and other available facilities at Project Site. Post local fire department call number on each telephone instrument at Project Site.

D. Environmental Protection Procedures: Designate one person, the Construction Superintendent or other, to enforce strict discipline on activities related to generation of wastes, pollution of air/water/soil, generation of noise, and similar harmful or deleterious effects which might violate regulations or reasonably irritate persons at or in vicinity of Project Site.

E. Water Control: Provide pumps as required to keep the excavation free from standing water and shall slope the excavation to prevent water from running toward existing buildings at all times.

1.09 BURNING OF TRASH

A. No burning of trash or debris shall be done on Owner's property. All such materials shall be removed from the site and disposed of in accordance with local laws and ordinances.

1.10 POWDER ACTUATED TOOLS

A. The use of powder actuated tools shall be prohibited from use during all phases of the construction, unless explicitly approved in writing, prior to construction, by the Project Engineer.

1.11 FIRE HAZARDS

A. Special precautions shall be taken to reduce fire hazards where electrical or gas welding or cutting Work is done and suitable fire extinguishing equipment shall be maintained near such operations.

1.12 CONDUCT OF WORKERS

A. Workmen, who, because of improper conduct or persistent violation of Owner's requirements, become objectionable, shall be removed at the Owner's request. Inform all workmen of Owner's requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 61 15 BASIC PRODUCT REQUIREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The products of The Work and the requirements for their quality, delivery, handling, storage, protection and installation.

1.02 DEFINITIONS

A. “Products”. Defined as: The materials, machinery, equipment, components, and systems, in whole or in part, incorporated into The Work. “Products” does not include materials, tools, devices, machinery, equipment and systems used for the preparation, manufacture, fabrication, conveying and installation of The Work.

B. “Level of Excellence”. Defined as: The degree of quality for the Products and Workmanship of this Project. The required “degree of quality” shall be established on the basis of one or more of the following criteria which shall become the minimum acceptable “level of excellence” for the Work of this Project:

1. Products selected by Architect / Engineer.
2. Architect’s / Engineer’s Specifications.
3. Reference Standards.
4. Manufacturer’s Instructions.
5. Industry Standards.
    a. In the absence of all the criteria from the Specifications Section, the normal local Industry Standard shall prevail. The Party or Parties responsible for the required work shall be experienced in the work to be provided; shall have knowledge as to what, in the local area, constitutes “good and acceptable practice” in producing the completed Work of this Section, and will be expected to provide nothing less.
        1) Example: Masonry and Drywall Contractors are expected to know that Industry Standards, “good practice”, and “common sense” dictate, to prevent cracks in the completed work, control joints must be installed at minimum distances or should be placed in certain locations where movement or other stress conditions are likely to occur. When such items are not specified or shown on the Drawings, the Contractor will be expected to request the MDOT Architect’s clarification for location (primarily for esthetic considerations) and then provide not less than the minimum Industry Standard, at no additional cost to the Owner.

C. “Standard of Quality”. Defined as: A specific and particular manufacturer whose product(s) has / have been selected by the Architect as amply suitable to meet the Project requirements in one or more of the following criterions: appearance, physical attributes, performance characteristics, appropriateness for intended use, and cost.

1. The work of the individual Specification Section will be based on product(s) of the “Standard of Quality Manufacturer” and the product(s) of that manufacturer, designated within the Specifications Section by catalog number(s) (or other identification), shall become “Standard of Quality Product(s) and the basis by which the product(s) of “Other Acceptable Manufacturers”, and any substitutions, are judged.
2. In the absence of the designation “Standard of Quality”, such as for generic product, material or system, then the specified item (product, material or system) shall be the reference standard and shall become the “Standard of Quality”.

D. “Equivalent Products”. Defined as: Products having a level of excellence which, in the MDOT Architect’s judgment, is equal to the level of excellence established by the product(s) selected as Architect’s / Engineer’s “Standard of Quality”.

E. "Manufacturer". Defined as: An entity whose principal business is the manufacturing, fabricating, assembling, and / or supplying of products / systems from off site for incorporation (in whole, or in part, such as components of a system) into the construction at the Project Site.

1. The Architect's / Engineer's selection of a particular manufacturer usually is on the basis of the manufacturer's reputation within the Construction Industry, and / or "track record" with the Architect / Engineer, for producing quality products on time, and providing responsive follow-up and reliable warranties.
2. The terms "Fabricator" and "Supplier" used in these Specifications shall be synonymous with "manufacturer".

F. "Other Acceptable Manufacturers". Defined as: Manufacturers who have qualifications and products similar to those of the "Standard of Quality" Manufacturer (see above) selected by Architect / Engineer and are therefore "acceptable" to offer any of their products considered to be "equivalent" to the specified product(s).

1. To the best of the Architect's / Engineer's knowledge, information and belief, the manufacturers, listed as "Other Acceptable Manufacturers", now have products available that are considered to be "equivalent" to the specified product (or selection) of the "Standard of Quality" Manufacturer. Where no "Standard of Quality" is indicated then any of the "Acceptable Manufacturers" listed may offer products complying with the specified requirements.
2. The inclusion of particular manufacturers as "Other Acceptable Manufacturers" does not signify that other (that is, unlisted) manufacturers are not acceptable or that they do not have equivalent products nor does the omission of any manufacturer's name indicate unacceptability for any reason.
3. Manufacturers, who are not listed in the Contract Documents, and who desire consideration, must submit their product under provisions of Section 01 62 14 - Product Options and Substitutions Procedures.

1.03 QUALITY ASSURANCE – GENERAL

A. The quality of all products and workmanship shall be in accordance with the provisions of this Section and the requirements of the individual Specifications Section.

B. Whenever a "level of excellence" higher than the minimum industry standard is expected for products and workmanship, the more rigid standards and precise requirements will be indicated within individual Specifications Sections.

1. Example: For whatever reason, the Architect may specify a "dry film thickness (DFT)" for a coating that is more than the manufacturer's recommendation or than normally available in a three coat system. It shall be the Contractor's responsibility to achieve the required DFT with one or more additional coats, none of which shall be more than the manufacturer's recommendation for wet film thickness, for a single coat, when applied.

C. Establishing and maintaining Project Quality Control shall be the responsibility of the Contractor.

1.04 QUALITY ASSURANCE – PRODUCTS

A. All products incorporated into The Work shall be new except where otherwise provided by the Contract Documents and shall comply with the requirements of the individual Specifications Sections and as supplemented herein. All products incorporated into the Work shall be asbestos free. Products containing asbestos are not acceptable and will be considered as defective material. Whenever these products containing asbestos are discovered, they shall be removed from the Work at no cost to the Owner. Contractor shall certify that all materials incorporated into the Work are asbestos free, refer to Section 01 77 00 - Closeout Procedures.

B. Matching / Mating of Products:

1. Products required in quantity within a Specifications Section shall be the same, and shall be interchangeable.
2. All manufactured products exposed to view, especially those considered as "Finishes" (including, but not limited to, items as floor material, wall coverings, glass, paint ceiling tile, that are installed or applied directly from manufacturer's containers), shall be of the same factory "run".
3. The Contractor is expected to secure a sufficient quantity with initial purchase to avoid running short. Materials within an area that do not match, as a result of such failure, will be cause to reject all materials and will not be grounds for additional compensation.

C. Extra Materials: When required by individual Specifications Sections, provide products, spare parts and maintenance material in condition and quantities required. All "extra materials" shall be of the same factory "run" as installed materials. Deliver to Project Site, properly store in appropriate locations, and obtain receipt from authorized person prior to Final Payment.

1.05 QUALITY ASSURANCE – WORKMANSHIP

A. Comply with the "level of excellence" required by individual Specifications Sections. In the absence of specific requirements, comply with product(s) manufacturer's instructions and Industry Standards.

B. Use only suitably qualified craftsmen to produce work of the specified quality.

1. Craftsmen shall be of excellent ability, thoroughly trained and experienced in types of work required, completely familiar with the quality standards, procedures and materials required.
2. In the acceptance or rejection of manufactured and / or installed work, the MDOT Architect will make no allowance for the lack of skill on the part of workmen.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Provide finishes to match approved samples.

E. Adjusting of Operating Products: As follows:

1. Adjust moving parts of product / equipment (including, but not limited to, doors, drawers, hardware, appliances, mechanical and electrical equipment) to ensure smooth and unhindered operation and movement at time when Owner assumes control of item's use.
2. All items shall be properly set, calibrated, balanced, lubricated, charged, and otherwise prepared and ready for intended use.
3. Starting of Systems: When specified in individual Sections, require manufacturer's representative to be present at the Site to inspect, check, and approve equipment installation prior to start-up; to supervise placing equipment in operation; and to certify by written report that equipment has been properly installed, adjusted, lubricated, and satisfactorily operated under full load conditions.
4. Equipment/systems Demonstrations and Personnel Instruction: When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems and to instruct Owner's personnel on proper operation and maintenance manuals as basis of instruction and demonstration. Include start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at schedule times, at equipment location.

1.06 TRANSPORTATION AND HANDLING

A. Transport products by means and methods to avoid product damage; deliver in undamaged condition in manufacturers' unopened containers or packaging, keep dry.

B. Provide equipment and personnel to handle products by means to prevent soiling or damage.

C. Promptly inspect shipments for compliance with requirements, quantities, and damage.

1.07 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Protect prefinished surfaces from damage or deterioration by acceptable means; do not use adhesive papers, sprayed or strippable coatings that bond when exposed to sunlight or weather.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering (do not use "Visqueen" or other polyethylene sheeting when subject to direct sunlight); provide ventilation to avoid condensation.

C. Store loose granular materials on solid surface in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under specified conditions and are fit for use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 62 14 PRODUCT OPTIONS AND SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: To give the product options available to the Contractor and to set forth the procedure and conditions for substitutions.

1.02 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, select any product meeting standards by any manufacturer.

B. For products specified by naming several (minimum of three) products or manufacturers, select any product and manufacturer named. Contractor must submit request, as required for substitution, for any product not specifically named and give reasons for not using product specified. Substitutions WILL NOT be granted unless reasons are considered justified.

C. For product specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or approved equal" after specified product, Contractor must submit request, as required for substitution, for any product not specifically named.

D. For products specified by naming only one product and manufacturer, an equivalent product will always be accepted if it is equal in all respects (size, shape, texture, color, etc.). The Contractor must submit a request for substitution as set forth in this section

E. For products specified by naming only one product and manufacturer and stating no substitutions will be accepted, there is no option and no substitutions will be allowed.

1.03 PRODUCT SUBSTITUTION LIST

A. Within 45 days after Notice to Proceed, submit to the MDOT Architect 4 copies of complete list of all proposed product substitutions. Substitutions WILL NOT be considered if received after this time.

B. Tabulate list by each Specification Section.

C. For named products specified with reference standards, include with listing of each product:

1. Name and address of manufacturer.
2. Trade name.
3. Model or catalog designation.
4. Manufacturer's data.
5. Performance and test data.
6. Reference standards.

D. Proposed product will be reviewed for incorporation into the Project. Contractor will be notified for substitution rejection if not allowed, or will be instructed to submit in standard substitution submittal process for approval. See attached Substitution Request Form.

1.04 SUBSTITUTIONS

A. The MDOT Architect will consider formal written requests from Contractor for substitution of products in place of those specified. ONLY ONE REQUEST per product will be allowed. Refer to Section 01 33 00 - Submittal Procedures. Include in request:

1. Complete data substantiating compliance of proposed substitutions with Contract Documents.
2. For products:
   a. Product identification including manufacturer's name and address.
   b. Manufacturer's literature: Submit literature of actual product specified and literature of proposed substitution with all comparable features or components highlighted. Highlighted information is to include, but shall not be limited to, product description, performance, test data and reference standards.
   c. Samples of the proposed substitution.
   d. Name and address of 3 similar projects on which product was used and date of installation.
3. For construction methods:
   a. Detailed description of proposed method.
   b. Drawings illustrating methods.
4. Itemized comparison of proposed substitution with product or method specified.
5. Data relating to changes in construction schedule.
6. Accurate cost data on proposed substitution in comparison with product or method specified.

B. In making request for substitution, Contractor represents:

1. He has personally investigated proposed product or method, compared the product specified with the proposed substitution, and determined that it is equal or superior in all respects to that specified.
2. He will provide the same guarantee for substitution as for product or method specified.
3. He will coordinate installation of accepted substitution into Work, making such changes required of Work to be complete in all respects.
4. He waives all claims for additional costs related to substitution that consequently becomes apparent.
5. Cost data is complete and includes all related costs under his Contract.

C. Substitutions WILL NOT be considered if:

1. They are indicated or implied on Shop Drawings or product data submittals without formal request submitted in accordance with this Section.
2. Acceptance will require substantial revision of Contract Documents.
3. In the MDOT Architect’s judgment, the product or material is not equal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRODUCT SUBSTITUTION REQUEST FORM (AS FOLLOWS)

SUBSTITUTION REQUEST FORM

PROJECT:_____ PROJECT NO._____

OWNER:_____

CONTRACTOR:_____

ARCHITECT:_____

_____

_____

_____

CONTRACTOR'S REQUEST, WITH SUPPORTING DATA

1. Section of the Specifications to which this request applies:

   _____

   [ ] Product data for specified item and proposed substitution is attached (description of product, reference standards, performance and test data).

   [ ] Sample is attached

   [ ] Sample will be sent if requested by Authority having Jurisdiction.

2. Itemized comparison of proposed substitution with product specified.

	ORIGINAL PRODUCT	SUBSTITUTION
Name, brand		
Catalog No.		
Manufacturer		

Significant variations:_____

_____

3. Proposed change in Contract Sum:

   Credit to Owner: $_____

   Additional Cost to Owner: $_____

4. Effect of the proposed substitution on the Work:

   Contract Time: _____

   Other Contracts, if any:_____

CONTRACTORS STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENTS

I / We have investigated the proposed substitution. I / We

1. Believe that it is equal or superior in all respects to originally specified product, except as stated in 2. above;
2. Will provide same warranty as required in Contract Documents;
3. Have included all cost data and cost implications of proposed substitution; including, if required, costs to other contractors, and redesign and special inspection costs caused by use of proposed substitution;
4. Will coordinate incorporation of proposed substitution in the Work;
5. Will modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning;
6. Have verified that use of this substitution conforms to all applicable codes.
7. Waive future claims for added cost to Owner caused by proposed substitution.

CONTRACTOR_____DATE:_____
Signature

ARCHITECT'S REVIEW AND ACTION

___ Accepted

___ Not Accepted

___ Provide more information in the following categories and resubmit _____

___ Sign Contractor's Statement of Conformance and resubmit

___ Proposed substitution is accepted, with the following conditions:

_____

_____

Change Order will make the following changes:

(Add to) (Deduct from) Contract Sum: $_____

(Add to) (Deduct from) Contract Time: _____days

ARCHITECT:_____DATE_____

OWNER: _____DATE_____

_____Accepted _____Not accepted

END OF SECTION

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope: To set forth broad general conditions covering cutting and patching that applies to everyone and everything on the job.

B. Execute cutting including excavating, fitting or patching or work required to:

1. Make several parts fit properly.

2. Uncover work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to Contract requirements.

5. Install specified work in existing construction.

C. In addition to Contract requirements, upon MDOT Architect's written instructions:

1. Uncover work for observation of covered work.

2. Remove samples of installed materials for testing.

3. Remove work to provide alteration of existing work.

D. Do not cut or modify work of another Contractor without his consent.

E. Payment for Costs: Costs caused by ill-timed, defective or work not conforming to the Contract will be borne by party responsible for ill-timed, defective or non-conforming work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials for replacement of work removed shall comply with individual Specifications Sections for type of work to be done.

PART 3 - EXECUTION

3.01 GENERAL

A. Inspection: Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching.

B. Preparation prior to cutting: Provide shoring, bracing and supports required to maintain structural integrity. Provide protection for other portions of project and protection from the elements.

C. Performance:

1. Execute cutting and demolition of methods that prevent damage to other work and will provide surfaces to receive installation of repairs and new work.

2. Execute excavating and backfilling by methods that prevent damage to other work and prevent settlement

3. Restore work that has been cut or removed install new products to provide completed work in accordance with requirements of the Contract Documents.

4. Refinish entire surfaces as necessary to provide an even finish. Refinish continuous surfaces to the nearest intersection and assemblies.

END OF SECTION

SECTION 01 74 00 CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Maintain premises and public properties from accumulations of waste, debris, and rubbish, caused by operations. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

B. Dispose of all waste, debris and rubbish in accordance with the 0wner's requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by the manufacturer of surface to be cleaned, but cross reference cleaning materials used on surfaces to insure they are recommended by the cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to insure that structure, grounds, and surrounding properties are maintained free from accumulations of waste materials and rubbish. Wet down dry materials and rubbish to lay dust and prevent blowing dust. Clean site and surrounding properties at reasonable intervals during progress of Work, and remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off MDOT owned property. Handle materials in a controlled manner with as few handling as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust or other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces.

B. No materials may be disposed of by dumping them in the sanitary or storm sewer systems without specific approval by the Owner.

C. Washdown of cement trucks will be done at locations determined by the Project Engineer.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning. In preparation for Inspection of structure, conduct final inspection of sight-exposed surfaces and concealed spaces. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed finished surfaces. Repair, patch and touch up marred surfaces to specified finish to match adjacent surfaces.

B. Remove temporary fencing and leave in same condition as surrounding landscaped areas.

C. Broom clean paved surfaces; rake clean other surfaces of grounds. Keep Project clean until occupied by Owner.

END OF SECTION

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Scope of Work required under this Section consists of the Final Inspections, submitting of all closeout Documents and related items to complete the Work indicated on the Drawings and described in the Project Manual.

1.02 FINAL INSPECTIONS

A. Engineer and Architect's Inspection: The Contractor shall make written request for a Final Inspection to the Project Engineer and MDOT Architect. Notice is to be given 10 calendar days prior to this inspection. At the day of inspection, the Contractor shall have in hand 6 copies of the HVAC Test and Balance Report, Reference Specification Sections in Division 23 and 6 copies of a list prepared by the Contractor of deficiencies, which will be edited by the Project Engineer, MDOT Architect and Consultants. A copy of these composite lists will be given to the Contractor for correcting the Work. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed. If, in the Project Engineer and MDOT Architect’s judgment, the Project is not ready for an Inspection, the Project Engineer may schedule another inspection.

B. Owner's Inspection: After the Project Engineer and MDOT Architect have determined the Project to be Complete and all punch list items have been corrected, an Owner's Inspection will be scheduled. The Contractor shall submit a letter that states all items have been corrected and submit required closeout Documents. The Owners may add to the punch list items; if it is determined that corrective work still needs to be done. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed.

C. Correction of Work before Final Payment: Contractor shall promptly remove from the Owner's premises, all materials condemned for failure to conform to the Contract, whether incorporated in Work or not, and Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after 10 days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor or charged to the Contractor in the event no payment is due.

D. Should additional inspections by the MDOT Architect’s Consultants of the Work be required due to failure of the Contractor to remedy defects listed, the Project Engineer may deduct the expense of additional Consultants inspections from the Contract Sum in the Owner / Contractor Agreement. The additional expense will be based on the rate shown for services in the Consultants’ Architect or Engineering Services Contract.

1.03 FINAL ACCEPTANCE

A. The Mississippi Department of Transportation does not recognize the term “Substantial Completion”. The Project Engineer shall determine when the building is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion.

B. All Warranties and Extended Warranties shall use this Date of Completion as the starting date of Warranty Period.

C. Final Payment shall not be made until items covered in Closeout Procedures are satisfied. This date shall be the Date of Final Acceptance.

1.04 CLOSEOUT DOCUMENTS

A. Unless otherwise notified, the Contractor shall submit to the Owner through the Project Engineer to the MDOT Architect 2 copies the following before final payment is made:

1. Request for Final Payment: AIA Document G702, current edition, completed in full or a computer generated form having similar data.

2. Contractor's Affidavit of Payment of Debts and Claims: AIA Document G706, current edition, completed in full.

3. Release of Liens and Certification that all Bills Have Been Paid: AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this project have been paid and that the Owner is released from any and all claims and / or damages.

4. Consent of Surety Company to Final Payment: AIA Document G707, current edition, completed in full by the Bonding Company.

5. Power of Attorney: Closeout Documents should be accompanied by an appropriate Power of Attorney.

6. Guarantee of Work: Sworn statement that all Work is asbestos free and guaranteed against defects in materials and workmanship for one year from Date of Completion, except where specified for longer periods.
   a. Word the guaranty as follows: "We hereby guarantee all Work performed by us on the above captioned Project to be free from asbestos and defective materials. We also guarantee workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work".
   b. All guarantees and warranties shall be obtained in the Owner's name.
   c. Within the guaranty period, if repairs or changes are requested in connection with guaranteed Work which, in the opinion of the Owner, is rendered necessary as a result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular, all such guaranteed Work, correct all defects wherein and make good all damages to the building, site, equipment or contents thereof which, in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract; and make good any Work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guaranty.
   d. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the guaranty, the Owner may have the defects corrected and the Contractor and his sureties shall be liable for all expense incurred.
   e. All special guaranties applicable to definite parts of the Work stipulated in the Project Manual or other papers forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.

7. Project Record Documents: Furnish all other record documents as set forth in Section 01 78 39 - Project Record Documents.
   a. Provide all certificates, warranties, guarantees, bonds, or documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements
8. Additional Documents Specified Within the Project Manual:
   a. General: Provide all Operational and Maintenance documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
   b. Maintenance Stock: Deliver to Owner all required additional maintenance materials as required in the various Sections of the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 23 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Emergency manuals.
2. Operation manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, a finishes systems and equipment.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 32 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.02 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.

1.03 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual with request for Final Inspection. Include a complete operation and maintenance directory. MDOT Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 2 copies of each manual in final form at least 5 days before Owner’s Final Inspection. MDOT Architect will return one copy with comments (if required) within 15 days after Owner’s Final Inspection.

1. Correct or modify each manual to comply with MDOT Architect's comments. Submit 2 copies of each corrected manual within 15 days of receipt of MDOT Architect's comments.

1.04 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

2.01 MANUALS, GENERAL

A. 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.

B. 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.

C. 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. 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.

D. 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 inches by11 inches 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 inches by11 inches 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.

2.02 EMERGENCY MANUALS

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

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

B. 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. Chemical release or spill.
8. System, subsystem, or equipment failure.

C. 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.

D. 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.

2.03 OPERATION MANUALS

A. 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.

B. 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.

C. 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.

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

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

2.04 PRODUCT MAINTENANCE MANUAL

A. 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.

B. 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.

C. 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.

D. 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.

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

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

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. 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.

B. 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.

C. 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.

D. 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 from manufacturers / suppliers.

E. 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.

F. 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.

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

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

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. 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.

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

C. 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.

D. 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.

1. 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.
2. 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.

E. 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. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: To set forth the minimum procedure and requirements for keeping the Project Record Documents. One of these Documents is to be kept on site throughout the Project.

1.02 MAINTENANCE OF DOCUMENTS

A. Maintain 2 copies of all: Half-size Contract Drawings, Project Manual (Proposal), Addenda, Change Orders, Warranties, Certificates, Guarantees, Bonds, reviewed Shop Drawings, reviewed submittals (materials, fixtures, appliances, etc.), hardware schedules, field and laboratory test records, equipment brochures, spare parts lists, maintenance and operation manuals and other modifications to the Contract.

B. Store Record Documents apart from Documents used for construction.

C. Maintain Record Documents in clean, dry, and legible condition. Do not use Record Documents for construction purposes.

D. Make Record Documents available at all times for inspection by the Project Engineer, MDOT Architect and Owner.

1.03 RECORDING

A. General: Mark all modifications in red pencils. Keep Record Documents current. Review log at Progress Meetings. Do not permanently conceal any Work until required information has been accurately recorded.

B. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground and overhead utilities with their connections referenced to permanent surface improvements.
2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
3. Field changes that involve dimension and detail.
4. Changes made by Supplemental Agreement (Change Order) or Field Order.

C. Project Manual (Proposal) and Addenda: Legibly mark up each Section to record manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

D. Shop Drawings: Maintain as Record Documents; legibly mark Drawings to record changes made after review.

1.04 SUBMITTALS

A. Furnish two (2) copies of all Record Documents.

B. The information, except Contract Drawings, shall be arranged and labeled by corresponding Specification Section, neatly bound in three ring binders, indexed, and all drawings readable without being removed or unstapled.

C. The name and address of each subcontractor and material supplier shall be listed in front of each binder along with the Project Manual (Proposal).

D. Sufficient information, such as as-built control drawings for air handling system and variable drive controls, shall be furnished to allow qualified personnel to service equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1- GENERAL

1.01 SECTION INCLUDES

A. All concrete formwork and other related items necessary to complete project indicated by Contract Documents unless specifically excluded.

1.02 RELATED ITEMS SPECIFIED ELSEWHERE

A. Section 03 20 00 – Concrete Reinforcing.

B. Section 03 30 00 – Cast-in-Place Concrete.

1.03 PROJECT CONDITIONS

A. Contractor shall examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wood forms: 3/4 inch exterior grade plywood on studs and joists.

B. Form Ties: Standard snap ties, 1-1/2 inch break-back.

C. Form Oil: Approved non-staining type, "Noxcrete" or equal. Oil must not affect bonding of finishes on exposed concrete.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION

A. Forms shall be properly aligned, adequately braced and mortar tight to produce concrete shapes required by Drawings. Align forms so that the actual surface does not vary from true surface more than l/8 inch. The surface shall be clean, undamaged, and free of offsets and irregularities at joints. Adequately brace and frame to retain true shapes under vibration and placing strains without leaks, bowing, or deflection.

B. Studs, girts, and walls shall not be less than 2 by 4’s, S4S, construction of standard grade Douglas fir, or equal, selected for straightness. All walls shall consist of at least two 2 by 4’s. Studs shall not be spaced more than l6 inches, girts not more than 24 inches and ties not more than 27 inches, on center.

C. Lightly oil wood forms prior to placing reinforcing, and with oil not permitted on the reinforcing. Where oil form is used, remove excess before pouring concrete.

D. Meet recommendations of "Recommended Practice for Concrete Form work" ACI 347 unless specified herein otherwise.

3.02 INSERTS AND FASTENING DEVICES FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, dowels, nailing strips, grounds and other fastening devices required for attachment of other Work

B. Locate partitions for other trades prior to pouring concrete in order that conduits, sleeves and inserts required by others will be installed in the proper locations

C. Do not install sleeves in any concrete beams or piers except upon approval of the Project Engineer.

D. Do not put aluminum conduits in concrete.

3.03 FORM REMOVAL

A. Grade beam and column forms may be removed 24 hours after a pour is completed.

B. Floor slab wood forms may be removed l0 days after pour, providing compressive strength has reached a minimum of 2500 psi based on job cast cylinders.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All concrete reinforcing and the related items necessary to complete the Project indicated by the Contract Documents unless specifically excluded.

1.02 RELATED ITEMS SPECIFIED ELSEWHERE

A. Section 03 10 00 – Concrete Forming and Accessories.

B. Section 03 30 00 – Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Submit reinforcing steel shop drawings and materials list prior to placement for MDOT Architect's approval. Shop drawings shall include complete DIMENSIONED placing plans including control joint locations, order lists, bend diagrams, and DETAILS SHOWING DIMENSIONS WITH CLEARANCES. Submittals not including this requirement will be considered as an incomplete submittal and will be returned to Contractor for re-submittal.

B. Furnish mill certificates for steel bar reinforcement, to the Project Engineer certifying that each shipment meets specifications. The fabricator will furnish certificates with bar lists to designate location of shipment and the time steel is delivered to the project.

1.04 QUALITY ASSURANCE

A. Reinforcing bars shall conform to ASTM A 615 "Deformed Billet-Steel Bars for Concrete".

B. Mesh reinforcement shall conform to ASTM A 185 "Welded Steel Wire Fabric for Concrete Reinforcement".

C. Accessories shall conform to American Concrete Institute ACI 301 "Specifications for Structural Concrete for Buildings".

D. Placement shall be in accordance with approved shop drawings and ACI 318 "Standard Building Code Requirements for Reinforced Concrete".

E. Comply with ACI 315 "Manual of Standard Practice of Detailing Reinforced Concrete Structures".

1.05 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing bar steel and mesh shall be handled, shipped and stored in a manner that will prevent distortion or other damage.

B. Materials shall be stored in a manner to prevent excessive rusting and fouling with dirt, grease, or other bond-breaking coatings.

1.06 PROJECT CONDITIONS

A. Coordinated placement of concrete reinforcing with installation of concrete formwork, vapor barriers, concrete inserts, conduit and all other items occurring in the area.

PART 2 - PRODUCTS

2.01 STEEL BAR REINFORCEMENT

A. Bar reinforcement shall conform to ASTM A 615, grade 60, of domestic manufacture. Bars shall be new; free from rust, scale, oil, or other coatings that will prevent bond.

2.02 WELDED STEEL WIRE FABRIC

A. Shall conform to ASTM A 185, new, free from rust and other coatings that will prevent bond.

2.03 ACCESSORIES

A. Metal accessories as required shall support reinforcing bars and comply with ACI 315. Chairs and bolsters for use in exposed concrete shall have plastic coated or stainless steel legs or shall be plastic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fabricate and place reinforcement in accordance with the latest requirements of the American Concrete Institute and the approved shop drawings. Fabrication shall not proceed until MDOT Architect's approval is obtained.

B. Reinforcing for one day's pour shall be completely placed and an inspection made by the Project Engineer / MDOT Architect prior to starting the pour.

C. Concrete Protection for Reinforcement: Minimum coverage shall be as follows unless shown otherwise on drawings:

1.	Footings (bottom and sides)	3 inches clear
2.	Slabs	1-1/2 inches clear top and 3/4 inch clear bottom
3.	Beams	1-1/2 inch clear to stirrups
4.	Walls	2-1/2 inches clear
5.	Columns	2 inches clear to verticals

D. Steel Dowels for successive work shall be wired in correct position before placing concrete. The "sticking" of dowels after placing concrete will not be permitted.

F. Lap all bars 24 bar diameters at corners, splices and intersections.

G. INTERRUPT REINFORCING steel at control joints in floor slabs.

H. Do not weld reinforcing steel unless specifically approved by the Project Engineer.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All cast-in-place concrete and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.

1.02 RELATED SECTIONS

A. Section 03 10 00 – Concrete Forming and Accessories.

B. Section 03 20 00 – Concrete Reinforcing.

1.03 SUBMITTALS

A. Submit concrete mix design, concrete compression test reports and product data and manufacturer's installation instructions for concrete curing compound.

1.04 TESTING LABORATORY SERVICES

A. The Owner will provide testing as specified in Section 01 45 29.

1.05 QUALITY ASSURANCE

A. Concrete work shall conform to all requirements of ACI 301, Specifications for Structural Concrete for Buildings and ACI 318 Building Code Requirements for Reinforced Concrete, latest editions, except as modified by supplemental requirements herein.

B. Concrete mix design proportioning shall be by a certified MDOT Class III technician and submitted to the Project Engineer prior to placing concrete. Mix proportions shall meet the requirements of the 804.02.10 Section of the MDOT's Standard Specifications, 2004 Edition, except concrete requiring a trowel finish shall not be air entrained. Concrete shall be sampled according to ASTM C 172 and compression test cylinders made and cured according to ASTM C 31. Control of mixes is to be maintained at the Ready-Mix Plant and on the job site. Adjustments of the mix proportions shall meet the requirements of Section 804.02.10.4 of MDOT's Standard Specifications, 2004 Edition.

C. The Owner will provide testing as specified in Section 01 45 29 – Testing Laboratory Services. Cylinders, 3 specimens from each sample, are to be cast on the job in accordance with ASTM C 31. Specimens will be tested in accordance with ASTM C 39. One cylinder from each location will be tested at 7 days for information and the other two at 28 days for acceptance. Owner is to make at lease one strength (average of two cylinders) for each class of concrete placed on any one day and an additional one strength test for each 100 cubic yards, or fractions thereof, of concrete placed in any one day. Copies of all test reports shall be furnished to the ready mixed concrete producer and as directed by the Project Engineer.

1.06 COORDINATION

A. Verify that all pipes under grade have been installed and tested before being covered. Check and verify materials and locations of inserts, anchors, and items required by other trades before pouring concrete. Concerned subcontractors shall be notified of date of pour in sufficient time to allow for completion of their work.

B. The Contractor shall notify the Project Engineer upon completing formwork and all reinforcing steel for the next intended pour, and shall not commence pouring operation until all forms and reinforcing steel are approved by the Project Engineer.

C. Project Engineer shall have free access to all materials used, and the required samples are to be furnished by the Contractor, as directed.

D. Inspection and written approval from the floor-covering subcontractor is required for slab finish receiving floor covering.

PART 2 - PRODUCTS

2.01 CONCRETE

A. All concrete, unless otherwise specifically approved in writing by the Project Engineer, shall be transit-mixed in accordance with ASTM C94. Control of concrete shall be under supervision of testing laboratory as described in Section 01 45 29.

B. All concrete shall have 3,500-psi minimum compressive strengths at 28 days, unless noted otherwise.

C. Maximum slump for normal weight concrete shall be 4 inches. Sump may be increased to 6 inches with an approved mid-range water reducer and up to 8 inches with an approved high-range water reducer.

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C-150, Type I.

B. Water: From an approved source.

C. Structural Concrete Aggregate: Nominal maximum aggregate size67 shall be used and shall meet the requirements of MDOT Standard Specifications, 2004 Edition.

D. Admixtures: Admixtures shall be from the MDOT Approved List. Non-uniform addition of mixtures that result in erratic setting of the concrete will cause rejection of the concrete with subsequent removal from the structure at the concrete producer’s expense.

2.03 RELATED MATERIALS

A. Preformed Expansion Joint Fillers: Provide pre-molded, asphalt impregnated board in widths and thickness required by conditions (1/2-inch minimum). Joint fillers shall conform to ASTM D994, D1751 or D1752.

B. Chemical Hardener (Sealer): Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent containing not less than 2 pounds of fluosilicates per gallon.

C. Curing Compound: Clear bond, manufactured by Guardian Chemical Co., Kure-N-Seal, manufactured by Sonneborn, Safe-Cure, manufactured by Dayton Superior Corp. or approved equal. Compound shall not interfere with bonding or floor finish.

D. Non-shrink Grout: Shall be one part Portland cement to 2-1/2 parts of fine aggregate or Cement grout ASTM C 387 Dry Package mixtures similar and equal to Masterflow 713, Master Builders; Sonnogrout, Sonneborn; Five Star Grout, U.S. Grout Company.

2.04 CONCRETE MIXES

A. The ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C 94. Uniformly and accurately control proportions of material weight. Slump tolerances given in ASTM C 94 apply. Calcium chloride shall not be used.

B. Failure of concrete to meet the specified requirements may result in rejection with subsequent removal and replacement or re-testing (including coring, load test, etc.) at the supplier's expense. Concrete exhibiting adverse reaction as a result of the presence of deleterious substances shall be removed and replaced or repaired in a manner completely satisfactory to the Project Engineer. All cost of such corrective action, including all necessary testing, shall be borne by the concrete producer.

C. The Contractor may request adjustment to concrete mix design when characteristics of materials, job conditions, weather, test results, or circumstances warrant, at no additional cost to the Owner and as approved by the Project Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and approved before using in the Work.

PART 3 - EXECUTION

3.01 PLACING CONCRETE

A. Concrete shall be placed so as to avoid segregation of materials and to prevent cold joints by avoiding re-handling, by keeping pours generally level, and by adequate vibration. Placing is not to be started during rain or snow, and if placing is underway when such conditions occur, continue operations only long enough to provide a suitable construction joint.

B. During hot weather or periods of low humidity combined with a definite breeze, rapid loss of moisture shall be discouraged by thorough wetting of forms and by using a fine fog spray when finishing. At these times particular attention shall be given to providing an adequate number of finishers to expedite this operation. During cold weather fresh concrete shall be protected from freezing.

C. Prior to placing, forms shall be cleaned free of foreign material and shall be washed down with water. Placing shall be a continuous operation between planned construction joints with fresh cement mixed only with plastic concrete already in place. Avoid cold joints.

D. Vibration shall be thorough, using vibrators small enough to work within reinforcing. The vibrator shall be inserted at many points about 24 inches apart. Avoid over-vibration and transporting concrete in form by vibration. A spare vibrator, which will operate, shall be kept on the job during all placing operations.

3.02 CONSTRUCTION JOINTS

A. Locate construction joints and provide shear keys as directed by the Project Engineer / MDOT Architect. Allow concrete to set for 24 hours before an adjoining pour is started. Slabs across the joint shall be level and the surface shall be level and shall not be feathered. Before proceeding with the following pour at a joint, thoroughly clean the joint, remove all loose material, and brush in a thick cement slurry.

3.03 CURING

A. Keep all concrete moist for 5 days after placing by covering with concrete curing paper, by leaving forms in place or by using curing compound. All combined with regular wetting as necessary.

3.04 PATCHING

A. Honeycombed and defective concrete shall be removed and replaced, or repaired, as directed by the Project Engineer. Form tie holes and minor areas, as determined by the Project Engineer, shall be repaired as follows:

1. Completed patch shall be indistinguishable from surrounding surfaces in color and texture.
2. Patching mixture, using same cement sand as used in concrete shall consist of 1 part cement to 2-parts sand, with just enough mixing water to permit placing. Premix mixture, allow standing at least 30 minutes before using, stirring with trowel during this period.
3. Remove material to sound concrete, dampen surface and brush thick 1 to 1 cement sand bond coat into surface.
4. When bond coat begins to lose water sheen, thoroughly pack patching mixture in place, leaving it somewhat higher than adjacent surface. Embed pieces of gravel by hand into patch.

3.05 FINISHES FOR FLATWORK

A. Trowel finish floor surfaces scheduled as concrete finish walking surfaces, or floor surfaces scheduled to receive floor covering. Trowel finished surfaces shall be true planes within 1/8 inch in 10 feet as determined by a 10 foot straightedge placed anywhere on the slab in any direction.

B. Smooth trowel finish after the surface is screeded and floated. Start troweling when all water has disappeared from the surface to first level the surface, then start final troweling when concrete has set where it no longer shows indentation from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting of cement or cement and sand will not be permitted.

C. Exterior walks and ramps shall have smooth trowel and fine broom finish.

3.06 FINISHES FOR GRADE BEAMS

A. Exposed grade beam faces shall have a smooth form finish obtained by using selected form facing plywood, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed. Provide grout cleaned finish consisting of 1 part Portland Cement to 1-1/2 parts fine sand by column, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.

B. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members, support members, with required bracing, welds, fasteners, base plates, bearing plates, anchor bolts and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.

1.02 RELATED SECTIONS

A. Section 09 05 15 - Color Design.

B. Section 09 90 00 - Painting and Coating.

1.03 SUBMITTALS

A. Shop drawings shall conform to requirements of current AISC Specifications. Indicate sizes, spacing, connections, and location of structural members. Indicate net weld lengths and welded connections with AWS welding symbols.

B. Mill Test Reports shall be furnished; certifying that each shipment meets specified structural strength.

C. Welders' Certificates indicating that all welders employed on the Work are qualified operators, verifying AWS qualifications within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Structural steel shall be furnished in accordance with current edition of the American Institute of Steel Construction "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".

B. Qualification of Welders: All welding shall be in accordance with the "Code of Arc and Gas Welding in Building Construction" of the American Welding Society. Certification that each welder is qualified in accordance with American Welding Society Code D1.1 shall be provided.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS

A. All structural steel shall conform to ASTM A-36, domestic manufacture, except tube sections, which shall conform to ASTM A-501. Unless shown otherwise on Drawings, all bolts shall conform to ASTM Specification A307. Where indicated on Drawings, high strength bolts shall conform to ASTM Specification A 325.

B. Welds shall be E70XX Series electrodes for manual arc welding and grade SAW-1 for submerged arc process.

C. All bolts not indicated otherwise on the plans are 3/4 inch. All connections not noted otherwise on the Drawings shall be framed connections.

D. Grout for base plates shall be precision, premixed, non-shrink and non-metallic in conformance with ASTM C827. Grout shall be easily workable as well as being made flowable with an initial setting time of not less than 45 minutes and shall meet the requirements of ASTM C191. Grout shall have a 14-day compressive strength of 6000 psi when mixed to its flowable state.

2.02 PAINT MATERIALS

A. Shop coat paint, ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 Painting and Coating.

PART 3 - EXECUTION

3.01 FABRICATION AND ERECTION:

A. Fabricate and erect steel in accordance with the latest requirements of the American Institute of Steel Construction and the approved shop drawings. Fabrication shall not proceed until MDOT Architect's approval is obtained.

B. Shop connections shall be welded. Field connections shall be bolted, unless welded connections are detailed. Welded connections shall be detailed consistent with requirements of the American Welding Society. Bolted connections shall be proportioned as shown in AISC Manual, using 3/4 inch unfinished bolts (A307), unless shown otherwise on Drawings.

1. Shop and field welders shall have been recently certified as qualified structural welder according to requirements of the American Welding Society.
2. Any splices not shown on the drawings shall be indicated clearly on the shop drawings and shall be made only with the Project Architect's approval.

C. Members shall be straight, plumb, and level so that the error does not exceed 1 to 1,000. During erection provide guys, stays, and braces to hold steel in position until the frame is permanently secured.

d. Neatly miter joints, weld full and grind welds smooth where steel shapes are used as finish members.

3.02 PAINTING

A. Apply one shop coat of paint to all structural steel. After erection, touch up joints and abraded areas with the same brand of paint.

B. Areas around welded joints and members to be encased in concrete shall not be painted in the shop. Thoroughly clean scale and loose rust from steel prior to painting. Steel shall be dry when painted and paint shall be allowed to dry before material is handled.

C. All steel exposed to view shall be painted additional coats as specified in Section 09 90 00.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All miscellaneous metal work. The Work includes, but is not limited to steel lintels and miscellaneous framing & supports.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

B. Section 09 90 00 - Painting and Coating: Painting for all ferrous metal exposed to view.

1.03 SUBMITTALS

A. Submit shop drawings for shop fabricated items. Indicate profiles, sizes, materials connection details, attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, with plans, elevations, and details where applicable.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural shapes shall be standard sections conforming to the American Society for Testing Materials Specification A-36. Punch and drill as necessary for work of others. Provide all bearing plates and all anchors, bolts, and etc. The Work shall be true and free of twists, bends and open joints between component parts. Materials shall be thoroughly straightened in the shop before laid off or worked in any way, care being used to avoid injury to the material.

B. Gray cast iron shall conform to ASTM A48-83, class 30. All castings shall be of uniform quality, free from blowholes, shrinkage defects, swells, cracks or other defects. Castings shall be free of fins, burrs and slag.

C. Expansion bolts shall be equal to Phillips Red Head or "cinch" bolts as manufactured by the National Lead Company. Hilti Fasteners, Rawlplug Company and Wej-it Corporation are acceptable manufacturers. Use toggle type bolts or similar for all anchorage into hollow construction.

D. Bolt or weld connections: Provide necessary lugs and brackets for anchorage. Welding shall be in accordance with current "Code of Fusion, Welding and Gas Cutting in Building Construction, Part A - Structural Steel" issued by the American Welding Society, both for fabrication and erection. All welders shall have certification, as a result of tests prescribed by the American Welding Society.

E. Detail metal Work for ample size, strength and stiffness and as indicated. Countersink and provide reinforcement where necessary; fill or punch holes for bolts and screws. At the proper time furnish the necessary templates, patterns and items of miscellaneous metal, such as sleeves, inserts and similar items to be built into adjoining Work.

F. Fabricate metal Work with sharp lines and angles, with smooth true surfaces and clean edges. Form exposed joints to exclude water. Furnish certificates from manufacturers stating that materials comply with the specification requirements.

G. Provide as necessary holes of proper number and spacing for the attachment of Work of other trades. Do not use cutting torch in field without permission of the Project Engineer.

H. Anchor bolts, washers, nuts and clamps shall be furnished where indicated on the Drawings and where necessary for properly securing Work in place. All bolts and anchors used on the exterior of the building or built into exterior walls shall be cadmium plated. Miscellaneous angles and plates not indicated or specified otherwise shall not be less than 1/4 inch thick.

I. Shop paint and field touch up shall be ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 – Painting and Coating.

J. Fastenings shall be invisible where possible. Where exposed, screws, bolts, and the like shall be vandal-proof. All welded exposed joints on steel manufactured items; etc. shall be ground smooth and filled to receive paint.

2.02 METAL PRIMER

A. Where materials come in contact with dissimilar materials which may cause harmful reaction, where exposed to moisture, or such as aluminum to cement mortar or concrete, the surface shall be protected by zinc chromate primer or approved paint.

2.03 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete Work.

B. Fabricate miscellaneous units to sizes, shapes, and profiles indicated, or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

C. Galvanize exterior miscellaneous frames and supports.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Perform cutting, drilling and fitting required for installation; set Work accurately in location, alignment and elevation measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other Work.

B. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 2 part Portland Cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

C. Touch-up shop paint after installation. After cleaning field welds, bolted connections and abraded areas, apply same type paint as used in shop. Color to be selected from standard colors available. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION

SECTION 05 51 33 METAL LADDERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aluminum access ladder with platform and railings as indicated on the Drawings including indications of sizes and locations.

1.02 RELATED SECTION

A. Section 05 50 00 – Metal Fabrications for fasteners and installation requirements used to attach ladders to structure.

1.03 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars.

D. OSHA 1910.27-Fixed Ladders.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.

B. Shop Drawings: Submit Shop Drawings for the fabrication and erection of Ladder units and accessories. Include plans, elevations and details of sections and connections to adjoining Work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements. Provide reaction loads for each hanger and bracket.

1.05 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project and with Professional engineering competent in design and structural analysis to fabricate ladders, platforms and railings in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain operational and structural performance.

C. Product Qualifications: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers’ instructions and recommendations.

1.07 Warranty

A. Manufacturer shall guarantee materials and workmanship against defects for a period of 5 years after Final Completion. Within the warranty period, the manufacturer, at its option, shall repair or replace defective products.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by O'Keefe's, Inc., 325 Newhall Street, San Francisco, CA 94124. Tel. (888) 653-3333.

B. Equivalent products by the following manufacturers are acceptable:

1. ACL Industries, Inc., Manchester, NH. (603) 668-1276.
2. Precision Ladders, LLC, Morristown, TN. Tel. (800) 225-7814.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures

2.02 APPLICATION / SCOPE

A. Fixed access ladder with platform and guard rail, around platform and top of ladder as shown on Drawings.

2.03 FINISHES

A. Mill finish as extruded.

2.04 MATERIALS

A. Aluminum Sheet: ASTM B 209, Alloy 5005-H34 with temper as required for forming or as otherwise recommended by metal producer to provide required finish.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.05 FABRICATION

A. Rungs: Not less than 1-1/4 inches in section and 18-3/8 inches long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides. Rungs shall withstand a 1,000 pound load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch wall thickness by 3 inches wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions not less than 1/8 inch wall thickness by 3 inches wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Landing Platform: 1-1/2 inches or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads. Railing shall be not less than 3'-6" above the landing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate anchorages. Provide setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

3.03 PROTECTION

A. Protect installed products until Final Completion.

B. Touch-up, repair or replace damaged products before Final completion.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concealed wood grounds and blocking to frame openings, form terminations, to provide anchorage and / or support of other interior and exterior locations; plywood and rough hardware.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 08 71 00 - Door Hardware.

1.03 COORDINATION

A. Fit carpentry Work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

1.04 QUALITY CONTROL

A. Factory mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks. Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the Work. Contractor shall comply with manufacturer’s required protection procedures.

1.06 PROJECT CONDITIONS

A. Installer must examine all parts of the supporting structure and the conditions under which the carpentry Work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

PART 2 - PRODUCTS

2.01 LUMBER: For each use, comply with the "American Softwood Lumber Standard" PS 20 by the U.S. Department of Commerce. Nominal sizes are shown or specified; provide actual sizes complying with the minimum size requirements of PS20 for the moisture content specified for each use. Provide dressed lumber, S4S, unless otherwise shown or specified. Provide seasoned lumber with 19 percent MAXIMUM MOISTURE CONTENT at time of dressing and complying with dry size requirements of PS 20, unless otherwise specified.

2.02 FRAMING LUMBER

A. Where wood framing is shown or scheduled, provide lumber complying with grading rules which conform to the requirements of the "National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee established under PS 20.

B. For Light Framing: Standard Grade.

C. For Structural Framing: (4 inches and wider and from 2 inches to 4 inches thick), provide the following: No. 1 Grade; Douglas Fir (WCLB or WWPA), Southern Pine (SPIB). Fb (minimum extreme fiber stress in bending); 1,250 psi. E (minimum modulus of elasticity); 1,700,000 psi.

2.03 BOARDS

A. Where lumber less than 2 inches in nominal thickness and 2 inches or more in nominal width is shown or specified, provide boards complying with dry size requirements of PS 20.

B. Concealed Boards: Where boards will be concealed by other work, provide the following:

1. Moisture Content: 19 percent maximum, mark boards "S- Dry".
2. Species and Grade: Provide one of the following:
   a. Southern Pine (SPIB) No. 2 boards.
   b. WCLB (any species) No. 3 boards.

2.04 PLYWOOD

A. For each use, comply with the requirements for "Softwood Plywood/Construction and Industrial" PS 1 by the U.S. Department of Commerce.

B. Concealed Plywood: Where plywood will be concealed by other work, provide 5/8-inch minimum thickness Interior Type plywood C-D Plugged Grade, unless otherwise specified or shown on Drawings.

C. Exposed Plywood: Where plywood will be exposed to view, provide 5/8 inch minimum thickness Interior Type plywood B-C Plugged Grade, unless otherwise specified or shown on Drawings. For backing panels for electrical or telephone equipment, provide 3/4 inch thick fire-retardant treated Standard grade plywood with exterior glue. Unless specifically stated otherwise, all exposed plywood shall be painted or stained from standard colors as selected by Project Engineer / MDOT Architect.

2.05 ANCHORAGE AND FASTENING MATERIALS

A. For each use, select proper type, size, material, and finish complying with the applicable Federal Specifications. Zinc electroplated steel fasteners for high humidity and treated wood locations. All nails shall be coated.

2.06 TREATED WOOD

A. Complete fabrication of treated items prior to treatment, wherever possible. If cut after treatment, coat cut surfaces with heavy brush coat of same fire-retardant chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

B. Preservative Treatment: Where lumber or plywood is indicated as "Treated", or is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Institute (AWPI). Mark each treated item to comply with the AWP Quality Mark requirements for the specified requirements.

1. Pressure-treat aboveground items with water-borne preservatives complying with AWPI P-2. After treatment, kiln-dry to maximum moisture content of 15 percent. Treat indicated items and the following:
   a. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
   b. Wood sills, sleepers, blocking, furring stripping and similar concealed members in contact with masonry or concrete.

C. Fire-Retardant Treatment: Where "PR-S" lumber or plywood is shown or scheduled, comply with the AWPI Specification C-208 for pressure impregnation with fire-retardant chemicals to achieve a flame-spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E A4, or NFPA Test 355. Where treated items are indicated to receive a transparent or paint finish, use a fire-retardant treatment that will not bleed through or adversely affect bond of finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing. Use materials free from warp that cannot be easily corrected by anchoring and attachment. Sort out and discard warped material and material with other defects that would impair the quality of the Work.

B. Securely attach carpentry work to substrates by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

C. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3.02 ATTACHMENT AND ANCHORAGE

A. Use common wire nails, except as otherwise shown or specified. Use finishing nails for finish Work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

B. Exposed Plywood: Panel ends and edges shall have spacing of 1/8 inch maximum, unless otherwise indicated by the panel manufacturer. Fasten 6 inches on center along supported panel edges and 10 inches on center at intermediate supports

3.03 WOOD GROUND NAILERS, BLOCKING, AND SLEEPERS

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Set true to line and level, plumb with intersections true to required angle. Coordinate location with other Work involved.

B. Attach to substrates securely with anchor bolts and other attachment devices as shown as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Building into masonry; anchor to formwork before concrete placement.

C. Provide grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.04 WOOD FURRING

A. Install plumb and level with closure strips at all edges and openings. Shim with wood as required.

D. Suspended Furring: Provide of size and spacing shown, complete including hangers and all attachment devices. Level to a tolerance of 1/8 inch in 12 feet.

3.05 WOOD FRAMING

A. Set wood framing accurately to required lines and levels. Provide framing members of sizes and on spacing shown, and frame openings as shown, or if not shown, comply with the recommendation of the "Manual for Housing Framing" of the National Forest Products Association. Cut, join, and tightly fit framing around other Work. Do not splice structural members between supports unless otherwise detailed.

B. Anchor and nail as shown, or if not shown, to comply with the "Recommended Nailing Schedule - Table 1 of the "Manual of House Framing" and other recommendations of the N.F.P.A.

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building insulation for interior walls, and ceilings as shown on the Drawings and specified herein.

1.02 SUBMITTALS

A. Submit manufacturer's product and technical data for each type of insulation describing location, extent, material and method of fastening prior to installation for Project Engineer/MDOT Architect’s approval.

1.03 PRODUCT HANDLING

A. Protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs or replacements as necessary.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. CertainTeed Corp., Valley Forge, PA. Tel: (800) 233-8990.
2. Johns Manville Corp, Denver, CO. Tel. (303) 978-2531.
3. Knauf Insulation, Shelbyville, IN. Tel.(317) 398-4434.
4. Owens Corning, Toledo, OH. Tel. (800) 438-7465.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 BATT INSULATION

A. Provide glass fibers and resinous binders formed into flexible batts conforming to ASTM C 665, Type III, Class B with density not less than 1.5 lbs. Per cubic foot and an R value of 3.17 per inch of thickness at 75 degrees F. mean temperature, with aluminum foil and asphalt vapor barrier laminated to one face. Thickness of insulation shall be as shown on the Drawings.

2.03 SOUND ATTENUATION INSULATION

A. Similar to above specified insulation except manufacturer's standard unfaced batt insulation manufactured for sound attenuation.

2.04 ACCESSORIES

A. Tape: Bright aluminum, self-adhering type, mesh reinforced, and two inches wide.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where building insulation is to be installed and notify the Project Engineer/MDOT Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Project Engineer / MDOT Architect.

3.02 INSTALLATION

A. Comply with manufacturer's instructions for the particular condition of installation in each case. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.

C. Apply a single layer of insulation to the required thickness, unless a double layer is required, to make up the total thickness shown.

D. Set vapor barrier faced units with vapor barrier to inside of construction, except as otherwise shown. Do not obstruct ventilation spaces. All joints at vapor barriers shall be sealed with 4 inches wide, foil faced duct tape to prevent vapor and air migration.

E. Tape joints and ruptures in vapor barriers, using tape specified above, and seal each continuous area of insulation to surrounding construction so as to ensure vapor tight installation of the units.

F. Where insulation is impaled on stick clips, provide clips not less than 3 inches from corners or edges and not more than 12 inches on center.

G. Adhesive Application - per manufacturer's printed directions. Apply adhesive over entire back of insulation and on edges of insulation, except as noted below.

H. Fastener Installation - per manufacturer's printed directions. Install fasteners 12 inches on center each way. Use adhesive as specified herein per fastener manufacturer's recommendations.

3.03 BATT INSULATION

A. Install blanket fiberglass insulation with edges closely butted. Cut and fit insulation to closely fit intersecting or penetrating surfaces.

B. Walls: Install sound attenuation insulation between studs at all interior partitions. Attach to studs with staples, adhesive or method as recommended by manufacturer. Tape and seal small joints and punctures and replace insulation where large tears occur.

C. Ceilings: Where indicated on Drawings, install above ceilings continuous with vapor barrier down. Lay above gypsum board at bottom of ceiling joists in method recommended by manufacturer. Tape and seal small joints and punctures and replace insulation where large tears occur.

END OF SECTION

SECTION 07 41 14 SUB-PURLIN RETROFIT ROOF SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The contractor shall provide all material, labor, and administration and other items to provide an engineered sub-purlin retrofit roof system complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement and exposure to weather without failure or infiltration of water into the building interior.

B. Coordinate engineered sub-purlin retrofit roof system with roofing substructure work.

1.02 SECTION INCLUDES

A. Preformed structural standing seam metal roof system with continuous interlocking field formed seams, concealed clips and fastening devices.

B. Coordinated ridge, hip, valley, gable, eave, corner, rake, headwall, counterflashings and miscellaneous flashings and attaching devices.

C. Concealed clips, fasteners, closures and factory and field applied sealants as necessary to meet design criteria and ensure a weathertight installation.

D. Engineered sub-purlin framing system for panels in vertical and near horizontal installation.

1.02 REFERENCES

A. AISI-01 - American Iron and Steel Institute; Cold-Formed Steel Design Manual.

B. ASTM A 653/A653M – Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or by Hot-Dip Process.

C. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot Dip Process, General Requirements.

D. ASTM E 1680 as applicable - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E1646 as applicable - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

F. UL 580 - Underwriters Laboratories, Inc.; Test for Uplift Resistance of Roof Assemblies

G. ASTM E-1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.04 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design metal sub-purlin system as a structural package, engineered and factory fabricated, in accordance with AISI references.
2. Provide for movement of components due to thermal variations without damage, failure, or excessive stress on components.
3. Conform to requirements of current edition of the International Building Code.
4. Horizontal Assemblies:
   a. Withstand 20 pounds per square foot live load, plus weight of 2.5 pounds for retrofit framing and roof assembly.
   b. Maximum Allowable Vertical Deflection: L/180 of span, after installation of equipment.
   c. Maximum Allowable Horizontal Deflection in Framing Members not to exceed H/60 TH of length.
   d. UL 90 uplift resistance in accordance with UL 580.
5. Panel Assemblies:
   a. Air infiltration: Maximum 0.2 cubic feet per minute per linear foot of seam at static pressure of 6.24 pounds per square foot when tested in accordance with ASTM 1680.
   b. Water penetration: No uncontrolled water penetration through panel joints at a static pressure of 6.24 pound per square foot when tested in accordance with ASTM 1646.
   c. Provide factory-preformed panel that has been tested and approved for a Class 4 Impact (Hail) resistance rating per UL 2218. Listing shall be present on the UL website (Refer to Underwriters Laboratories website at www.ul.com/)

B. Performance Requirements:

1. Panel finish is based on hot dipped aluminum-zinc (Galvalume) coated steel. Galvalume panel finish will be warranted for a period of twenty years against:
   a. rupture,
   b. structural failure,
   c. perforation due to normal atmospheric corrosion.

1.05 SUBMITTALS

A. Product Data: Manufacturer’s product literature for panel, finishes, and trim.

B. Shop Drawings:

1. Indicate layout of panels and panel sizes, including each item of trim and accessories.
2. Indicate profiles and gages of sheets; locations and types of fasteners; locations, gages, shapes, and methods of attachment of panels, trim and accessory items.
3. Indicate layout of sub-purlin system, including attachment on center and intermediate sub-purlin members as required to meet wind up-lift design loads required in the design performance section of this specification.
4. Indicate products/materials required for construction activities of this section not supplied by manufacturer of products of this section.

C. Selection Samples: For each product requiring finish selection, submit three (3) physical samples of the specific finish representing the actual material to be used for material fabrication.

D. Verification Samples: For each finish selected, return one approved chip to the manufacturer with an acceptance signature of the design professional or letter from the same indicating acceptance of the selected finish.

E. Quality Assurance Submittals:

1. Certificates: Contractor's certification that:
   a. Manufacturer of products of this section meets specified qualifications.
   b. Installer of products of this section meets specified qualifications.
2. Manufacturer's instructions: Printed installation instructions for each specified product.

F. Close-out Submittals:

1. Special Warranty: Warranty documents issued and executed by Contractor.
2. Manufacturer's Warranty: Warranty documents issued and executed by manufacturer of products of this section, countersigned by Contractor.

1.06 DESIGN PERFORMANCE

A. Design sub-purlin retrofit system to meet the applicable local building code.

1.07 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Minimum five (5) years experience producing products specified in this Section.
2. Installer: Minimum five (5) years documented experience installing products specified in this Section, and approved by manufacturer of products of this section.

B. Certifications: Installer (Erector) must be trained by the Manufacturer in the installation of the products specified herewith and have completed a minimum of fifteen hours of hands-on product installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling and unloading:

1. Bundle panels in waterproof wrapping paper.
2. Package trim and accessories in waterproof wrapping paper.

B. Storage and Protection:

1. Store products of this Section in manufacturer's unopened packaging until installation.
2. Maintain dry, heated storage area for products of this Section until installation of products.

1.09 PROJECT/SITE CONDITIONS

A. Field Measurements: Where conditions permit, obtain field measurements before fabrication of any materials.

1.10 WARRANTIES

A. Special Warranty: The Contractor warrants construction activities and products of this section, as installed, to be in accord with the Contract Documents and free from faults and defects in materials and workmanship for a period of 2 years.

B. Applicator's Warranty: Furnish written warranty signed by applicator for two year period from date of Final Completion of the building covering repairs required to maintain roof and flashings in watertight conditions.

C. Manufacturer's Warranty: Furnish Panel Manufacturer's Standard 20-year warranty stating architectural fluorocarbon finish will be:

1. Free of fading or color change in excess of 5 NBS units as measured per ASTM D 2244-68;
2. Will not chalk in excess of numerical rating of 7 when measured in accordancwith standard procedures specified in ASTM D 659-74;
3. Will not peel, crack, chip or delaminate.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Drawings and Specifications are based on products manufactured by AEP-Span Retrofit Systems, 5100 E. Grand Avenue, Dallas, TX 75223, Contact: Roger Wallace (817) 498-6159, www.aep-span.com.

B. EQUIVALENT products by the following manufacturers are acceptable:

1. Architectural Building Components, Houston, TX. Tel: (800) 423-1105.
2. Englert, Inc., Perth Amboy, NJ, Tel: (732) 826-8614.
3. Firestone Metal Products, Anoka, MN, Tel: (800) 426-7737.
4. Innovative Metals Company (IMETCO), Tucker, GA. Tel (800) 646-3826.
5. MBCI, Hernando, MS, Tel: (800) 206-6224.

C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS:

A. Supply all products specified in this section from a single manufacturer.

B. Steel Sheet for Panels: Minimum yield strength 33,000 pounds per square inch (psi), aluminum-zinc alloy coated, conforming to ASTM A 792, AZ50 coating; thickness as specified below.

C. Formed Sheet Sub-Purlin Members: Steel sheets conforming to ASTM A 570, minimum yield strength 50,000-psi minimum.

D. Galvalume Coated Steel Finish:

1. Full strength 70% Kynar 500®.

2.03 COMPONENTS

A. Retrofit Sub-purlin System for Roof Panel System: Specified in FABRICATION Article of this section.

B. Roof Panel System:

1. Panels:
   a. Acceptable Product: SpanLok-hp as manufactured by AEP-Span.
   b. Profile: SpanLok-hp, 2” tall x 16” wide
   c. Material: 24 Gage
   d. Finish: Full strength 70% Kynar 500®.
   e. Color: As selected by Project Engineer / MDOT Architect from manufacturer’s full range of standards colors available.
2. Panel Attachment: Concealed clips with self-drilling screws.

C. Flashings: Steel sheet components, break-formed to manufacturer's standard profiles.

1. Provide all trim required, including, but not limited to:
   a. Copings.
   b. Termination and transition strips.
   c. Corner cap.
   d. Roof edge cap.
   e. Roof peak cap..
2. Thickness: 24 gage
3. Finish: Full strength 70% Kynar 500®.
4. Color: As selected by Project Engineer / MDOT Architect from manufacturer’s full range of standards colors available

D. Joint Sealers:

1. Tape Sealant: pre-formed butyl rubber base, manufacturer's standard extruded shape.
2. Tube Sealant: butyl rubber base materials.
3. Closures: fabricated metal matching adjacent panel material and finish.

E. Supply items required for installation of panels in accordance with manufacturer's installation instructions and other indicated items.

2.04 FABRICATION

A. Fabricate retrofit sub-purlin framing members as an engineered system, factory fabricated for field assembly.

B. Size members to 10’-0” length in accordance with MDOT Architect-accepted shop drawings.

C. Fabricate components of retrofit sub-purlin framing system in accordance with MDOT Architect-accepted shop drawings and the following:

1. Roof panel sub-purlin support members (purlins): EZEE brand sub-purlin by AEP-Span, minimum 16 gage 50 ksi minimum yield strength G-90 galvanized finished steel sheet per ASTM A-653, zee shape steel members with 1.18 inch minimum bottom flange and 2.0 inch top flange with a 0.25 inch minimum lip. The web depth shall vary to accommodate the existing metal roof panel profile.

2.05 FINISHES

A. All steel sub-purlin members shall be coating carbon steel with G-90 Galvanized coating in accordance with ASTM A-653.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer's Examination:

1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
2. Transmit two copies of installer's report to MDOT Architect within 24 hours of receipt.
3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.02 PREPARATION

A. Surface Preparation:

1. Remove indicated existing roof-mounted equipment; seal indicated roof penetrations closed and watertight.
2. Where retrofit framing members are to be attached to existing roof; ensure full and even contact surface between retrofit framing members and existing roof structure.

3.03 INSTALLATION

A. Sub-purlin Retrofit Framing System:

1. Install in accordance with MDOT Architect-accepted shop drawings and manufacturer's printed installation instructions.
2. Fasten sub-purlins with appropriate self drilling hex-head roofing screws which have been tested and meet the pull-out values necessary to provide adequate hold down for wind uplift resistance as specified.
3. Anchors for attaching the framing system to the existing roof support system shall have a corrosion resistant coating.
4. Anchors for attaching the framing system to the existing roof support system shall fasten directly into the existing primary structural support system.

B. Panels:

1. Install panels plumb, true, and in correct alignment with structural framing, in accordance with Architect approved shop drawings and manufacturer's printed installation instructions.
2. Install panels using manufacturer's non-corroding concealed fasteners.
3. Install flashings and joint sealers at ridges, hips, valleys, walls, penetrations, and eaves to ensure watertight construction.
4. Install flashings using concealed fasteners where possible. Where sight-exposed fasteners are used, provide non-corroding fasteners color-matched to trim.

C. Site Tolerances:

1. Variation from Plumb: Maximum 1/8 inch.
2. Variation from Level: Maximum 1/8 inch.
3. Variation from True Plane: Maximum 1/8 inch.
4. Variation from True Position: Maximum 1/4 inch.
5. Variation of Member from Plane: Maximum 1/8 inch.

3.04 PROTECTION OF INSTALLED PRODUCTS

A. Protect installed products from damage by subsequent construction activities.

B. Replace products having damage other than minor finish damage.

C. Repair products having minor damage to finish in accordance with panel manufacturer's and/or coating manufacturer’s recommended procedures.

D. MDOT Architect shall be sole judge of acceptability of repair to damage finishes; replace products having rejected repairs.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Firestopping as indicated on the drawings, specified herein, and/or required for completion of the work. Firestopping shall be required at all rated fire and smoke "fire barrier" walls and at floors.

1.02 SUBMITTALS

A. Submit manufacturer’s product data, specifications and installation procedures for each type of firestopping and accessory required. Submit detailed location where each will be used. Submit UL data for assemblies where shown on the Drawings.

1.03 QUALITY ASSURANCE

A. Penetrations and miscellaneous openings in rated fire and smoke "fire barrier" walls shall be protected in accordance with NFPA 101, Life Safety Code, Chapter 6, Features of Fire Protection. All openings for air-handling ductwork or air movement, pipes, conduits, bus ducts, cables, wires, air ducts, pneumatic tubes and ducts and similar building service equipment that pass through or penetrate in any way a rated fire or smoke "fire barrier" wall or floor shall be protected. All firestopping materials used shall conform to ASTM E814, ASTM E119, and UL 1479 and tested in accordance with NFPA 90A and NFPA 251 as part of a rated assembly.

1.04 FIRE AND SMOKE PARTITIONS AND RELATED ASSEMBLIES

A. Based on Underwriters Laboratories (UL) systems and tests and are designed in accordance with UL fire resistance ratings. Contractor shall comply with the applicable UL requirements for fire and smoke partitions and assemblies shown on the drawings.

B. Materials not conforming to these firestopping specifications shall not be used. Materials that are not UL rated and approved shall not be allowed. Materials containing asbestos are not acceptable and shall not be used in this project.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in manufacturer's original unopened containers and store in weathertight enclosure. Handle and store all materials so as to prevent inclusion of foreign materials, breakage or damage by water.

1.04 WORKMANSHIP

A. Materials and workmanship not conforming to provisions of the Specifications and manufacturer's printed instructions shall be rejected at any time during the course of the work. Rejected materials shall be removed from the site at the time of rejection. Rejected workmanship shall be corrected immediately after rejection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Hilti, Inc., Tulsa, OK. Tel. (800) 879-8000.
2. International Protective Coatings Corp., Hatfield, PA. Tel. (800) 334-8796.
3. 3M Fire Protection Products, Saint Paul, MN. Tel. (800) 328-1687.
4. United States Gypsum Company, Chicago, IL. Tel. (880) 874-4968.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SEALANT

A. Equal to Hilti, Inc. FS-One.

2.03 CAULKING AND PUTTY

A. Equal to 3M Brand Fire Barrier CP- 25 Caulk and Putty 303.

2.04 PENETRATION SEALANTS

A. Equal to 3M Fire Barrier Penetration Sealing Systems 7902 and 7904 series as required.

2.05 INSULATION

A. Equal to United States Gypsum Company “Therafiber” Safing Insulation, 4 pcf density, unfaced.

2.06 INTUMESCENT FIRESTOPPING

A. Equal to Hilti, Inc. FS-One, CP 642 and FS 657 Fire Block as required.

2.07 ACCESSORIES

A. Provide backing / filling materials, retainers, collars, clamps, sleeves, primers and other necessary items of types and duration required by regulatory requirements and / or as recommended by product manufacturer for the specific substrates, surfaces and applications.

2.08 FINISHES

A. Concealed locations: Manufacturer’s Standards.

B. Exposed to View Locations: “Custom” Colors as selected by Project Engineer / MDOT Architect unless Manufacturer’s Standards closely matches finish of penetrated surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of firestopping materials for small openings, cracks, crevices, and penetrations shall be in accordance with manufacturer's printed instructions.

B. Verify application required and location for each type of firestopping to be used and conform to manufacturer's exact instructions for specific applications.

C. After installation of all Work, including but not limited to ductwork, fire and smoke dampers, communication cabling, electrical conduit, etc., properly seal all openings, cracks, crevices and penetrations throughout the entire project, to maintain fire ratings shown.

D. Install fireproof sealant at all penetrations through rated walls and floors and at top and bottom on each side of rated walls.

E. Install approved metal sleeves with fireproof sealant at all communication and control wiring passing through rated walls throughout the entire project.

F. Install firestopping at fire and smoke walls and floors where construction passes through those areas.

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation of substrate surfaces to receive materials.

B. Sealant and joint backing (backer rod) materials and installation in the following general locations (even though not shown on the Drawings):

1. Exterior and interior wall joints, including control / expansion joints and abutting like or similar materials (in walls, ceilings, and roof construction) that have spaces between in excess of 3/16 inch (except where less restrictive tolerances are indicated or where the condition is specifically the responsibility of others).
2. Abutting dissimilar materials, exterior and interior.
3. Exterior and interior wall openings (including louvers, and penetrations required by piping, ducts, and other service and equipment, except for sealants provided by Section 07 84 00-Firestopping).
4. Joints in pavement and walks.
5. Other locations, not included above but, specifically required by manufacturers of installed materials / products (except that sealing materials for glazing are under provision of other Section.).

C. Accessories: Including, but not limited to, primer, cleaner, backer rod, bond breaker, and masking tape.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures and Section 09 05 15 – Color Design.

1.03 DEFINITIONS

A. Wherever the words "caulk" or "seal" occur, they shall be interpreted to mean "effectively seal the indicated joint with a material to render it air and watertight." "Caulk" shall indicate the use of the interior materials specified hereinafter and "Seal" shall indicate the use of the exterior materials.

1.04 WORK OF OTHER SECTIONS

A. Caulking and sealing may be performed as Work of other Sections when specified. However, all Work shall conform to the requirements of this Section.

1.05 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of sealant required. Product data shall include chemical characteristics, limitations, and color availability.

1.06 QUALITY ASSURANCE

A. Applicator: Company specializing in the work of this Section with minimum 3 years documented satisfactory experience.

B. Manufacturer's Certificate: Provide manufacturer's letter of certification that products meet or exceed specified requirements and are appropriate for uses indicated.

C. Installation: Conform to Sealant and Waterproofers Institute requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver caulking and sealant material to the site in original unopened packages with manufacturer's labels, instructions and product identification and lot numbers intact and legible.

B. Store materials under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438. Tel: (800) 523-6688.

B. Equivalent products by the following manufacturers are acceptable:

1. Dow Corning Corporation, Midland, MI. Tel: (800) 322-8723
2. GE Silicones, Waterford, NY. Tel: (518) 233-2639.
3. Sonneborn Building Products, Shakopee, MN. Tel: (800) 433-9517.
4. Tremco, Inc., Beachwood, OH. Tel: (800) 562-2728.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SEALANT TYPES AND USE SCHEDULE

A. Type 1: Use for interior locations, sealing around doors, louvers, drywall and other locations to be painted and where joints are less than 1/8 inch with none to slight movement anticipated: Pecora AC-20 + Silicone.

B. Type 2: Use for sealing nonporous interior surfaces where conditions of high humidity and temperature extremes exist: Pecora 898.

C. Type 3: Use for horizontal floor and pavement joints: Pecora Urexpan NR-200.

D. Type 4: Use for exterior sealing at masonry, and other materials: Pecora 890NST (one-part Architectural Silicone Sealant). Color(s) to be selected by the Project Engineer / MDOT Architect from manufacturer's full range of standard Architectural colors.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Open cell polyurethane foam or closed cell polyethylene foam, compatible with sealant, sized and shaped to provide proper compression upon insertion in accordance with manufacturer's recommendations.

D. Bond Breaker: Pressure sensitive adhesive polyethylene, TEFLON, or polyurethane foam tape.

E. Masking Tape: Pressure sensitive adhesive paper tape.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer must examine areas and conditions under which this Work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

A. Cleaning: Clean joint surfaces, using joint cleaner as necessary, to remove dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, frost or other matter that might adversely affect adhesion of sealant. Rake joints out to a depth equal to one-half the width.

B. Masking: Mask areas adjacent to joints.

C. Priming: If required, prime substrate surfaces following manufacturer's instructions.

D. Mixing: When required, mix components of sealant materials in accordance with manufacturer's instructions to achieve required characteristics of sealant.

3.03 APPLICATIONS

A. Mixing, application, surface condition, weather condition shall be as recommended by the manufacturer. Do not use material that has exceeded the recommended pot life.

B. Install backing material in joints using blunt instrument to avoid puncturing. Do not twist the backing rod while installing. Install backing rod so that joint depth is 50 percent of joint width, but a minimum of 1/8-inch deep and a maximum of 3/8-inch deep.

C. Apply sealant in joints using a pressure gun with nozzle cut to fit joint width. Ensure sealant is deposited in a uniform, continuous bead without gaps or air pockets.

D. Tool joints to the required configuration within 10 minutes of sealant application. Remove masking materials immediately after tooling.

3.04 CLEANING AND REPAIRING

A. Do not allow sealant or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means necessary to eliminate evidence of spillage.

B. When using flammable solvents, avoid heat, sparks and open flames. Provide necessary ventilation. Follow all precautions and safe handling recommendations from the solvent manufacturer and pertinent local, state and federal regulations.

C. Leave finished work in a neat, clean condition with no evidence of spillovers onto adjacent surfaces.

D. Repair or replace defaced or disfigured finishes.

3.04 CURE AND PROTECTION

A. Cure sealant and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Sealant Supplier / Applicator shall advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at Time of Completion.

END OF SECTION

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hollow metal Work, including but not limited to, the following:

1. Hollow metal doors and frames (where indicated).
2. Preparation of metal doors and bucks to receive finish hardware, including reinforcements, drilling and tapping necessary.
3. Factory prime painting of Work in this Section.

1.02 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 08 71 00 - Door Hardware.

C. Section 09 05 15 - Color Design.

D. Section 09 90 00 - Painting and Coatings.

1.03 QUALITY ASSURANCE

A. In addition to complying with all pertinent codes and regulations, manufacture labeled doors in accordance with specifications and procedures of Underwriters' Laboratories, Inc. In guarantee and shop drawings, comply with nomenclature established in American National Standards Institute publication A123.1, latest edition, "Nomenclature for Steel Doors and Steel Door Frames".

B. Work is subject to applicable portions of the following standards:

1. ANSI A115 "Door and Frame Preparation for Door Locks and Flush Bolts", American National Standards Institute.
2. ANSI A123.1 "Nomenclature for Steel Doors and Steel Door Frames", American National Standards Institute.
3. NFPA 80 "Fire Doors and Windows", National Fire Protection Association.
4. NFPA 101 "Life Safety Code", National Fire Protection Association.

C. Hollow metal doors and frames shall comply with the specifications for Custom Hollow Metal Doors and Frames, National Assoc. of Architectural Metal Manufacturers (NAAMM) Standard CHM 1-74, and the Steel Door Institute, SDI 100-80.

1.04 SUBMITTALS

A. Product Data: Submit schedule and manufacturer’s technical product data / literature.

B. Shop Drawings: Shop drawings shall indicate door and frame elevations, frame configuration, anchor types and spacing, reinforcement and location of cut-outs for hardware.

1.05 PRODUCT IDENTIFICATION

A. Deliver doors and frames and other work of this section properly tagged and identified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.

B. Provide packaging, separators, banding, spreaders, and individual wrappings as required to completely protect all metal doors and frames during transportation and storage.

C. Store doors upright, in a protected dry area, at least 4 inches off the ground and with at least 1/4 inch air space between individual pieces, protect all pre-finished and hardware surfaces.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Steelcraft Manufacturing Company, 9017 Blue Ash Road, Cincinnati, OH 45242 Tel. (513) 745-6400.

B. Equivalent products by the following manufacturers are acceptable:

1. Amweld Building Products, Inc., Garrettsville, OH. Tel. (330) 527-4385.
2. Ceco Door Products, Brentwood, TN. Tel. (615) 661-5030.
3. Republic Builders Products, McKenzie, TN. Tel. (901) 352-3383.

C. Substitutions shall fully comply with specified requirements and Section 01 64 14-Product Options and Substitution Procedures.

2.02 FABRICATION

A. Fabricate hollow metal units rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Unless otherwise indicated, provide countersunk flat Philips or Jackson heads for exposed screws and bolts.

B. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping per final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware".

C. Locate finish hardware in accordance with approved shop drawings.

2.03 FRAMES

A. Frames for interior openings shall be commercial grade cold rolled steel conforming to ASTM A366-68 or commercial grade hot rolled and pickled steel conforming to ASTM A569-66T. Metal thickness shall be 16 gage for frames in openings 4 feet or less in width; 14 gage for frames in openings over 4 feet in width.

B. Design and Construction: Frames shall be custom made welded units with integral trim, of the sizes and shapes shown on approved shop drawings. KNOCKED-DOWN FRAMES WILL NOT BE ACCEPTED. Finished work shall be strong, rigid, and neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths. Jamb depths, trim, profile and backbends shall be as shown on Drawings. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops mitered. The use of gussets will not be permitted.

1. Stops shall be 5/8 inch deep.
2. Hardware reinforcements: Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates. Frames shall be reinforced for closers. Minimum thickness of hardware reinforcing plates shall be as follows:
   a. Hinge and pivot reinforcements - 7 gage, 1 1/4 inches by 10 inches minimum.
   b. Strike reinforcements - 12 gage.
   c. Flush bolt reinforcements - 12 gage.
   d. Closer reinforcements - 12 gage.
   e. Reinforcements for surface-mounted hardware - 12 gage.
3. Floor anchors: Floor anchors shall be securely welded inside jambs for floor anchorage. Where required, provide adjustable floor anchors, providing not less than 2 inches height adjustment. Floor anchors shall be 14-gage minimum.

C. Finish: After fabrication, tool marks and surface imperfections shall be removed, and exposed faces of welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and coated on accessible surfaces with rust-inhibitive primer complying with FS-TT-P-57 (Type II) or FS-TT-P-659 with 2.0 mils minimum thickness. Fully cure before shipment.

2.04 HOLLOW METAL DOORS

A. Doors shall be made of commercially quality, level, cold rolled steel conforming to ASTM A366-68 and free of scale, pitting or other surface defects. Face sheets for interior doors shall be18 gage minimum with zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.

B. Design and Construction: Doors shall be custom made, of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 1-3/4 inches unless otherwise noted. Doors shall be strong, rigid and neat in appearance, free from warp or buckle. Corner bends shall be true, straight and of minimum radius for the gage of metal used.

C. Stiffen face sheets with continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gage minimum, spaced 6 inches apart and securely attached to face sheets by spot welds 5 inches on center. Spaces between stiffeners shall be sound-deadened insulated full height of door with an inorganic non-combustible batt-type material.

D. Join door faces at their vertical edges by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

E. Top and bottom edges of doors shall be closed with a continuous recessed 16 gage minimum steel channel, extending the full width of the door and spot welded to both faces.

F. Edge profiles shall be provided on both vertical edges of doors as follows:

1. Single-acting swing doors - beveled 1/8 inch in 2 inches.

F. Hardware reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closures, etc.) is to be applied, doors shall have reinforcing plates. Minimum gages for hardware reinforcing plates shall be as follows:

1. Hinge and pivot reinforcement - 7 gage.
2. Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gage.
3. Reinforcements for all other surface mounted hardware - 16 gage.

G. Finish: After fabrication, tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall be chemically treated to ensure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive primer. Fully cure before shipment.

H. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum in any direction, including a diagonal direction.

2.05 LABELED DOORS & FRAMES

A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings, and as scheduled on Drawings. Such doors and frames shall be Underwriters' Laboratories, Inc. labeled or other nationally recognized agency having a factory inspection service.

B. When door or frame specified to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Project Engineer / Architect shall be advised before fabricating work on that item is started.

2.06 HARDWARE LOCATIONS

A. Hinges:

1. Top – 5 inches from head of frame to top of hinge.
2. Bottom – 10 inches plus 1 inch from finished floor to bottom of hinge.
3. Intermediate, centered between top and bottom hinges.

B. Unit and integral type locks and latches – 3’- 2” to centerline of knob from finished floor.

2.07 CLEARANCES

A. Edge clearances:

1. Between doors and frame, at head and jambs - 1/8 inch.
2. At door sills: where no threshold is used - 1/4 inch maximum above finished floor; where threshold is used - 3/4 inch maximum above finished floor.

2.09 PREPARATION FOR FINISH HARDWARE

A. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Include preparation for mortise and concealed hardware.

B. Provide reinforcements for both concealed and surface applied hardware. Drill and tap mortise reinforcements at factory, using templates. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

2.10 REJECTION

A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed. Replace rejected materials.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions where hollow metal Work is to be installed and notify Project Engineer of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hollow metal units and accessories in accordance with approved Shop Drawings, manufacturer's data, and Specifications.

B. Placing frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. At stud partitions, attach wall anchors to studs with tapping screws. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
2. Make field splices in frames as detailed on final Shop Drawings, welded and finished to match factory work.
3. Remove spreader bars only after frames or bucks have been properly set and secured.
4. Door installation: Fit hollow metal doors accurately in their respective frames, with the following clearances:
   a. Jambs and head: 3/32 inch.
   b. Meeting edges, pairs of doors: 1/8 inch.
   c. Bottom: 1/4 inch, where no threshold.
   d. Bottom: at threshold: 1/8 inch.
   e. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hardware as shown on the Drawings and in Schedules. Door hardware is hereby defined to include all items known commercially as builders hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. The required types of hardware include (but are not limited to) the following:

1. Butts and hinges
2. Lock cylinders and keys
3. Lock and latch sets
4. Bolts
7. Closers
8. Door trim units
9. Stripping and seals
10. Thresholds

C. Items of hardware not definitely specified, but required for the completion and proper operation of the doors, shall be suitable in type, comparable to the type specified for similar openings. Labeled doors shall be fitted with labeled hardware.

D. All modifications of hardware required by reason of construction characteristics shall be such as to provide the proper operation or functional features. Contractor shall be fully responsible for checking all details, such as wall trim clearance, bevels, backsets, proper type strike plates, length of spindles, hands of locks, etc., in order that all items of hardware shall fit properly. Hardware for application to metal shall be made to standard templates. Template information shall be furnished to door and frame fabricators and all other trades requiring same, in order that they may cut, reinforce or otherwise prepare in the shop, materials for reception of hardware.

E. Hardware shall be free from defects affecting appearance and serviceability. Working parts shall be well fitted and smooth working without unnecessary play. All items of hardware shall be delivered to the building site in sufficient time in advance of its requirement for use for inspection prior to installation.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and Installation instructions for each type of hardware. Include operating instructions, maintenance information and spare part sources.

B. Contractor's Hardware Schedule: After all samples have been approved but prior to delivery of hardware, Contractor shall prepare and submit to the Project Engineer / MDOT Architect a complete schedule of all finish hardware required. Schedule shall follow requirements of Specifications and shall indicate type, manufacturer's name and number, location and finish of each item required. Approval of schedule will not relieve Contractor of responsibility for furnishing all necessary hardware.

C. Submit such samples as required by the Project Engineer / MDOT Architect for approval. Do not deliver hardware until approval is obtained.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:

1. ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. NFPA 101.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience and approved by manufacturer.

C. Hardware supplier shall have in his employment, an Architectural Hardware Consultant (AHC) in good standing as certified by the Society of Hardware Consultants Council. The Architectural Hardware Consultant shall assist the Contractor in installation and verify that hardware has been furnished and installed in accordance with manufacturer's instructions and as specified herein.

D. Templates: The hardware supplier shall provide templates and / or physical hardware to trades as required and in sufficient time to prevent delay in the execution of the Work.

1.04 PACKING AND MARKING

A. Package each item of hardware and lockset separately in individual containers, complete with screws, keys, instructions and installation template for spotting mortising tools. Mark each container with item number corresponding to number shown on Contractor's hardware schedule.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Best Access Sys. Indianapolis, IN. Tel: (800) 311-1705.
2. Corbin Russwin Arch't. Hardware. Berlin, CT. Tel: (800) 543-3658.
3. Dorma Door Controls, Inc. Reamstown, PA. Tel: (800) 523-8483.
4. Hager Companies. Saint Louis, MO. Tel: (800) 325-9995.
5. LCN. Princeton, IL. Tel: (800) 526-2400.
6. McKinney Hinge. Scranton, PA. Tel: (800) 346-7707.
7. Pemko. Ventura, CA. Tel: (800) 283-9988.
8. Rockwood Manufacturing Co. Rockwood, PA. Tel: (800) 458-2424.
9. Schlage Lock Co. Colorado Springs, CO. Tel: (800) 847-1864.
10. Stanley Hardware. New Britain, CT. Tel: (800) 337-4393.
11. Trimco/BBW/Quality. Los Angeles, CA. Tel: (323) 262-4191.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 KEYING / CYLINDERS

A. All cylinders and locksets shall be set to the existing masterkey system. Furnish all cylinders & locksets with removable type cores. The removable core system shall be one that uses either temporary construction cores or construction keyed cores operated by a construction key until such time the construction key is rendered inactive by the change key or retractor key.

B. All cylinders shall be keyed in sets as directed by the Project Engineer / MDOT Architect. Furnish 3 change keys per lock and 6 masterkeys per set.

2.03 MATERIALS

A. See Hardware Schedule at end of this Section. Products listed set standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount hardware units at heights recommended in "Recommended Locations for Builders' Hardware" NBHA, except as other wise specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Project Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

D. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hairline joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

E. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel that will not corrode in contact with the threshold metal.

1. At exterior doors, and elsewhere as indicated, set thresholds in a bed of either butyl rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture from every source.
2. Do not plug drainage holes or block weeps. Remove excess sealant.

3.02 ADJUSTING AND CLEANING

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

3.03 SCHEDULE:

HW1 (For interior Hollow Metal Door @ Mechanical Room)

Each Opening Shall Have:

1 – Set Spring Hinges	Hager	1256 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND80BD Rhodes X 626
1 – Core	Best	1C7-A2
1 – Stop	Rockwood	440 X 626
3 – Silencers		

HW2 (For Interior Dbl. Hollow Metal Doors @ Mechanical Room)

Each Opening Shall Have:

6 – Each Hinges	Hager	BB1279 4 1/2 X 4 1/2 X 652
1 – Lockset	Schlage	ND80BD Rhodes X 626
1 – Core	Best	1C7-A2
2 – Flushbolts	Rockwood	555-12” X 626
2 – Stops	Rockwood	440 X 626
2 – Silencers		

END OF SECTION

SECTION 09 05 15 COLOR DESIGN

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. A coordinated comprehensive Color System in which requirements for materials specified in other sections of this Specification and/or shown on the Drawings are identified for quality, color, finish, texture and pattern.

1.02 MANUFACTURER'S TRADE NAMES

A. Manufacture's trade names and number designations used herein identify colors, finishes, textures and patterns for materials and products specified in the technical sections of the Specifications. Wherever such products are referred for selection or approval in other sections, such products shall be understood to be referenced to this Section.

B. If no selection is listed herein for products, the Project Engineer / MDOT Architect shall be contacted for a color selection.

C. Subject to approval of the Project Engineer / MDOT Architect, products of other manufacturers will be considered, provided they are equivalent to the quality, colors, finishes, textures and patterns listed and meet the requirements of the Specifications and Drawings.

1.03 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

1.04 SAMPLES

A. Color samples shall be submitted for approval prior to applying or installing any finishes or items that are included in this Section. See appropriate technical Sections for submittal requirements.

B. Upon receipt of samples, the Project Engineer / MDOT Architect may make revisions to the Color schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials are specified in other sections of the specifications. Any reference by trade name or manufacturer shall be considered as establishing a standard of quality and shall in no way limit competition.

2.02 MANUFACTURERS

A. The following manufacturers were used in preparing the Color Schedule:

SECTION / MATERIAL	MANUFACTURER / NUMBER & COLOR NAME	COLOR DESCRIPTION
• 05 50 00 - Miscellaneous Steel	S/W #6083 Sable	(bronze)
• 06 10 00 - Rough Carpentry	SW #6079	(light tan)
• 07 41 14 - Sheet Metal Roof	AEP Span – Medium Bronze	(bronze)
• 07 41 14 - Sht Met Flash & Trim	AEP Span – Medium Bronze	(bronze)
• 07 92 00 - Joint Sealants	Pecora (Match adjacent lighter material)	
• 08 11 13 - HM Doors & Frames	S/W #6083 Sable	(bronze)
• 08 71 00 - Door Hardware	Satin Chrome	(Silver)
• 09 29 00 – Gyp.Bd Walls	SW #6079	(light tan)
• 10 82 15 – Arch Screen wall	C/S Group Medium Bronze	(bronze)

PART 3 - EXECUTION

3.01 EXECUTION

A. Refer to execution requirements specified in other Sections of this Specification for the specific products listed. Any remaining colors, finishes, textures or patterns not included in this Color Design Section will be selected by the MDOT Architect upon written notification and subsequent submittals by the Contractor.

END OF SECTION

SECTION 09 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gypsum board work with a tape-and-compound joint treatment system known as "drywall finishing" work. The types of work required include the following:

1. Gypsum board including screw-type metal support system.
2. Gypsum board applied to metal and wood framing and furring.
3. Gypsum backing boards for application of other finishes.
4. Drywall finishing (joint tape-and-compound treatment).

1.02 SUBMITTALS

A. Submit manufacturer’s technical product data, installation instructions and recommendations for products specified.

1.02 QUALITY ASSURANCE

A. Where work is indicated for fire resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL and A.I.A.

B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.

C. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.

D. Manufacturer: Obtain gypsum boards, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.03 PRODUCT HANDLING

A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.05 PROJECT CONDITIONS

A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

PART 2 - PRODUCTS

2.01 METAL SUPPORT MATERIALS

A. To the extent not otherwise indicated, comply with Gypsum Association Specification GA-203 "Installation of Screw-Type Steel Framing Members to Receive Gypsum board" (as specified and recommended) for metal system supporting gypsum drywall work.

B. Interior Studs: ASTM C 645; 20 gage by 3-5/8 inches deep, except as otherwise indicated or specified herein. Provide stud manufacturer's standard accessories such as clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system. Runners shall match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work. Provide double 20 gage studs at all openings and doorjambs and at door and opening headers.

C. Furring Members: ASTM C 645; 20 gage, hat-shaped. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

D. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.

2.02 GYPSUM BOARD PRODUCTS

A. To the extent not otherwise indicated, comply with GA-216, as specified and recommended. Exposed gypsum board shall be Type X, fire rated type with tapered long edges and as follows:

1. Edge Profile: Special rounded or beveled edge.
2. Sheet Size: Maximum length available that will minimize end joints.
3. Thickness: 5/8 inch, except where otherwise indicated.
4. Water-resistant Type (WR-1): Provide at exterior walls and where indicated; equal to 5/8 inch thick DensArmor Plus Fireguard by G-P Gypsum.

2.03 TRIM ACCESSORIES

A. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

B. Where metal moldings are specifically called out on the drawings, provide the appropriate item from below:

1. Edge Trim - USG No. 200-A.
2. Control Joint - USG No. 093.

2.04 JOINT TREATMENT MATERIALS

A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

B. Joint Tape: Perforated type.

C. Joint Compound: On interior work provide chemical hardening type for bedding and filling, ready-mixed vinyl-type or non-casein-type for topping. On exterior work provide water- resistant type.

2.05 MISCELLANEOUS MATERIALS

A. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board. Gypsum board fasteners shall comply with GA-216. Provide anti-corrosive type at exterior applications.

PART 3 - EXECUTION

3.01 INSTALLATION OF METAL SUPPORT SYSTEMS

A. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions. Furnish concrete inserts, steel deck hanger clips, and similar devices to other trades for installation well in advance of time needed for coordination with other work. Isolate stud system from transfer to structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work. Terminate partition stud systems one foot above finished ceiling, braced each side at 45 degrees at 4 feet on center, except where indicated to be extended to structural support or substrate above. Space studs 16 inches on center except as otherwise indicated.

B. Door Frames: Install additional jamb studs at door frames as indicated, but not less than 2 studs (minimum 20 gage) at each jamb. Space jack studs over doorframes at same spacing as partition studs, with bottom runner secured to doorframe.

C. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.02 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed. In addition to compliance with GA-216 and ASTM C 840, comply with manufacturer's instructions and requirements for fire resistance ratings (if any), whichever is most stringent.

B. Install sound attenuation blankets and insulation as indicated, prior to gypsum board unless readily installed after board has been installed.

C. Install wall/partition boards vertically to avoid end- butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

D. Cover both faces of steel studs with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls that are properly braced internally. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than eight (8) square foot area, and may be limited to not less than 75 percent of full coverage.

E. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide l/4 inch to l/2 inch space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

F. Floating construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.

G. Space fasteners in gypsum boards in accordance with GA-2l6 and manufacturer's recommendations, except as otherwise indicated.

3.03 SPECIAL GYPSUM BOARD APPLICATIONS

A. Install exposed gypsum board by fastening with screws.

B. Wall Tile Base: Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install cement based backing board. At toilets, showers, labs, janitor closets, and similar "wet" areas, install water-resistant gypsum board. Apply with uncut long edge at bottom of work, and space l/4 inch above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant sealant before installation.

3.04 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

B. Install metal corner beads at external corners of drywall work.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U- type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints.) Install metal control joint (beaded type) where indicated or required for proper installation.

3.05 INSTALLATION OF DRYWALL FINISHING

A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners heads, surface defects and elsewhere as required to prepare work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound specified herein and recommended by manufacturer.

B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.

C. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.

D. Base for Ceramic Tile: Do not install drywall finishing where ceramic tile and similar rigid applied finishes are indicated.

E. Unless otherwise indicated, install drywall finishing at all gypsum board exposed to view and to receive finishes, and where not exposed to view and above ceilings install at all fire rated and smoke, sound, air, conference, exam, toilet, private office, mechanical and electrical room walls.

F. Finishing Gypsum Board Assemblies: Level 4 finish, unless otherwise indicated; Level 1 finish for concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and Level 5 finish is required in areas with a gloss or epoxy finished coating.

3.06 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protection of the gypsum drywall Work from damage and deterioration during the remainder of the construction period.

END OF SECTION

SECTION 09 90 00 PAINTING AND COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Painting and finishing of exterior and interior exposed items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections of the Work.

B. The Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical Work, except as otherwise indicated.

C. "Paint" 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.

D. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available for the materials system specified.

E. Extra Materials: Deliver to Owner a 1-gal. Container, properly labeled and sealed, of each color and type of finish coat paint used on Project and with readable labels.

1.02 PAINTING NOT INCLUDED

A. The following categories of Work are not included as parts of the field-applied finish Work, or are included in other Sections of these Specifications.

B. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various Sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated or factory-built mechanical and electrical equipment or accessories.

C. 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) plastic toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixture, switch-gear and distribution cabinets, elevator entrance frames, door and equipment.

D. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundations spaced, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

E. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

F. Operating Parts and Labels: 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, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.03 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.

B. Paint Systems: Comply with Article 2.04 indicating each type of primer and top coat required for each substrate by product name and number.

C. Samples: Submit color samples for selection by Architect from manufacturer’s full range of colors. Indicate submitted manufacturer’s CLOSEST STANDARD COLORS that match colors specified.

D. Bidders desiring to use coatings other than those specified shall submit their proposal in writing to the Architect at least ten (10) days prior to the bid opening. Substitutions which decrease the film thickness, the number of coats applied, change the generic type of coating or fail to meet the performance criteria of the specified materials will not be approved. All primers and topcoats plus the seam sealer and pit filler shall be furnished by the same manufacturer to ensure compatibility.

1.05 QUALITY ASSURANCE

A. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes as specified. On at least 100 square feet of surface as directed, provide full-coat finish samples until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place Work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Name or title of material.
2. Fed. Spec. Number, if applicable.
3. Manufacturer's stock number and date of manufacturer.
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 under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer’s instructions.

1.07 PROJECT CONDITIONS

A. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instruction. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by the Sherwin-Williams Company, 101 Prospect Avenue NW, Cleveland, OH 44115. Tel. (800) 321-8194.

B. Equivalent products by the following manufacturers are acceptable:

1. Benjamin Moore & Company, Montvale, NJ. Tel. (800) 344-0400.
2. Farrell-Calhoun Paint, Memphis, TN. Tel. (901) 526-2211.
3. Tnemec Company Inc., Kansas City, Missouri. Tel. (800) 863-6321.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures

2.02 COLORS AND FINISHES

A. Paint colors, surface treatments, and finishes will be selected from color chips submitted by contractor. Prior to beginning Work, the Architect will select color chips for surfaces to be painted. Use representative colors when preparing samples for review. Final acceptance of colors will be from samples.

B. Color Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated. Lead content in the pigment, if any, is limited to contain not more than 0.5 percent lead, as lead metal based on the total non-volatile (dry-film) of the paint by weight.

C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coats system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials provided for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primer or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.03 MATERIAL QUALITY

A. Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best grade product WILL NOT BE ACCEPTED. Proprietary names used to designate colors or materials are not intended to imply that products of the named manufacturers are required to the exclusion of equivalent products of other manufacturers.

B. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

2.04 PAINT SYSTEMS

A. Provide the following paint systems for the various substrates, as indicated. Where touch-up paint is required, use the system below that most closely matches existing finish. Follow manufacturer recommendations for compatible applications and color of existing finishes. Touch-ups may not require three (3) coats, but obvious applications that do not match existing areas to remain will not be accepted.

B. Exterior Paint Systems are as follows:

1. Ferrous and Zinc Coated Metal
   - 1st Coat: S-W ProCryl® Universal Primer, B66-310 Series (2-4 mils dry)
   - 2nd Coat: S-W Duration® Exterior Latex Acrylic Gloss Coating, K34 Series (7 mils wet, 2.8 mils dry per coat)

C. Interior Paint Systems are as follows:

1. Gypsum Drywall (Semi-Gloss)
   - 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
   - 2nd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series
   - 3rd Coat: S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (4 mils wet, 1.6 mils dry per coat)
2. Gypsum Drywall (Eggshell)
   - 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
   - 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series
   - 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (4 mils wet, 1.6 mils dry per coat)
3. Gypsum Drywall (in wet areas)
   - 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
   - 2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
   - 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5 - 3 mils dry per coat)
4. Concrete Masonry Units (Waterborne Acrylic)
   - 1st Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry)
   - 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series
   - 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (4 mils wet, 1.4 mils dry per coat)

5. Concrete Masonry Units (Epoxy)
   - 1st Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry)
   - 2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
   - 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5 - 3 mils dry per coat)
6. Ferrous and Zinc Coated Metal
   - 1st Coat: S-W ProCryl Universal Primer, B66-310 Series
   - 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series
   - 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (4 mils wet, 1.4 mils dry per coat)
7. Painted Woodwork
   - 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (4 mils wet, 1.3 mils dry per coat)
   - 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series
   - 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (4 mils wet, 1.4 mils dry per coat)
8. Concrete Floor Stain & Sealer (Opaque Color)
   - 1st Coat H&C Shield Plus Ultra, Acrylic Concrete Stain
   - 2nd Coat H&C Shield Plus Ultra, Acrylic Concrete Stain
   - Option - H&C SharkGrip Slip Resistant Additive to the 2nd coat
   - Note - New concrete must be etched prior to application
9. Concrete Floor Sealer (Clear)
   - 1st Coat H&C Shield Plus Ultra, Acrylic Concrete Stain/Sealer – Clear
   - 2nd Coat H&C Shield Plus Ultra, Acrylic Concrete Stain/Sealer - Clear
   - Option - H&C SharkGrip Slip Resistant Additive to the 2nd coat

PART 3 - EXECUTION

3.01 EXAMINATION

A. Applicator must examine the areas and conditions under which painting Work is to be applied and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator. Starting of painting Work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.02 SURFACE PREPARATION

A. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition. Remove all 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 the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, re-install the removed items by workmen skilled in the trades involved. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule the cleaning and painting so that contaminates from the cleaning process with not fall onto wet, newly painted surfaces.

B. Ferrous Metals:

1. 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.
2. Touch-up shop-applied prime coats wherever damaged or bare. Where required by other Sections of these Specifications, clean and touch-up with the same type shop primer.

C. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent.

D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat.

1. Prime, stain, or seal wood required being job-painted, as soon as practicable upon delivery to job. Prime edges, ends, faces, under sides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dry.
2. When transparent finish is required, use sealer as recommended by manufacturer. Seal tops, bottoms, and cutouts of unprimed wood doors with sealer immediately upon delivery to project.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.04 APPLICATION

A. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

B. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint. Paint the back- sides of access panels, and removable or hinged covers to match the exposed surfaces.

C. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.

D. Sand lightly between each succeeding enamel or varnish coat.

E. Omit the first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated or barrier coat is required for compatibility.

F. Scheduling Painting: Apply the 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. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

G. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

H. Mechanical and Electrical Work: Painting of mechanical and electrical Work include items exposed to view in mechanical equipment rooms, in occupied spaces and where indicated on Drawings or specified in other Sections. Coordinate with Division 15 and Division 16 Sections.

1. Mechanical items to be painted include, but are not limited to, the following:
   a. Piping, pipe hangers, and supports.
   b. Heat exchangers.
   c. Tanks.
   d. Ductwork.
   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.
   b. Switchgear.

I. Prime Coats: Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Re-coat 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.

J. 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, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

L. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint Work not in compliance with specified requirements.

3.05 CLEANING AND PROTECTION

A. Cleaning: During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care 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 others for protection of their Work, after completion of painting operations. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 10 82 15 ARCHITECTURAL SCREEN WALL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Materials, labor, equipment and services necessary to furnish, deliver and install aluminum screen walls at Equipment Yard complete with framing, gates and hardware as shown on the Drawings and as specified herein.

1.02 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications

B. Section 09 05 15 – Color Design

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, technical data, and installation instructions for required products, including finishes and color samples.

B. Shop Drawings: Submit shop drawings for fabrication and reaction of screen units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

1.04 QUALITY ASSURANCE

A. Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

B. Field Measurements: Verify size, location and placement of screen units prior to fabrication, wherever possible.

C. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, mechanical attachment and field assembly of units. Pre-assemble units and ship to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for unit re-assembly and coordinated of installation.

1.05 WARRANTY

A. Paint Finish: Paint finish shall have a 20-year guarantee against cracking, peeling and fade (Not to exceed 5 N.B.S. units).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Construction Specialties, Inc., 49 Meeker Ave., Cranford, NJ 07016. Tel. (908) 272-5200.

B. Equivalent products by the following manufacturers are acceptable:

1. All-Lite Louvers. Mineral Wells, WV. Tel. (304) 489-8113.
2. Ruskin Manufacturing, Kansas City, MO. Tel. (816) 761-7476.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 211, Alloy 6063-T52.

B. Clip Angles: Structural grade aluminum.

C. Fastenings: Fasteners shall be aluminum or stainless steel. Provide types, gauges and lengths to suit unit installation conditions.

D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drilled-in place anchors.

2.03 FABRICATION GENERAL

A. Provide Architectural Screen equal to C/S Vert-a-Cade 301 Screen and accessories of design, materials, sizes, depth, arrangement, and metal thickness as indicated or as required for optimum performance with respect to strength; durability; and uniform appearance.

B. Include supports, anchorages, and accessories required for complete assembly.

2.04 SCREEN CONSTRUCTION

A. Blades shall be fabricated from extruded aluminum sections in 6063-T52 alloy, minimum .081 inch thick and spaced approximately 6-3/4 inches on center. Blades to be nominal 4 inches deep, supported and lined up with heavy gauge extruded aluminum blade braces positively interlocked to each blade and mechanically secured to extruded aluminum supports. Aluminum supports fixed directly to horizontal or vertical steel supports, by Contractor, and to spandrel beams with extruded aluminum clip angles. All fasteners shall be stainless steel or aluminum. Material shipped knocked down for field assembly by the installer. Aluminum supports and blade braces to be in mill finish.

2.05 ALUMINUM FINISH

A. General: Comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are assembled. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.

B. Fluorocarbon Coating: Inhibitive thermo-cured primer, 0.2 mil minimum dry film thickness, and thermo-cured fluorocarbon coating containing “Kynar 500” resin, 1.0mil minimum dry film thickness. Furnish manufacturer’s twenty (20) year guarantee of “Kynar 500” finish.

C. Color: Provide Color as indicated in Section 09 05 15 – Color Design or, if not otherwise indicated, as selected by Project Engineer / MDOT Architect from full range of C/S Standard and Premium Kynar 500 colors.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorage. Coordinate delivery of such items to Project Site.

1.05 INSTALLATION

A. Locate and place aluminum screen units plumb, level and in proper alignment with adjacent Work. Use concealed anchorage wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces.

B. Form tight joints with exposed connections accurately fitted together.

C. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective Work. Return items that cannot be refinished in field to manufacturer, make required alterations and refinish entire unit, or provide new units, at manufacturer's option.

D. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

E. Use isolation tape where aluminum comes in contact with steel or concrete.

END OF SECTION

SECTION 22 05 10 PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete plumbing systems as specified herein and as shown on the drawings.

B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary and other conditions) and other divisions as appropriately apply to work specified in this division.

1.02 CODES, ORDINANCES, AND PERMITS:

A. All plumbing materials and workmanship shall comply with the following codes and standards as applicable:

1. The National Electric Code (2005 Edition)

2. The International Building Code (2006 Edition)

3. The International Plumbing Code (2006 Edition)

4. The International Fuel Gas Code (2006 Edition)

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

1. Air Conditioning and Refrigeration Institute Standards (ARI)

2. American National Standards Institute, Inc. Standards (ANSI)

3. American Society for Testing and Materials Publications (ASTM)

4. American Gas Association Inc. Laboratories (AGA)

5. American Society of Mechanical Engineers Code (ASME)

6. Factory Mutual Underwriters (FM)

7. National Fire Protection Association Standard (2006)

8. Underwriters Laboratories Inc. (UL)

C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be used made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.

D. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.

E. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

1.03 APPLICABILITY: The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the plumbing systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

1.04 COORDINATION OF PLUMBING DOCUMENTS:

A. The plumbing work listed in these documents shall be coordinated with the work indicated on all other drawings, schedules, schematics, and specifications that are part of these construction documents. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

1.05 WELDERS QUALITY ASSURANCE: All welders shall be certified by ANSI B31.1.0-1967 “Standard Qualification Welding Procedures, Welders and Welding Operators” or “Qualification Tests” in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder’s qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder’s identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

PART 2 - PRODUCTS

2.01 COORDINATION OF PRODUCTS: The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the plumbing systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

2.02 DESCRIPTION: All components of the plumbing systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter’s Laboratories, Inc. (UL) label.

PART 3 - EXECUTION

3.01 GENERAL:

B. The Contractor shall provide and prepare all openings for plumbing work as required in walls, roof, ceilings, etc.; he shall also do all painting as may be required. He shall coordinate the installation of all plumbing equipment in the exterior wall and roof.

B. The plumbing plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.

C. If the Contractor proposes to install equipment and piping requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.

D. The Contractor is responsible for the proper location and size of all slots, holes or openings, in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.

E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interference shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. For example sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

F. Except where otherwise noted, all piping in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

G. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this contract. All control wiring shall be by the Controls Contractor.

H. Piping and equipment shall not be installed in electrical equipment rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel-boards, power panels, motor control centers, or dry type transformers:

1. Within 42" in front (and rear if free standing) of equipment; or

2. Within 36" of sides of equipment,

3. Clearances apply vertically from floor to structure.

4. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

3.02 ELECTRICAL WORK: All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

3.03 PROTECTION OF EQUIPMENT:

A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation and wind.

B. Plug ends of pipe when work is stopped and close ends of ducts with plastic taped in place until work resumes.

C. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

3.04 PAINTING:

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All new un-insulated black ferrous metal items exposed to sight inside the building, such as piping, equipment hangers and supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibitor primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. New black ferrous metal items exposed outside the building, such as equipment support beams, un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. In lieu of painting hanger rods, cadmium plated or galvanized rods may be furnished.

E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.

F. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.

3.05 PROTECTION OF EXISTING UTILITIES:

A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.

B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

3.06 CUTTING AND PATCHING:

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. All surfaces shall be patched to the condition of the adjacent surfaces.

C. The Contractor shall make suitable provisions for adequately water-proofing at his floor penetrations of water proof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, clean-outs, and sleeves for the various piping. This also applies to membrane roofing systems.

3.07 SLEEVES, FLOOR AND CEILING PLATES:

A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under each section of the Specification.

B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.

C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.

D. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.

E. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.

F. All penetrations through rated walls and floors shall be packed, sealed and encapsulated per the applicable U.L. details(s).

G. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.

H. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to ¾" diameter, and permitting lateral adjustment.

3.08 ESCUTCHEONS:

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.09 CLEANING:

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.

B. Before installing thermostatic members of the steam traps, and connecting return mains to the return pumps, pipe the return mains outside the building and blow down the new steam piping system until thoroughly clean. Open automatic steam valves while blowing down.

C. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

D. The exterior surfaces of all mechanical equipment, piping, etc., shall be cleaned of all grease, oil, paint, dust and other construction debris.

E. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

F. Equipment rooms shall be left broom clean.

G. End of open pipes shall be covered during construction except when working directly on such one prohibits covering.

H. Clean and polish identification plates.

3.10 EQUIPMENT, MATERIALS AND BID BASIS:

A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products will be considered and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect for review prior to bid, he shall furnish descriptive catalog material, text data, samples, etc., as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect.

B. The use of one named manufacturer in the schedules on the Drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

3.11 GUARANTEE: All systems and components shall be provided with a one year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.

3.12 FOUNDATIONS: All concrete foundations required by equipment furnished under the Plumbing Division shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed. Unless otherwise noted, foundations shall be four inches 4" - 6" high. All concrete work performed shall conform entirely to the requirements of the General Specifications that describe this class of work.

3.13 RECORDS AND INSTRUCTIONS FOR OWNER:

A. The Contractor shall accumulate during the job's progress the following data in triplicate prepared in neat brochures or packet folders and turned over to the Architect/Engineer for check and subsequent delivery to the Owner:

1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.

2. Provide approved fixture brochures, wiring diagrams, and control diagrams.

3. Provide copies of approved shop drawings.

4. Three sets of operating instructions for plumbing equipment and systems. Operating instructions shall also include recommended periodic maintenance and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

5. Any and all other data and/or drawings required during construction.

6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

B. All of the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor asks for his last estimate prior to his final estimate, but in no case, less than two weeks before final inspection.

C. The Contractor shall also give not less than 1 day of operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in paragraph above shall be used as a basis for this on-the-job instruction.

3.14 RECORD DRAWINGS:

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work the Contractor shall purchase from the Architect a set of mylar sepia prints to be used for the "Record Drawings".

B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS" – “3/8" high letters to be used for recording field deviations, and "5/16" high letters to be used for dimensional data only.

3.15 INSTALLATION: All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

3.16 ACCESS DOORS:

A. Furnish and install access doors at each point required to provide access to concealed valves, cleanouts, and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.

C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor to be installed.

D. Access doors shall be MILCOR or approved equal in accordance with the following:

Style AT Door for Acoustical Tile Ceilings
Style AP Door for Acoustical Plaster Ceilings
Style K Door for Plastered Wall and Ceiling Surfaces
Style DW Door for Drywall
Style ATR for Suspended Drywall Ceilings
Style M Door for Masonry, Ceramic Tile, Etc.
Fire-Rated 1-1/2 hr. (B-label) Door where required.
Security access doors for all security walls and ceilings shall have minimum 3/16” x 2” x 2” welded steel frame with 10 gauge door panel and heavy duty stainless steel hinge welded to door and frame. Door shall have detention type deadbolt lock.

E. Size and type shall be as required for proper service and/or as may be directed by the Architect.

F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

3.17 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS:

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

3.18 EQUIPMENT FURNISHED BY OWNER:

A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the owner for installation by the contractor.

B. The contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

3.19 HAZARDOUS MATERIALS:

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in specification Division 22. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

3.20 PROTECTION OF EXPOSED PIPING: All piping exposed to freezing shall be heat traced as per manufacturer’s recommendations per Section 22 05 33 “Heat Tracing for Plumbing Piping” and insulated per Section 22 07 00 “Plumbing Insulation”.

END OF SECTION

SECTION 22 05 11 PLUMBING SUBMITTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, and Section 22 05 10 Plumbing General Requirements, apply to all work herein.

1.02 QUALITY ASSURANCE:

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit to the Architect a sufficient number of copies of all such Shop Drawings or catalog data to provide him with as many reviewed copies as he may need, plus two (2) copies for retention; one by the Architect and one by the Engineer.

B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

C. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.

E. Reproduction of design documents in any portion for use in a submittal is not acceptable.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

PART 3 - EXECUTION

3.01 SUBMITTAL DATA:

A. General

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.

2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 22 and Division 23, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.

3. Plumbing submittal data shall be bound into separate 3-ring binders, Each plumbing volume shall contain one copy of all specified equipment/shop drawing submittals. Each binder shall be provided with an index of materials and an identification tab for each Specification Section that requires submittals. Each item in each tabbed section shall be identified with the paragraph number relating to the item submitted. FAILURE to provide BOUND AND IDENTIFIED SUBMITTALS will result in the AUTOMATIC REJECTION of the submittal data with NO EXCEPTION**.**

B. The bound submittals are to be submitted for review within 30 days after the Contract is awarded. No submittal will be checked until ALL required submittals have been received by the Engineer. Only piping fabrication drawings may be submitted after the completed bound submittal is reviewed and accepted by the Engineer.

C. The Contractor shall submit with the bound and identified submittal data a letter signed by the Contractor's Project Manager (or higher level officer of the firm) stating that all electrical characteristics of the mechanical equipment to be supplied has been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

Air Compressors and Air Dryers
Backflow Preventers
Cleanouts
Disconnect Switches
Drains
Gas Cocks
Heat Cable

Hydrants
Insulation
Pipe Hangers and Supports
Plumbing Drains
Strainers
Thermometers, Gauges, etc.
Valves

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS:

A. Description

1. Complete operating and maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instruction shall be included for each piece of equipment. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.

2. A system wiring and control diagram shall be included in the operating and maintenance instruction.

3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the Owner in the operation of all systems for a period of not less than three (3) days. This instruction shall include a complete walk-through of all equipment and systems. The Architect reserves the right to attend any such meeting and shall be duly notified.

3.03 OTHER SUBMITTALS – CLOSEOUT FORMS:

A. Submit two copies of the following prior to occupancy of the project by the Owner. See Contract Closeout Forms – Section 00 65 00.

1. As built drawings for plumbing systems.

2. Request for final payment.

3. Letter or “Release of Liens”.

4. Letter of “Guarantee”.

5. Submit two (2) copies of welder’s certificate.

6. Consent of Surety Company to final payment.

7. Contractor’s Affidavit of Payment of Debts and Claims.

END OF SECTION

SECTION 22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions, and General Requirements Division 01 00 00 apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.

B. "C" CLAMPS may be used as point of attachment to building structure for pipe hangers and/or all-thread rods; however, piping shall not be supported directly by “C” clamps.

C. Do not pierce waterproofing with support bolts.

D. All ferrous metal hangers and supports, not otherwise coated, shall be provided with a field-applied coat of zinc chromate primer prior to any installation. In lieu of field painting, the contractor may furnish cadmium plated, or galvanized hangers and supports.

1.03 QUALITY ASSURANCE:

A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.

B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories. Submit fastening methods to the Structural Engineer for approval and as approved copy to the engineer.

C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel straps are not acceptable.

D. For the purpose of this specification, Grinnell product figure numbers are given. Equal products by B-Line and Michigan Hanger Co. (M-Co) are acceptable.

1.04 DESIGN:

A. Supporting steel not shown for the equipment will be designed, supplied and erected by the Contractor; the supporting steel is that steel which is connected to the structural steel shown on the drawings and carries the weight of the mechanical items. This supporting steel design must carry the dead weight and dynamic load imposed by the equipment, piping and other mechanical components.

B. The supporting steel shall be connected to the structural steel in such a manner as not to overload the structural steel. It is the responsibility of the Contractor and the steel fabricator to verify that this purpose is accomplished. It is the responsibility of the Contractor to call to the attention of the Architect-Engineer any deficiency prior to bidding.

C. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger in order to prevent excessive stress in either pipe or connected equipment.

PART 2 - PRODUCTS

2.01 UPPER ATTACHMENTS:

A. Existing Concrete Construction:

1. Support piping in existing concrete construction with Cadmium plated, malleable iron, expansion case, Grinnell Fig. 117.

2. Where hangers are required between structural members (beams) side beam brackets Grinnell Fig. 20, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

B. Steel Construction:

1. Support piping in steel construction with adjust-able beam clamps and tie rods, Grinnell Fig. 218, or side beam brackets bolted or welded to the side of the beam.

2. Where hangers are required between structural members (beams or joist) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC steel Handbook and shall receive a field coat of zinc chromate primer.

C. Wood Construction: Support piping in wood construction with Side Beam Bracket, Grinnell Fig. 202 or Hanger Flange, Grinnell Fig 128R, using lag screws.

2.02 WALL SUPPORTS: Where piping is run adjacent to walls or steel columns welded steel brackets Grinnell Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

2.03 FLOOR SUPPORTS:

A. Where pipe lines are located next to the floor and no provision for expansion are required support piping with Grinnell Fig. 258, pipe rest with nipple and floor flange.

B. Where provisions for expansion are required support piping with Grinnell adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.

C. Vertical piping shall be supported at every other floor using riser clamps Grinnell Fig. 261, for steel and cast iron pipe, and copper clad riser clamp Grinnell Fig. CT-121 for all copper piping.

2.04 SUPPORTS FOR PIPING OUTSIDE THE STRUCTURE: Support piping outside the structure on adjustable pipe supports Grinnell Fig. 264.

2.05 INTERMEDIATE ATTACHMENTS: Supports for horizontal piping shall be all-thread galvanized steel rods, ASTM A-107, Grinnell Fig. 146, of the following sizes:

Pipe Size	Hanger Rod Diameter
2" and smaller	3/8"
2-1/2" and 3"	1/2"
4" and 5"	5/8"
6"	3/4"
8" to 12"	7/8"
14" and 16"	1"

2.06 PIPE ATTACHMENTS:

A. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.

B. Hangers for steel and cast-iron horizontal piping where provision for expansion are not required shall be Grinnell Fig. 260, clevis type with vertical adjustment.

C. Hangers for uninsulated copper pipe 4" and smaller shall be copper plated adjustable band hangers Grinnell Fig. CT. 99C, for pipe sizes over 4" provide Grinnell copper clad clevis type hanger with a copper clad saddle at each hanger location.

D. Hanger for PVC pipe shall be Grinnell Fig. CT. 99, adjustable band hanger.

E. Hangers for steel and copper piping where provisions for expansion are required shall be Grinnell Fig. 171 or Fig. 181, adjustable roller hanger with Grinnell Fig. 160, pipe covering protection saddles.

F. Support hot and cold water piping in spaces behind plumbing fixtures with plastic coated brackets and plastic coated U-bolts.

G. Pipe guide shall be Grinnell Fig. 256.

H. Hangers and supports for fire protection and sprinkler system shall conform to the requirements of NFPA 13, and be UL listed.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.

B. Support each horizontal length of NO-HUB cast iron pipe within 2-1/2 feet of each joint and a maximum of 5'-0" on centers.

C. Provide a hanger within one foot of each elbow.

D. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.

E. Unless specified otherwise, provide the following support spacing.

1. Pipe Size	Support Spacing
1" and smaller	5'-0"
1-1/4" and larger	10'-0"

END OF SECTION

SECTION 22 05 33 HEAT TRACING FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 RELATED SECTIONS:

22 07 00	Plumbing Insulation
22 10 00	Plumbing Piping and Pumps

1.02 REFERENCES:

NEC	National Electrical Code
ASTM – E84	Surface Burning Characteristics of Building Material
NFPA 255	Surface Burning Characteristics of Building Material
UL 723	Surface Burning Characteristics of Building Material

1.03 SUBMITTALS:

A. Product Data: Provide a description, list of materials for each product and/or piece of equipment.

B. Manufacturer shall provide written procedures which describe the minimum acceptable workmanship and industry standards for this installation.

1.04 QUALITY ASSURANCE: Flame spread/smoke development rating of 25/50 or less in accordance with ASTM E84 and NFPA 255.

1.05 QUALIFICATIONS: Installing Contractor specializing in this work shall have a minimum of five (5) years experience.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site in factory-fabricated water resistant packaging, labeled with manufacturer's identification, including product description.

B. This Contractor shall store heating cable and components in a clean and dry space that protects from weather.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS:

A. Manufacturers: Provide products complying with these specifications. The following is an approved list of manufacturers.

1. Chromalox Division, Emerson Electric Company
2. Raychem Corporation.
3. Dekoron, DeKoron – Furon, Inc.
4. Thermon Manufacturing Company.

B. UL Standards: Electric heating cable shall conform to all applicable standards and shall be UL-labeled.

C. Provide heat tracing cable as specified herein and as indicated on the drawings. Heat trace the entire length of the pipe including all valves, fittings, and accessories. Provide all associated accessories including thermostats, termination kits, cold lead kits, end seal kits, and fiberglass tape as recommended by the manufacturer.

D. Self-regulating Freeze Protection Heat Tracing Cable: Provide self-regulating heat tracing cable rated at 5 watts/foot, 120 volts and the amount and length required. Heat tracing cable shall consist of twin cooper conductors encased in a conductive polymer core matrix whose resistance varies with temperature.

E. Electric heating Cable Thermostats: Provide rain tight NEMA 4X enclosure electric heating cable thermostats with a temperature setpoint of 40°F, 22 ampere contacts, remote sensing bulb/capillar tube and as recommended by the cable manufacturer for freeze protection applications. Thermostats shall be used in the ambient sensing mode with the sensor bulb exposed to ambient air. Contractor shall verify power requirements.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. General: Install electric heat tracing cable in accordance with the manufacturer's written instructions, the applicable portions of the NEC, and recognized standards. Furnish, install and connect the heat trace cable and all required accessories in accordance with the manufacturer's instructions. All metallic piping which is heat traced shall be grounded per NEC requirements.

B. Contractor shall install electric heat trace cable for freeze protection of piping systems where indicated on the drawings. Maintain a 40°F water temperature within the traced pipe with an ambient temperature of 0°F.

1. Secure cable to the traced pipe in the 5 o'clock or 7 o'clock position with fiberglass tape on 12" centers. Loop cable at valves, flanges, and unions to allow adequate slack cable such that the valve flanges and unions can be removed without removing the cable.

2. Where the traced piping is PVC, install heat transfer foil as recommended by the manufacturer.

C. Thermostats: Install ambient sensing thermostats for control of freeze protection heat cable in locations where shown on the drawings or as directed by the Engineer.

D. This Contractor shall coordinate installation of power connections to thermostats and heat cable with Division 16.

E. Provide insulation and jacketing for the traced piping as specified in Section 15180. Do not install insulation until the heat cable has been tested.

F. Labeling: Install labels on heat traced piping that indicates that the pipe is electrically traced.

3.02 TESTING: Test heating tape and cable to demonstrate proper operation. Repair or replace damaged tape and cable. Retest to ensure proper operation.

END OF SECTION

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABILITY:

A. All work specified in this Section shall comply with the provision of General Provisions Division 01 00 00.

B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take-off, and 40'-0" maximum spacing on exposed straight pipe runs.

D. All new underground plastic sewer and water piping outside the building shall have #14-copper (TW) tracer wire attached to pipe. Install directly above pipe a continuous 6-inch wide vinyl plastic tape with printing identifying buried service, 12 inches below finished grade, during backfilling operation.

PART 2 - PRODUCTS

2.01 PIPE MARKINGS:

A. Pipe markings shall be manufactured preprinted markings in accordance with the following:

1. No tape or self-adhering markers will be allowed.
2. Snap on pipe markers, W. H. Brady Co. or approved equal are acceptable.
3. Markers shall be strapped on with nylon fasteners.
4. Markers will be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

2.02 BAND AND LETTER SIZE: Band and letter sizes shall conform to the following table:

O.D. of Pipe	Width of Color Band	Size of Letter/Numbers
1-1/4” and smaller	8”	½”
1-1/2” to 2”	8”	¾”
2-1/2” to 6”	12”	1– ¼”
6” to 10”	24”	2– ½”
Over 10”	32”	3- ½”

2.03 IDENTIFICATION:

A. Band legend and color and letter color shall conform to the following table:

Piping Band	Legend	Letters	Band Color
Cold Water (Domestic)	CW (Dom)	White	Green
Drain	D	Black	Green

B. For applications where existing color schemes may already be in place, all new work requiring identification and color coding shall match the existing color schemes.

PART 3 - EXECUTION

3.01 EXECUTION:

A. Locate pipe identification in the following areas:

1. Each riser and each valve,
2. One on each side where piping pass thru walls and floors,
3. Locate at or near each change in direction,
4. Every 40 feet along continuous runs,
5. Located within 4 feet of exit or entrance to a vessel or tank.

B. Indicate pipe content flow direction with arrows of matching style and placed so the arrow points away from the legend.

C. A copy of the pipe identification legend will be framed and accompany the valve tag schedule.

END OF SECTION

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 01 00 00 Specification sections, apply to work of this section.

1.02 DESCRIPTION:

A. All insulation products used outside of mechanical rooms shall meet NFPA requirements for Flame Spread Rating 25, Smoke Developed Rating 50, and Fuel Contributed 50.

B. Staples SHALL NOT be used for securing insulation. All insulation shall be installed in accordance with the insulation manufacturer's recommendations. Insulation shall be continuous through wall, ceiling, floor and roof openings and sleeves, except at fire/smoke dampers.

C. Supports for insulated piping shall be outside the insulation. Inserts shall be provided at hangers. Inserts shall be Foamglass Insulation, Calcium Silicate or Perlite and shall be 2 inches longer than the pipe shields. Pipe shoes welded to the pipe shall be used for roll type hangers.

D. All required tests of the relevant section of pipe or equipment shall be completed before insulation is applied.

E. Do not store materials in building until it is enclosed and dry. Wet insulation shall not be installed.

F. Insulation products with self-sealing type jacket shall not be applied at temperatures below 40 degrees F.

G. Items not to be insulated:

1. Underground domestic cold water piping.
2. Vents from pressure relief valves.

H. Clean and dry all surfaces to be insulated from loose scale, dirt, oil, moisture and other foreign matter.

I. Insulate completely all metal surfaces of piping and equipment other than hangers.

J. Surface finishes shall present a tight smooth appearance.

K. Permit expansion and contraction without causing damage to insulation or surface finish.

L. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation.

M. Vapor barriers must be continuous and uninterrupted throughout the system where specified.

1.03 PIPING:

A. Insulate all valves, strainers and fittings. For the purposes of this Specification, fittings include unions and flanges. Use premolded material where available. Insulate valves up to and including bonnets.

B. Pipe Hangers that are installed in direct contact with the surface of the pipe, such as a pipe clamp shall have the insulation applied over the hanger as well as the pipe. Provide a rain shield on piping supported on hangers outdoors to prevent bulk water from entry.

1.04 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations. Insulation shall be applied by experienced workers regularly employed for this type of work. Material shall be furnished to the job bearing the manufacturer's label.

C. Insulation products shall be as manufactured by Pittsburgh Corning Corporation, Knauf, Owens-Corning, Certainteed or Armstrong.

PART 2 - PRODUCTS

2.01 PRE-MOLDED FIBERGLASS PIPE INSULATION:

A. Insulation shall be heavy density, one- piece insulation made from inorganic glass fibers bonded with a thermosetting resin and accurately molded to conform to the outside diameter of the pipe. Insulation shall be one piece snap-on or self-sealing type with white all service jacket. Insulation shall be suitable for use on either hot or cold water pipes with temperature range of +20 degrees to 400 degrees F. Thermal conductivity shall not exceed 0.23 at 75 degrees F. mean temperature.

B. Safe burning characteristics are UL Classified and does not exceed 25 flame spread, 50 smoke developed when tested in accordance with ASTM E84, NFPA 255 and UL723.

C. Insulation jacket shall have a water vapor transmission of 0.02 perms or less as tested by ASTM E96, Procedure A.

D. All pipe fittings and accessories insulated with fiberglass shall be fitted with heavy gauge PVC covers and jackets as manufactured by Johns Manville Zeston 300 Series. Fitting covers shall be two-piece PVC made for short and long radius elbows in shapes for 45° and 90° bends. Covers and jackets to have a white glossy finish and UV resistant. Material thickness to be minimum 30 mil and carry a flame spread of 25 or less with a smoke development of 50 or less.

E. Pre-molded fiberglass insulation shall be used on the following pipe systems. Pipe insulation shall be equal to Manville Fiberglass Micro-Lok AP-T Plus.

INSULATION THICKNESS IN INCHES FOR PIPE SIZES

	Temperature Up to	Up to 1"	1 ¼" to 2"	2 ½" to 3 ½ "	4" & Over
Cold Water	50º-65ºF	1/2"	1"	1"	1"
Drains Connecting A/C Equipment	40º-55ºF	1/2"	1"	1"	1- 1/2"

2.02 FOAMED PLASTIC SHEET AND TUBING:

A. Sheet Insulation shall be equal to Armstrong Armaflex. Minimum of 4.5 lbs. per cu. ft. Thermal conductivity shall not exceed 0.28 at 75° F mean temperature.

B. Piping outside the building shall be insulated with 1" thick flexible foamed plastic insulation with weatherproof aluminum as hereinafter specified.

2.03 ADHESIVES, MASTIC, COATINGS:

A. Benjamin Foster, Childers, Insul-Coustic, EPOLUX, Minnesota Mining and Manufacturing Co.

B. Treatment of pipe jackets to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Vapor barriers shall have a perm rating of not more than .05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than .25 perms.

2.04 TAPE: Wherever tape is used for sealing purposes, it shall be of the type and shall be applied as recommended by the non-conductive covering manufacturer. Where recommendation is lacking, the tape used shall be sealed with Minnesota Mining Adhesive EC-1329.

2.05 WEATHERPROOFING:

A. Protect exposed water piping from freezing down to 0°F in unheated areas with self-regulating heater cable with built-in thermostat. Cable shall be installed in contact with pipe and beneath pipe insulation. Protect piping insulation with Pabco insulating division aluminum sheets of .016 thickness and aluminum formed elbows with leak-proof beads and epoxy coated interior.

B. Heater cable shall be in accordance with specification section 22 05 33 “Heat Tracing for Plumbing Piping”.

PART 3 - EXECUTION

3.01 GENERAL:

A. Surfaces to be insulated shall be clean, dry, and free of foreign material, such as rust, scale and dirt when insulation is applied. Perform pressure tests required by other Sections before applying insulation.

B. Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.

3.02 INSULATION FOR ALL PIPING SYSTEMS:

A. Insulate pipe, fittings, flanges, unions and valves.

B. Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal seams and end laps. Do not use scrap pieces of insulation where a full length section will fit.

C. Install insulation, jackets and coatings continuous through wall and floor openings and sleeves.

D. Fittings, valves and flanges shall be insulated with field fabricated multiple mitered segments of molded fiberglass insulation of the same thickness as adjoining pipe insulation. Secure fitting insulation segments with 20 gauge galvanized steel wire and apply a smoothing coat of insulating cement. White fabric and mastic shall be used on exposed fittings.

E. Application of all materials shall be in accordance with the manufacturer's instructions.

F. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint straps furnished with insulation.

G. Care shall be taken so as not to place insulation over vent and drain inlets and outlets.

H. Staples are not permitted on pipe insulation.

END OF SECTION

SECTION 22 10 00 PLUMBING PIPING AND PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section of the Specifications and related drawings describe requirements pertaining to the plumbing piping and equipment.

B. Refer to the following sections for related work:

1.	22 05 11	Plumbing Submittals Data
2.	22 05 29	Hangers and Supports for Plumbing Piping and Equipment
3.	22 05 33	Heat Tracing for Plumbing Piping
4.	22 05 53	Identification for Plumbing Piping and Equipment
5.	23 11 23	Facility Natural Gas Piping

1.02 RECORD DOCUMENTS

A. Provide corrected Record Documents in accordance with the Project Record Documents Sections and the Mechanical General Section.

1.03 GENERAL PROVISIONS AND BASIC MATERIALS

A. The requirements of Plumbing General Requirements Section 22 05 10 apply to this work.

1.04 CODE

A. The work shall comply with the International Plumbing Code, International Fuel Gas Code, and NFPA 54; acceptability under the codes shall not authorize any substitution, smaller size, lighter weight or less durable materials for the items specified.

B. The Contractor shall obtain and pay for all required permits and inspections and shall deliver one copy of each inspection certificate to the Architect before the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 WATER PIPING:

A. Aboveground piping 3" and smaller: Type "L" copper tubing with tin-antimony soldered joints and wrought copper socket fittings.

B. Underground piping 3" and smaller: Type "K" hard drawn copper tubing, with 95-5 silver soldered joints and wrought copper socket fittings.

C. Underground piping outside building all sizes: Polyvinyl chloride (PVC) plastic piping Schedule 40, ASTM D-1785 with 150 PSI minimum pressure rating. Fittings shall conform to ASTM D-2466 with solvent weld joints conforming to ASTM D-2564.

D. Underground piping 1" and smaller below building slab: Below slab Type "L" soft drawn copper tubing, with no joints.

2.02 GAS PIPING:

A. Aboveground Piping, Pipe Sizes Up To and Including 2": Black steel pipe, Schedule 40, ASTM-A53 with threaded joints and Class 150 malleable iron threaded fittings, except piping located within return air plenums or above non-accessible ceilings which shall be all welded same as for pipe sizes 2-1/2 inches and larger.

B. Aboveground Piping, Pipe Sizes 2-1/2 inches and Larger: Black steel pipe Schedule 40, ASTM-A53 with buttwelded joints and standard weight wrought steel buttwelded fittings.

C. Exposed Exterior Piping, All Pipe Sizes: Black steel pipe, Schedule 40, ASTM-A120 with buttwelded joints and standard weight wrought steel buttwelded fitting. Pipe shall have a factory applied extruded high density polyethylene coating of a minimum thickness of 24 mils with a hot applied adhesive undercoating. Coating shall be equal to Republic X-Tru-Coat. All joints, fittings and mars in pipe coating shall be wrapped with a cold applied coal tar tape of 35 mil thickness minimum. Tape coating shall be equal to X-Tru-Tape Tapecoat CT or Scotchwrap No. 51.

D. All gas piping located above non-accessible ceilings shall be installed within a black steel, Schedule 10 pipe casing with welded joints and standard weight wrought steel buttwelded fittings.

2.03 BASIC PIPING SPECIALTIES:

A. Unions:

1. Unions shall be the same material and working pressure as the fittings specified for the piping system. Unions on piping 2-1/2 inches in size and larger shall be bolted flanged joint and on smaller than 2-1/2 inches shall be screwed connection.
2. Unions and flanges provided between copper and ferrous pipe connections shall be insulating (dielectric) type to electrically separate dissimilar metal connections in piping system.

B. Dielectric Adapters:

1. Dielectric adapters shall be the union type for pipes 2 inches in size and larger. Adapters shall have working pressure of 250 psi for union type and 165 psi for flanged type. The insulating gaskets shall have an operating range of 40 degrees F to 240 degrees F and shall limit the galvanic corrosion to a maximum of one percent of the short circuit current. Dielectric adapters shall be Ebco, Crane or Capitol.
2. Provide a dielectric adapter between any ferrous and copper connection including piping and equipment.

C. Thermometers:

1. Thermometers shall be the red-reading mercury filled adjustable angle type. Thermometers shall be adjustable to any angle through a 180 degree arc and shall be provided with a locking device. Thermometers shall have V-cast aluminum case with baked enamel finish and 9 inch scale. Thermometers shall be provided with separable sockets and, where installed on insulated pipes, sockets shall be extended neck type. Thermometer scale range shall be 0 to 160 degrees F. Thermometers shall be Weksler Adjust-Angle Series Type AA-5, Trerice Adjustable Angle Series Type BX, or Weiss Vari-Angle Series Type VS.

D. Pipe Sleeves:

1. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, equipment and devices furnished under each section of the Specification.
2. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
3. Where pipes pass through floor slabs, sleeve shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
4. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.
5. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
6. All penetrations through rated floors shall be sealed with a fire rated sealant as manufactured by 3M or Hilti in accordance with manufacturer's recommendations.
7. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
8. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to ¾ inch diameter, and permitting lateral adjustment.

E. Floor, Wall and Ceiling Plates:

1. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
2. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
3. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

2.04 BACKFLOW PREVENTERS:

A. Reduced Pressure Principle - Provide reduced pressure principle backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks, air-gap drain funnel, and pressure-differential relief valve located between two (2) positive seating check valves. Assembly shall be constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research. Pipe drain to nearest floor drain.

B. Double Check Valve - Provide double check valve backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks, and shall be suitable for supply pressures up to 175 psi. Assembly shall be constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research.

C. Provide backflow preventers as indicated on drawings. Backflow preventers shall be Watts or approved equal as follows:

Size	Double Check	Reduced Pressure Zone
½" to 3"	007QT-S	009QT-S
4" to 10"	709NRS-S	909NRS-S

2.05 VALVES

A. All shutoff valves shall be gate or ball valves unless otherwise noted. All drain valves shall be globe or angle valves unless otherwise noted.

B. Gate valves 2 inches and smaller shall be of Class 125, body and bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper-silicon alloy stem, brass packing gland, solder ends, Teflon-impregnated packaging, and malleable handwheel; NIBCO S-11 or approved equal.

C. Class 150 valves meeting the above specifications shall be used where pressure requires; NIBCO S-134 or approved equal.

D. Ball valves 2 inches and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome-plated brass ball, solder ends with extended solder cups; NIBCO S-580-BR-R-70 or approved equal.

E. Gate valves 2-1/2 inches and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-617-0 or approved equal.

F. Globe valves 2 inches and smaller shall be of Class 125, body and bonnet of ASTM B-62 cast bronze composition, solder ends, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwheel; NIBCO S-235-Y or approved equal.

G. Globe valves 2-1/2 inches and larger shall be of Class 125 iron body, bronze mounted with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged end, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-178-B or approved equal.

H. Check valves 2 inches and smaller shall be of Class 125, solder ends, with bodies and caps conforming to ASTM B-62 cast bronze composition, swing type disc; NIBCO S-413-BYW or approved equal.

I. Check valves 2-1/2 inches and larger shall be iron body, bronze mounted, with body and cap conforming to ASTM A-126 Class B cast iron, flanged ends, swing type disc; NIBCO F-918-B or approved equal.

J. Gas valves and cocks shall be Class 200 plug cocks, conforming to ASTM A-126 Class B, with semi-steel body Teflon coated tapered plug, threaded of flanged ends, wrench operated; Walworth 1559 or approved equal.

2.06 PLUMBING SYSTEM INSULATIONS: All water piping shall be insulated in accordance with specification section 22 07 00 "Plumbing Insulation".

2.07 WEATHERPROOFING:

A. Protect exposed water piping from freezing down to 0 degrees F in unheated areas with self-regulating heater cable with built-in thermostat. Cable shall be installed in contact with pipe and beneath pipe insulation. Protect piping insulation with Pabco insulating division aluminum sheets of 0.016 thickness and aluminum formed elbows with leak-proof beads and epoxy coated interior.

B. Heater cable shall be in accordance with specification section 22 05 33 “Heat Tracing for Plumbing Piping”.

2.08 PIPE HANGERS AND SUPPORTS: Provide pipe hangers and supports in accordance with Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment”.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Install piping and make all joints in accordance with the pipe manufacturer's recommendations. Make provisions for thermal expansion and contraction.

B. Rough-in for fixtures in accordance with the fixture manufacturer's roughing-in drawings to provide the heights and locations indicated on the Architectural drawings or as specified.

C. Install piping and pipe supports as specified. Keep pipe ends closed except for vent and drain openings; protect vent and drains from the entrance of materials that could cause stoppage.

D. Install shut-off valves where indicated on the drawings and required by the code including valves at all fixture groups, and equipment.

E. Install drain valves at low points of all new water piping except buried piping.

3.02 EXCAVATION, TRENCHING AND BACKFILLING:

A. Perform all excavation, trenching and backfilling for work under Division 22. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be re moved and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done.

B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface for pipe.

C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.

D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of 12 inches above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the modified Proctor test method of compaction.

3.03 TESTS OF PIPING

A. Install temporary connections and plugs or valves at all points necessary for venting air from the piping, filling, holding test pressure, draining and flushing the piping.

B. Test all new pressure piping roughing hydrostatically to show zero leakage in eight (8) hours at the following pressures measured at the low points: Domestic water (C.W.), 125 psi.

C. All gas piping shall be tested with air at a minimum of 50 psi for two (2) hours with no drop in pressure.

3.04 FLUSHING AND STERILIZING:

A. Flush all new water piping after pressure tests and repairs are completed by draining from the low points; refill with clean water.

B. Sterilize the new above ground water piping with 50 ppm chlorine solution distributed throughout all new C.W. piping; let stand for 24 hours, then flush enough water to reduce the residual chlorine content to less than one (1) ppm.

C. Furnish three copies of a Certificate of Performance of Complete Sterilization to the Architect before final inspection of the work, all certified by a registered chemical engineer.

3.05 START-UP, ADJUSTMENT, INSTRUCTIONS: Start-up, lubricate, adjust and test equipment installed under this Section and furnish instructions to the Owner as specified in the Plumbing General Requirements Section.

3.06 OPERATIONAL TESTS:

A. When installation and adjustment of all equipment is complete, perform operational tests of all plumbing system components at normal operating pressures as specified under the Plumbing General Requirements Section and include the following tests:

1. Operate all manual and automatic valves at least one full open-closed cycle; examine for stem leakage, failure to close or other malfunction.

END OF SECTION

SECTION 22 13 00 FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section of the Specifications and related drawings describe requirements pertaining to the sanitary sewerage piping and drainage accessories.

B. Refer to the following sections for related work:

1. 22 05 29 Hangers and Supports for Plumbing Piping and Equipment
2. 22 05 53 Identification for Plumbing Piping and Equipment

1.02 RECORD DOCUMENTS

A. Provide corrected Record Documents in accordance with the Project Record Documents Sections and the Mechanical General Section.

1.03 GENERAL PROVISIONS AND BASIC MATERIALS

A. The requirements of the General Requirements Division 01 apply to this work.

1.04 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of plumbing products of type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Subject to compliance with requirements, provide drains, cleanouts & drainage accessories of one of the following manufacturers:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Wade Div., Tyler Pipe
4. Zurn Industries, Hydromechanics Div.

1.05 CODE:

A. The work shall comply with the International Plumbing Code; acceptability under the codes shall not authorize any substitution, smaller size, lighter weight or less durable materials for the items specified.

B. The Contractor shall obtain and pay for all required permits and inspections and shall deliver one copy of each inspection certificate to the Architect before the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS FOR DRAINAGE SYSTEMS:

A. Aboveground piping all within building: Service weight (SV) No-hub cast iron soil pipe and fittings CISPI301 with "husky" heavy duty stainless steel clamps, CISPI301 and neoprene gaskets, ASTM C-564.

B. Underground building drain piping: Service weight (SV) cast iron hub and spigot soil pipe and fittings, ASTM A-74 with neoprene compression gasket, joints, ASTM C-564.

C. Condensate Drain Piping: Type DWV copper pipe with tin-antimony soldered joints and drainage fittings.

D. All traps shall have brass cleanout plug except where buried.

2.02 ROOF FLASHING:

A. Vent pipes passing through roof shall be flashed with a one piece pipe flashing unit constructed of E.P.D.M. rubber with an aluminum reinforcing ring suitable for a temperature range of -25 degrees F to 250 degrees F as manufactured by Butler Manufacturing Company or approved equal. Flashing to be installed in accordance with metal building manufacturer recommendations. Vents shall offset in roof joist area or ceiling cavity if necessary so that no vent shall be closer than 4'-0" from outside wall line.

2.03 DRAINAGE ACCESSORIES:

A. Provide factory fabricated drainage piping products of the size and type as indicated on drawings, including features as specified herein. Where not indicated, provide proper selection as determined by installer to comply with installation requirements and governing regulations.

B. Floor drains shall be provided with trap primer connections where indicated on drawings.

C. All floor drains without trap primers shall be provided with deep seal "P" traps.

D. All floor drains and floor sinks located on elevated floors shall be provided with seepage holes and flashing collar or clamping rings to provide for leak proof installation.

2.04 CLEANOUTS

A. Vertical and horizontal lines exposed - Test Tee – Smith 4510.

B. Vertical lines concealed – Smith 4472 with stainless steel access cover.

C. Horizontal lines under unfinished floors – Smith 4405.

D. Finished floors – Smith 4023 cast iron adjustable floor level cleanout assembly with round polished bronze top.

E. Finished Floors - Linoleum, Terrazzo or Tile – Smith 4143 cast iron adjustable floor level cleanout assembly with round polished bronze top. Top depression to be covered with surrounding floor pattern bonded with waterproof adhesive.

F. All lines outside of building - Smith 4400.

G. Finished floors - Carpet Smith 4023-Y cast iron adjustable floor level cleanout assembly with nickel bronze top and 1-1/2 inch diameter stainless steel carpet marker. Carpet shall cover top of cleanout with carpet marker exposed above carpet to serve as cleanout locator.

2.05 BASIC PIPING SPECIALTIES:

A. Pipe Sleeves:

1. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, equipment and devices furnished under each section of the Specification.
2. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
3. Where pipes pass through floor slabs, sleeve shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
4. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.
5. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
6. All penetrations through rated floors shall be packed with mineral wool and capped off with a silicon caulk. As an alternate, an approved, fire rated sealant as manufactured by 3M or Hilti may be used.
7. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
8. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4 inch diameter, and permitting lateral adjustment.

B. Floor, Wall and Ceiling Plates:

1. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
2. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
3. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide pipe hangers and supports in accordance with Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment".

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install soil and vent piping pitched to drain at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inches and smaller, and 1/8 inch per foot (1 percent) for piping 4 inches and larger.

B. Install piping and make all joints in accordance with the pipe manufacturer's recommendations. Make provisions for thermal expansion and contraction.

C. Install cleanouts on drainage piping where indicated on the drawings and as required by the code, and at every change in direction of more than 45 degrees in horizontal piping. Locate wall cleanouts as low as possible but high enough for the cover plate to clear the base. Locate test tees where necessary to separate sections of piping for testing.

D. Rough-in for fixtures in accordance with the fixture manufacturer's roughing-in drawings to provide the heights and locations indicated on the Architectural drawings or as specified.

E. Set floor cleanouts so that the top rims are level and flush with the finished floor surface and so that square and rectangular tops are parallel to the walls, unless otherwise noted.

F. Install piping and pipe supports as specified. Keep pipe ends closed except for vent and drain openings; protect vent and drains from the entrance of materials that could cause stoppage.

G. Vents shall terminate at 1'-0" above roof.

3.02 EXCAVATION, TRENCHING AND BACKFILLING:

A. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be re moved and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done.

B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface for pipe.

C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.

D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of 12" above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the modified Proctor test method of compaction.

3.03 TESTS OF PIPING:

A. Install temporary connections and plugs or valves at all points necessary for venting air from the piping, filling, holding test pressure, draining and flushing the piping.

B. Test all new soil, waste and vent piping under 10 feet head of water (except for the uppermost 10 feet) as required by the Plumbing Code, with zero leakage allowed. The test pressure shall be maintained for at least 30 minutes before inspection starts and maintained for the time necessary to inspect all joints but not less than 15 minutes.

3.04 OPERATIONAL TESTS:

A. When installation and adjustment of all fixtures and equipment is complete, perform operational tests of all plumbing system components at normal operating pressures include the following tests:

1. Pour at least five (5) gallons of water into every new floor drain to test for pipe stoppage.

B. All floor drain strainers shall be securely fastened to drain body.

C. During construction drains shall be kept covered so that traps, sediment buckets and dome type strainers are kept free from debris and trash.

END OF SECTION

SECTION 23 05 09 HVAC DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY OF WORK SECTION INCLUDES:

A. General Scope of Work
B. Sub-Contractor Use of Site and Premises
C. Work Sequence
D. Scheduling of Work
E. Damage to Others Work
F. Safety and Health Requirements
G. Publicity
H. Clean Up
I. Insurance
J. Codes and Regulations
K. Site Visit
L. Drawings and Specifications

1.02 GENERAL SCOPE OF WORK:

A. The intent and meaning of the Contract Documents is that this Contractor shall provide labor, materials, supplies, equipment, transportation facilities and appurtenances thereto which are indicated or reasonably implied by the Demolitions Drawings and Specifications to provide demolition for an HVAC Upgrade project for the MDOT Administration Building - Project #BWO-9021-25(006) and Main Shop Complex - Project #BWO-9018-25(005). This Contractor shall visit the sites to become aware of all existing conditions. He shall carefully read all specifications for additional information on the project. He shall be aware of the responsibilities of these interfaces. These plans and specifications are considered cooperative and complimentary. Where one contradicts the other, notify the Architect/Engineer for clarifications. Even though one phase of this project is considered demolition, there are some phases of the project that will require the contractor to leave condenser water systems in place and operable. These items will be shown on the demolition drawings along with notations explaining how these systems are to be handled.

B. Work to be done:

1. This work will include the demolition and removal of all gas furnaces, flues, gas piping at units, refrigerant lines, cooling cools, condensing units, air cooled chiller, chilled water pumps, chilled water piping where directed on plans for Buildings “A”, “C”, “D”, & “F” of the Main Shop Complex, and shall include the removal of two way control valves and thermostats within Building “A”. Demolition also includes removal of insulation, jacketing and heat cable on the condenser and makeup water piping, turbine condenser water pumps, and insulated pump enclosures located within the cooling tower enclosure, at the Administration Building as shown on drawings. Other work associated with this demolition also includes the removal from the site and the disposal of said mechanical materials that may remain as a result of the demolition. This work will include the haul-off of the demolition materials including all disposal fees and permits as may be required for the proper disposal.

2. Mechanical work to remain in place shall include the existing condenser and makeup water piping, valves, and cooling tower.

3. HVAC: Perform all HVAC and electrical work as outlined hereinafter to include all demolition of existing furnaces, flues, gas piping, condensing units, refrigerant lines, air cooled chiller, pumps, chilled water piping and insulation, condenser/makeup water piping insulation, devices, controls and all patching and repair of any existing materials, finishes and other components damaged during the process of the work. Work shall include demolition of the existing insulation, jacketing and heat cable on the condenser and makeup water piping to cooling tower, etc. This work shall include the removal of all insulation from the piping and the proper disposal thereof.

4. Electrical demolition work for this project shall be as described on the drawings. All HVAC demolition work shall include the work as described in these specifications and as shown on the Demolition Contract Drawings.

1.03 SUB-CONTRACTOR USE OF SITE AND PREMISES: This Contractor may work, with the permission of the Owner, on the immediate site as necessary to complete the work per the milestone dates established at the Preconstruction Conference.

1.04 WORK SEQUENCE: All work shall be performed within the allocated time frame as set forth by the Architect. This work shall be in accordance with the milestone dates for this project as established at the Preconstruction Conference.

1.05 SCHEDULING OF WORK:

A. Before any work within the scope of the contract has begun, this Contractor shall confer with the Architect and Owner and agree on the following:

1 Means of access and egress to the site.

2. Space for temporary storage of demolition materials and equipment.

3. Work hours that Sub-Contractor has access to job site.

B. As provided in the documents and in no case later than the preconstruction meeting, this Contractor shall provide sufficient information to the owner for the scheduling of his work and for the planning of the overall “work schedule”. At a minimum, this schedule shall illustrate the following:

1 Each task should be indicated in bar format with timeline in weekly periods, Indicate total man-hours to accomplish each task.

2. Each task should be shown indicating the starting period and ending period of that operation. Non-continuous operations shall be so indicated.

3. Completion of each task should conform to the milestone dates as set forth in the preconstruction meeting. The schedule shall be updated on a bi-weekly basis to the Architect.

1.06 DAMAGE TO OTHER WORK:

A. This Contractor shall be responsible for damage caused by his work or employees to adjoining property, the existing facilities, and any on-going work effort.

B. It is the responsibility of this Contractor to make a report immediately to the Owner if a utility line or service source of any kind is encountered or interrupted unexpectedly. He shall protect and maintain it until instructions for its repair or disposal can be issued.

1.07 SAFETY AND HEALTH REQUIREMENTS: This Contractor shall acknowledge his obligation to comply with any applicable federal, state and local acts and regulations. In addition to any other indemnities, he shall provide for, in his contract, and agree to comply with the Occupational Health and Safety Act of 1970 (OSHA).

1.08 PUBLICITY: Any publicity giving reference to this project, whether in the form of press releases, brochures, photography coverage, or verbal announcement shall be permitted only with the general or specific approval of the Architect and the Owner. In all instances, he shall give due mention of the Architect, the Architect's consultants and the Owner.

1.09 CLEANUP: This Contractor shall keep the work area reasonably clean and free of debris. He shall clean up debris on a daily basis and place it in his designated dumpster.

1.10 INSURANCE: This Contractor shall carry adequate insurance coverage, documented with a Certificate of Liability Insurance, stating that he has in force sufficient coverage of liability for the work in this contract. This liability coverage shall include General Liability, Automobile Liability, Excess/Umbrella Liability and Workers Compensation and Employers' Liability. The coverage amount/values shall be determined by the Architect and attached thereto the General Contractor's insurance coverage.

1.11 CODES AND REGULATIONS:

A. All work shall comply with all local laws, ordinances and regulations applicable to the mechanical, electrical and fire alarm/life safety code for the demolition of the systems as mentioned herein, or the regulations of NFPA, OSHA, ANSI, municipal ordinances governing electrical work, and with the requirements of the 2005 National Electrical Code or latest edition approved by the local authority having jurisdiction (LAHJ).

B. Where different sections of any of the aforementioned codes and regulations may dictate, the specifications or the plans require different materials, methods of demolition or construction, or other requirements, the most restrictive or stringent of these regulations and/or codes shall govern. In any conflict between a general provision and any special provisions, the special provisions shall govern.

C. Obtain all permits and licenses, and pay all fees as required for execution of the Contract. Arrange for necessary inspections required by the Architect, city, county, state and other local authorities having jurisdiction (LAHJ) and present certificates of approval to the Owner or his designated representative.

D. All work with reference to asbestos or asbestos related materials, to be by others.

E. Communicate with all required utility offices to meet utility schedules and regulations. Coordinate the local utility requirements with the requirements of these contract documents. Should conflicts arise, notify the Architect/Engineer immediately. Acquire services to avoid project delays. Conform to regulations of the local utility companies with respect to removal of metering, service entrances and service accesses.

1.12 SITE VISIT: In advance of any project activity or submission of bids, all interested parties shall visit the site and thoroughly familiarize themselves with the local and existing conditions which may affect the cost of the Work. No extras will be allowed for failure to comprehend, or lack or knowledge of, any existing conditions which may affect the completion of the project in the intended manner. Any such items discovered will be presented to the Architect/Engineer for solution prior to Bidding.

1.13 DRAWINGS AND SPECIFICATIONS:

A. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.

B. Should conflicts exist between the Drawings and Specifications, notify the Architect/Engineer.

C. No deviations from the drawings and specifications shall be made without the full authorization and consent of the Architect/Engineer.

D. If it is found that existing conditions or demolition methods make desirable a modification to the project scope, or to methods of completing the work, the Contractor shall report such item(s) to the Architect/Engineer for their decision and instructions. Obtain written approval prior to any work required by those revisions.

END OF SECTION

SECTION 23 05 10 HVAC GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete HVAC systems as specified herein and as shown on the drawings.

B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary and other conditions) and other divisions as appropriately apply to work specified in this division.

1.02 CODES, ORDINANCES, AND PERMITS:

A. All HVAC materials and workmanship shall comply with the following codes and standards as applicable:

1. The National Electric Code (2005 Edition)

2. The International Plumbing Code (2006 Edition)

3. The International Building Code (2006 Edition)

4. The International Mechanical Code (2006 Edition)

5. City of Jackson Heating, Ventilation and Air Conditioning Code.

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

1. Air Conditioning and Refrigeration Institute Standards (ARI)

2. American National Standards Institute, Inc. Standards (ANSI)

3. American Society for Testing and Materials Publications (ASTM)

4. American Gas Association Inc. Laboratories (AGA)

5. American Society of Mechanical Engineers Code (ASME)

6. Factory Mutual Underwriters (FM)

7. National Fire Protection Association Standard (2006)

8. Sheet Metal and Air Conditioning Contractor's National Association Inc. (SMACNA)

9. Underwriters Laboratories Inc. (UL)

C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.

B. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.

C. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

1.03 APPLICABILITY: The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the mechanical systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

1.04 COORDINATION OF MECHANICAL DOCUMENTS: The mechanical work listed in these documents shall be coordinated with the work indicated on all other mechanical drawings, schedules, schematics, and specifications. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

1.05 WELDERS QUALITY ASSURANCE: All welders shall be certified by ANSI B31.1.0-1967 “Standard Qualification Welding Procedures, Welders and Welding Operators” or “Qualification Tests” in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder’s qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder’s identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

PART 2 - PRODUCTS

2.01 COORDINATION OF PRODUCTS: The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

2.02 DESCRIPTION: All components of the mechanical systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter’s Laboratories, Inc. (UL) label.

PART 3 - EXECUTION

3.01 GENERAL:

C. The Contractor shall provide and prepare all openings for piping and other mechanical work as required in walls and supports etc.; he shall also do all painting as may be required. He shall coordinate the installation of all mechanical equipment, ductwork and piping with existing conditions.

B. The mechanical plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.

C. If the Contractor proposes to install equipment and piping, requiring space conditions other than those shown, he shall assume full responsibility for the rearrangement of the equipment and piping and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the piping in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.

D. The Contractor is responsible for the proper location and size of all openings, in the building structure pertaining to his work.

E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades.

F. Except where otherwise noted, all piping and ductwork in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases pipes, and ducts shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

G. The Electrical Contractor shall bring adequate power to and make final connections to all heat trace furnished under this contract. All control wiring shall be by the Controls Contractor.

H. Piping shall be installed as follows:

1. Within 42" in front (and rear if free standing) of equipment; or

2. Within 36" of sides of equipment,

3. Clearances apply vertically from floor to structure.

4. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors, valves, pumps, etc

3.02 ELECTRICAL WORK: All electrical equipment provided under this Division shall comply with the existing electrical system characteristics of the building.

3.03 PROTECTION OF EQUIPMENT:

A. Store equipment, including pipe, valves, insulation covering and heat trace, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation and wind.

B. Protect cooling coils by use of protective metal panels or plywood.

C. Plug ends of pipe when work is stopped and close ends of ducts with plastic taped in place until work resumes.

D. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

3.04 PAINTING:

A. Factory painted all pumps, piping hangers and supports that has been scratched or marred shall be repainted to match original color.

B. All new un-insulated black ferrous metal items exposed outside the building, such as equipment support beams, un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

C. In lieu of painting hanger rods, cadmium plated or galvanized rods may be furnished.

D. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.

E. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.

3.05 PROTECTION OF EXISTING UTILITIES:

A. The Contractor shall use extreme caution during removal operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.

B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

3.06 CUTTING AND PATCHING:

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. All surfaces shall be patched to the condition of the adjacent surfaces.

B. The Contractor shall make suitable provisions for adequately water-proofing at his floor penetrations of water proof membrane floors. This shall include but not be limited to drains, and sleeves for the various piping. This also applies to membrane roofing systems.

3.07 SLEEVES, FLOOR AND CEILING PLATES:

A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under each section of the Specification.

B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.

C. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.

D. Each pipe passing through existing walls shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.

E. All penetrations through rated walls shall be packed, sealed and encapsulated per the applicable U.L. detail(s).

F. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.

E. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to ¾" diameter, and permitting lateral adjustment.

3.08 ESCUTCHEONS:

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.09 CLEANING:

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.

B. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

C. The exterior surfaces of all mechanical equipment, piping, ducts, etc., shall be cleaned of all grease, oil, paint, dust, rust and other construction debris.

D. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

E. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

F. Equipment rooms shall be left broom clean.

G. Any fans operated during construction shall have temporary filters. Temporary filters shall be changed regularly to prevent contamination of the equipment and duct systems. Permanent filter shall be installed prior to final inspection.

H. End of open ducts and pipes shall be covered during construction except when working directly on such one prohibits covering. Cover with minimum four (4) mil thick polyethylene taped, tied or wired in place.

I. Clean and polish identification plates.

3.10 EQUIPMENT, MATERIALS AND BID BASIS:

A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products will be considered and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect for review prior to bid, he shall furnish descriptive catalog material, text data, samples, etc., as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect.

B. The use of one named manufacturer in the schedules on the Drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

3.11 GUARANTEE:

A. All systems and components shall be provided with a one year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.

B. All air conditioning compressors shall be guaranteed for an additional four years. This additional guarantee shall be non-prorated on all parts, refrigerant, and labor.

3.12 FOUNDATIONS:

A. All concrete foundations required by equipment furnished under the Mechanical Division shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed. Unless otherwise noted, foundations shall be four inches 4" - 6" high. All concrete work performed shall conform entirely to the requirements of the General Specifications that describe this class of work.

3.13 RECORDS AND INSTRUCTIONS FOR OWNER:

A. The Contractor shall accumulate during the job's progress the following data in triplicate prepared in neat brochures or packet folders and turned over to the Architect/Engineer for check and subsequent delivery to the Owner:

1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.

2. Provide approved fixture brochures, wiring diagrams, and control diagrams.

3. Provide copies of approved shop drawings.

4. Three sets of operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended periodic maintenance and seasonal changeover procedures, and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

5. Any and all other data and/or drawings required during construction.

6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

B. All of the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor asks for his last estimate prior to his final estimate, but in no case, less than two weeks before final inspection.

C. The Contractor shall also give not less than (2 days) of operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in paragraph above shall be used as a basis for this on-the-job instruction.

D. A competent technician employed by the Temperature Control Subcontractor shall be required to instruct the Owner in proper operating procedures and shall explain the significance of the temperature control literature filed in the maintenance manual over a period of (2 days) while the system is in continuous operation as specified above.

3.14 RECORD DRAWINGS:

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work the Contractor shall purchase from the Architect a set of mylar sepia prints to be used for the "Record Drawings".

B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS – “3/8" high letters to be used for recording field deviations,
and "5/16" high letters to be used for dimensional data only.

3.15 INSTALLATION: All INSULATION shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

3.16 ACCESS DOORS:

A. Furnish and install access doors at each point required to provide access to concealed valves, clean-outs, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.

C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor to be installed.

D. Access doors shall be MILCOR or approved equal in accordance with the following:

Style AT Door for Acoustical Tile Ceilings
Style AP Door for Acoustical Plaster Ceilings
Style K Door for Plastered Wall and Ceiling Surfaces
Style DW Door for Drywall
Style ATR for Suspended Drywall Ceilings
Style M Door for Masonry, Ceramic Tile, Etc.
Fire-Rated 1-1/2 hr. (B-label) Door where required.

E. Size and type shall be as required for proper service and/or as may be directed by the Architect.

F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

3.17 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS:

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

3.18 HAZARDOUS MATERIALS:

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

C. Handling of any hazardous material is not covered in specification Division 23. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

3.19 PROTECTION OF EXPOSED PIPING: All piping exposed to freezing shall be heat traced as per manufacturer’s recommendations per Section 23 05 33, “Heat Tracing for HVAC Piping” and insulated per Section 23 07 00, “HVAC Insulation”.

END OF SECTION

SECTION 23 05 11 HVAC SUBMITTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10 HVAC General Requirements, apply to all work herein.

1.02 QUALITY ASSURANCE:

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit to the Architect a sufficient number of copies of all such Shop Drawings or catalog data to provide him with as many reviewed copies as he may need, plus two (2) copies for retention; one by the Architect and one by the Engineer.

B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

B. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

C. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.

D. Reproduction of design documents in any portion for use in a submittal is not acceptable.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

PART 3 - EXECUTION

3.01 SUBMITTAL DATA

D. General:

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.
2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 23, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.
3. HVAC submittal data shall be bound into separate 3-ring binders, Each HVAC volume shall contain one copy of all specified equipment/shop drawing submittals. Each binder shall be provided with an index of materials and an identification tab for each Specification Section that requires submittals. Each item in each tabbed section shall be identified with the paragraph number relating to the item submitted. FAILURE to provide **BOUND AND IDENTIFIED SUBMITTALS** will result in the **AUTOMATIC REJECTION** of the submittal data with **NO EXCEPTION.**

E. The bound submittals are to be submitted for review within 30 days after the Contract is awarded. No submittal will be checked until ALL required submittals have been received by the Engineer. Only Automatic Temperature Controls, ductwork and piping fabrication drawings may be submitted after the completed bound submittal is reviewed and accepted by the Engineer.

F. The Contractor shall submit with the bound and identified submittal data a letter signed by the Contractor's Project Manager (or higher level officer of the firm) stating that all electrical characteristics of the mechanical equipment to be supplied has been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

1. Air Conditioning Units with fan, filter and coil data
2. Air Separators
3. Boilers/Boiler Trimming and Controls
4. Chillers/ Chiller Test Report
5. Coils
6. Disconnect Switches

7. Dampers
8. Drain Piping
9. Ductwork Accessories and Details
10. Energy Management System
11. Expansion Tanks
12. Fans
13. Fan coil Units (FCU)
14. Heat Cable
15. Insulation
16. Pumps
17. Piping
18. Piping Specialties (Chilled, Condenser and Hot Water)
19. Starters
20. Flexible Duct
21 Flexible Connectors
22. Ductwork Access Doors and Panels
23. Strainers
24. Test Wells
25. Combination Test Plugs
26. Flexible Pipe Connectors
27. Thermometers
28. Flow Switches
29. Gauges Gauge Cocks and Snubbers
30. Automatic Air Vents
31. Manual Air Vents
32. Heat Cable
33. Filters
34. Pipe Guides
35. Flow Measuring Devices
36. Variable Frequency Drives (VFD)
37. Water Treatment System
38, Prefabricated Stacks
39. Expansion and Compression Tanks and Capacities

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS:

A. Description

1. Complete maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and Maintenance instruction shall be included for insulation and cover. Manufacturers' Standard literature is acceptable for the owner.
2. Prior to final acceptance, provide the services of a competent representative to instruct the Owner in the maintenance of all system insulation. This instruction shall include a complete walk-through of all systems. The Architect reserves the right to attend any such meeting and shall be duly notified.
3. A system wiring and control diagram shall be included in the operating and maintenance instruction.

3.03 OTHER SUBMITTALS – CLOSEOUT DOCUMENTS:

A. Submit two copies of the following prior to occupancy of the project by the Owner. See contract close-out – Section 01 77 00.

1. As built drawings for, HVAC piping, plumbing systems.
2. Request for final payment.
3. Letter or “Release of Liens”
4. Letter of “Guarantee”.
5. Consent of Surety Company to final payment.
6. Manufacturer's representative shall certify that insulation and pipe covering are installed in accordance with the manufacturer's recommendations.
7. Contractor’s Affidavit of Payment of Debts and Claims.
8. Certify that all pumps have been realigned and provide data to show that pumps were realigned after each was grouted.
9. Provide a spare seal and coupling for each pump.
10. Submit three (3) copies of the vibration isolation manufacturer’s certified letter of approval.
11. Submit (6) copies of the water analysis chemical treatment performance tests to the Owner.
12. Provide 12 month supply of chemicals, chemical treatment procedures and schedules of visits to the Owner.

END OF SECTION

SECTION 23 05 12 HVAC **Error! Bookmark not defined.**PIPE, FITTINGS AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section is subject to the provisions of "HVAC General Requirements" Section 23 05 10.

B. The Contractor shall provide all reducers, flanges, unions, etc. of the size and type required to connect the equipment as indicated.

C. Pipes shall have burrs removed by reaming.

D. Changes in pipe sizes in horizontal pipe lines shall be made with eccentric reducing couplings, except reducing tees and reducing elbows will be allowed for connections for pressure gauges and gauge cocks, for thermometers and test wells, and for pipe mounted insertion-type temperature devices. Reducing tees, reducing elbows and concentric reducing couplings will be allowed for changing pipe sizes in vertical risers and for making connections to equipment from vertical risers.

E. For water lines, eccentric reducing couplings shall be installed with flat side on top to maintain top of pipe flush for proper air venting.

F. Aboveground horizontal heating and chilled water supply and return lines shall be installed level (on top of piping).

G. Open ends of pipe lines shall be plugged during installation to keep dirt and foreign material out of the system.

H. All pipe and fittings shall be of domestic manufacture.

I. Welders shall be qualified under the requirements of ANSI Specification B31.1.0, Section 127.5, 1973.

J. Evidence of welder's qualifications shall be submitted to the Architect before any welds are made.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS: (SEE SCHEDULE FOLLOWING LISTING)

Service Pipe Material	**Type**
Coil Condensate Drains	6
Heating and Chilled Water Supply and Return (2" and Smaller)	1
Heating and Chilled Water Supply and Return (2½" and Larger)	3
Cold Water Make-Up	5

Service Pipe Material	Type
Relief Valve Discharge	1
Pump Drains	2
Miscellaneous Drains (Not Listed Above)	2

PIPE AND FITTINGS SCHEDULE

A.Type	Sizes	Material	Standard	Material	Standard
1	2" & Smaller	Schedule 40 Black Steel, Threaded	ASTM A120	150 lb.* Black Malleable Iron, Screwed	ASTM A197
1	2½" & Larger	Schedule 40 Black Steel, Welded, Grooved, or Flanged	ASTM A120	150 lb. Standard Wt. Bevel & Welded; or Grooved	ASTM A234
				Ductile Iron, Forged Steel, or Fab. Steel	ASTM A536 ASTM A234 ASTM A53
2	All	Schedule 40 Galvanized; Grooved	ASTM A120	150lb. Galvanized Threaded Steel, Malleable Iron, Screwed; or Grooved	ASTM A197
				Ductile Iron, Forged Steel, or Fab. Steel	ASTM A536 ASTM A234 ASTM A53
3	All	Schedule 40 Black Steel, Threaded or Grooved	ASTM A120	150 lb. Black Malleable Iron, Screwed; or Grooved	ASTM A197
				Ductile Iron, Forged Steel, or Fab. Steel	ASTM A536 ASTM A234 ASTM A53
4	All	Schedule 80 Black Steel, Threaded or Grooved	ASTM A120	Extra Strong Butt Welding ; or Grooved	ASTM A234
				Ductile Iron, Forged Steel, or Fab. Steel	ASTM A536 ASTM A234 ASTM A53
5	All	Type "L" Copper	ASTM B88	Wrought Copper or Cast Copper Solder Joint, Push-Connect, or Grooved	ANSI B16.22 ANSI B16.18
6	All	Type "DWV" Copper	ASTM B88 ASTM B88	Wrought Copper or Cast Copper Solder Joint or Grooved	ANSI B16.22 ANSI B16.18

*Eccentric reducers 2" and smaller shall be B.C.I. - 125 lb.

2.02 PIPE JOINTS:

A. Joints for PVC piping shall be PVC solvent welded except connection to steel pipe, valves and equipment shall be flat faced with ASTM A-307 grade B bolts.

B. Joints for steel piping shall be screwed for 2” and smaller, welded, grooved, or flanged (150 lbs.) for 2-1/2” and larger.

C. Joints for copper piping shall be soldered with 95-5 solder or push-to-connect for 2” and smaller; grooved for 2-1/2” and larger.

2.03 UNIONS:

A. Unions in pipe sizes 2-1/2" and smaller shall be provided in each pipe line preceding the connections to each piece of equipment. Unions shall be black or galvanized to match the piping system in which installed.

B. Unions and flanges provided between copper and ferrous pipe connections shall be the insulating (dielectric) type to electrically separate dissimilar metal connections in piping system.

2.04 AIR VENTS:

A. Air vents shall be 150 psi rated and installed at all high points in HVAC piping systems and elsewhere as indicated on the drawings. Inlet of each vent shall be equipped with 3/4" gate valve. Provide U-tube on air vent discharge made of soft drawn copper tubing. Pipe the discharge to the nearest floor drain in mechanical rooms or janitor’s closet, discharge line size shall be 1/8" for single unit and 1/4" for multiple air vents. Air vents shall be ITT No. 87, Maid-O-Mist No. 75, Sarco 13W, Thrush No. 8 or Huffman No. 78.

2.05 DIELECTRIC ADAPTERS:

A. Dielectric adapters shall be the union type for pipes 2" in size and larger. Adapters shall have working pressure of 250 psi for union type and 175 psi for flanged type. The insulating gasket shall have an operating range of 40 degrees F. to 240 degrees F. and shall limit the galvanic corrosion to a maximum of 1% of the short circuit current. Dielectric adapters shall be Ebco, Crane or Capital.

B. Dielectric waterway fittings shall be grooved, threaded, or plain end for pipe 8” and smaller in size, designed for continuous use at temperatures to 230°F and working pressures to 300 psi. the body shall be carbon steel or ductile iron, zinc electroplated, with inert, non-corrosive, thermoplastic lining. Victaulic Style 47.

C. Provide a dielectric adapter or waterway fitting between any ferrous and copper connection including piping and equipment.

2.06 THERMOMETER TEST WELLS:

A. Test wells shall be for use with engraved stem thermometers. Test wells shall be brass and shall be provided with cap and chain with gasket for sealing when not in use. Wells installed in insulated pipes shall be extension neck type. Test wells shall be Weksler, Trerice or Weiss. Test wells shall contain oil for a sealant and be installed on an upright, inclined angle.

2.07 THERMOMETERS:

A. Thermometers shall be the red-reading mercury filled adjustable angle type. Thermometers shall be adjustable to any angle through a 180 degree arc and shall be provided with a locking device. Thermometers shall have V-cast aluminum case with baked enamel finish and 9 inch scale. Thermometers shall be provided with separable sockets and, where installed on insulated pipes, sockets shall be extension neck type. Thermometer scale range shall be: 0 to 160 degrees F. for chilled water and condenser water systems, and 100-500 degrees for boiler flue. Thermometers shall be Weksler Adjust-Angle Series Type AA-5, Trerice Adjustable Angle Series Type BX, or Weiss Vari-Angle Series Type VS.

2.08 PRESSURE GAUGES:

A. Pressure gauges shall be connected to the piping system with threaded brass pipe and screwed brass fittings. Gauges shall be flangeless type and shall have 4-1/2" dials, cast aluminum cases, stainless steel rotary gear movements, phosphor bronze bourdon tubes, forged brass rod sockets and tips, 1/2% accuracy of scale range, plexiglass dial covers, safety blow-out disc an 1/4" lower connections. Gauges shall be Weksler Type AA1, Trerice No. 500X Series or Weiss Series PG.

B. Each gauge shall be provided with brass lever handle cock and snubber for water service and siphon and cock for steam service.

C. Gauges in pump suction lines shall be the compound type. Gauges in all other locations shall be the plain pressure type. Select to operate at midpoint of scale during normal system operation.

D. Gauge cocks shall consist of a brass lever handle cock connected to the piping system with threaded brass pipe and screwed brass fittings. Gauge cocks shall be Weksler Type A, Trerice No. 880 or Weiss Type LC.

2.09 EXPANSION TANKS:

A. Furnish and install expansion tank designed for use in the building water systems as indicated.

B. Expansion tank shall be the pressurized captive air bladder type with a minimum working pressure of 125 psig. The expansion tank shall be constructed and certified in accordance with the ASME non-fired pressure vessel code. The air bladder shall be replaceable and shall be the elastomeric type suitable for operating temperatures of 240 degrees F. expansion tank shall be Taco series CA or approved equal by Bell and Gossett.

2.10 STRAINERS:

A. All strainers (except those provided with equipment) shall be the products of one manufacturer.

B. Y-Type Strainers:

1. Strainers 2" and smaller shall be iron-body (semi-steel) with screwed-end connections and screwed plug in blow-off. Strainers shall be rated for 400 pounds (minimum) WOG. Screens for water service shall be 20 mesh stainless steel screens (1/32 openings).

2. Strainers 2-1/2" and larger shall be iron body (semi-steel) with 125 pound flanged end connections for installation between 150 pound raised face slip-on weld flanges. Strainers shall have blow-down connection which shall be provided with full size gate valve. Strainer screens shall be stainless steel in accordance with the following:

Size	Service	Material Gage Diameter	Perforation
2-1/2", 3"	Water	28	3/64"
4", 5", 6"	Water	24	1/16"
8"	Water	24	1/8"
10", 12"	Water	20	¼"

3. Provide a blow down valve at each strainer full size of blow down connection. Strainers shall be Mueller, Schade Davis, Keckley, McAlear.

4. Grooved end strainers 2" and larger shall have a ductile iron body, type 304 stainless steel removable basket with 1/16" or 1/8" diameter perforations. Install with two Victaulic couplings, removable access cap and coupling for strainer maintenance, blowdown port in cap supplied with plug. Victaulic Style 732.

2.11 AIR ELIMINATING TANK:

A. Air eliminating tank shall be a combination centrifugal air separator with system strainer. Tank shall be designed for collection of free and entrained air in system. Air eliminating tank shall be constructed of steel for not less than 125 psig working pressure and shall be stamped with "U" symbol certifying compliance with ASME Codes. Inlet and outlet connections to tank shall be flanged. Tank shall be mounted as indicated and strainer shall be constructed of galvanized steel having not less than 5 times the free area of the connecting pipe. Tanks shall be provided with a factory applied coat of enamel. Air eliminating tank shall be Bell & Gossett Rolairtrol Series R, J.J. Finnigan Series BM, or Thrush AS Series.

2.12 COMBINATION PRESSURE AND TEMPERATURE TEST PLUG:

A. Combination pressure and temperature plugs shall be provided as indicated.

B. Plug shall be constructed of brass with two Nordel valve cores (self-closing). Plug shall have cap and gasket for sealing when not in use.

C. Furnish, and turn over to the Owner, one (1) complete pressure and temperature test kits including, but not limited to, pressure gauge, pressure gauge fittings and probes, thermometer, thermometer fittings and probes, and carrying case. These kits shall include all necessary equipment for acquiring temperature and pressure readings from the test plugs.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Copper tubing for condensate drain lines shall be cut square and burrs shall be removed. Both the inside and the outside of the tubing shall be cleaned with steel wool before brazing. The inside of the tubing shall then be cleaned with a dry cloth. All joints shall be brazed with silver solder. All brazing shall be done while the piping is being flushed with carbon dioxide, nitrogen or another inert gas.

B. All single pipe penetrations of the roof shall be flashed and sealed watertight using a conical pipe seal consisting of a spun aluminum base with a minimum five inch base diameter, a circular stepped neoprene boot, and adjustable stainless steel clamps which secure the boot to both the base and the pipe within. The pipe seals shall be as manufactured by the Pate Co. or an approved equal

C. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved couplings, fittings, valves and specialties shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation

D. Push-to-Connect Fitting Installation: Prepare copper tube and install in strict accordance with NVent installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by NVent to clean and make installation mark. Push copper tube into fittings to installation depth mark, per NVent installation instructions.

E. Vents and piping specialties shall be installed in complete conformance with the manufacturer’s recommendations and the Contract Documents.

3.02 PIPE SUPPORTS:

A. Refer to Section 23 05 29 for “Hangers and Supports for HVAC Piping and Equipment” for general pipe support.

B. Provide, a minimum, one support at each elbow, tee, valve, change of direction, branch and equipment connection, and at valves inlet and outlet.

3.03 TESTING:

A. Test heating tape and cable to demonstrate proper operation. Repair or replace damaged tape and cable. Retest to ensure proper operation.

END OF SECTION

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE:

A. All electrical work specified in this section shall comply with the provisions of Division 26. All mechanical work specified shall be in accordance with Division 23.

B. All motors shall be provided as noted herein.

C. A motor starter shall be provided under this section for each motor including package units which shall be furnished with integral starters. Motor starters shall be installed either in a motor control center or separately mounted adjacent to the motor served as shown, indicated and/or required. Motor starters not provided in the motor control center under Electrical Specifications Division 26, shall be provided.

D. Motor power wiring is defined as those conductors between the energy source and the motor. This power wiring shall be terminated at motor terminals and will be provided under Division 26 work.

E. All control wiring required for automatic starting and stopping of motors shall be provided under this Division unless specifically shown on the electrical drawings.

F. Power wiring will be connected through all line voltage control devices such as firestats and thermostats by Division 26 work.

G. Smoke detectors by Division 26.

H. System power wiring to be under Division 26.

PART 2 - PRODUCTS

2.01 STARTERS:

A. The Mechanical Contractor shall provide for each and every motor that is a part of his equipment, a properly sized motor starter. This includes, but is not limited to the following: Air handling unit motors, chiller starters, pumps, boilers, system controls, variable speed control devices, cooling towers, pilot lights, push button controls, etc., and shall be furnished complete as a part of the motor apparatus which it operates. All components shall be in conformance with the requirements of the National Electrical Codes (NEC) and Division 26 of this specification. Starters for fractional horsepower motors shall be furnished and installed under Division 26 and as noted herein.

B. All motor starters shall be turned over to the Electrical Contractor for installation with the following exceptions:

1. Starters for all motors that are ½ horsepower and smaller and are 120 volts, single phase shall be provided and installed by the Electrical Contractor.

2. Motor starters and motor control devices will be furnished and installed in Division 26 where motor control centers are provided by the Electrical Contractor.

C. Manual operated motor with magnetic controllers shall be pushbutton type. All automatic controlled motors shall have automatic (H.O.A.) switches. All magnetic starters shall have red and green pilot lights on cover. Power wiring and control circuits shall be run in rigid conduit and shall conform to the NEC standards.

D. All poly-phase motors and all motors that are automatically controlled shall be furnished with magnetic starters, full voltage, non-reversing type, complete with necessary auxiliary contacts for controls unless otherwise noted. Heaters shall be of the melting alloy type, sized to the exact nameplate running current of the motor. Overloads shall have visual trip indicators and shall be trip-free with reset button held in. All magnetic motor starters or controllers shall be equipped with one overload element in each phase. All starters for 3-phase motors, 3hp/3kw and larger, shall include protection against loss of any one phase or phase reversal and voltage fluctuations.

E. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single speed, unless otherwise indicated.

F. Each starter for a three-phase motor shall be combination magnetic type with circuit breaker and shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external “RESET” button or “HAND-OFF-AUTO” selector switch as scheduled with red “RUNNING” light. Provide a green pilot light to indicate motor “STOPPED”. Each pilot light shall have a legend plate indicating reason for signal.

G. Each overload relay shall have normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a “TRIPPED” legend plate.

H. Provide two sets each of normally open and normally closed auxiliary contacts for all magnetic starters. See equipment schedules on plans for voltage requirements.

I. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. Each starter shall have a laminated nameplate to indicate Division 23 unit number, function and circuit number. Outdoor starters shall be rain-tight weatherproof.

J. All motor starters, push buttons and pilot lights shall be of the same manufacture as the switchboard.

K. COMBINATION STARTERS: Combination starters shall consist of a circuit breaker and a motor starter mounted in a common NEMA Type 1 general purpose enclosure. The circuit breaker component shall be a minimum 22,000 RMS interrupting capacity and shall be as required in the Electrical Division.

2.03 MOTORS:

A. Unless specifically noted otherwise in other sections of this Specification, all motors and motor controllers shall meet the requirements specified in this Section. All motors shall be built in accordance with the current applicable IEEE and NEMA standards, and shall have voltage, phase, frequency and service as scheduled.

B. Each motor shall be suitable for the brake horsepower of the driven unit, rated with 1.15 minimum service factor and shall be NEMA design B. The motor temperature rise shall not exceed 104° F. for drip proof motors, 122° F. for splash proof motors and 131° F for totally enclosed or explosion proof motors. The motor shall be capable of operating continuously at such temperature rises, and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating.

C. Each item of motor driven equipment shall be furnished complete with the motors and drives as required to perform the specific function for which it is intended, scheduled, and specified.

D. Motors shall be ball bearing type selected for quiet operation and shall be manufactured for general purpose duty unless otherwise indicated. Each bearing shall be accessible for lubrication and designed for the load imposed by the V-belt drive or the driven apparatus. Direct drive motors shall be designed for the specific application with all necessary thrust bearings, shaft capacities, etc.

E. Motors larger than 1/2 horsepower shall have bearings with pressure grease lubrications fittings.

F. Motors connected to drive equipment by belt shall be furnished with adjustable slide rail bases except for fractional horsepower motors, which shall have slotted bases. Motor leads shall be permanently identified and supplied with connectors.

G. Each motor to be installed outdoors shall be of the totally enclosed fan-cooled type, or housed in a weatherproof housing.

H. Unless otherwise indicated, motors smaller than 1/2 horsepower shall be capacitor start or split phase type designed for 120 volt, single phase, 60 cycle alternating current. Shaded pole motors are not acceptable except 35 watts and smaller. Motors 1/2 horsepower and larger shall be squirrel cage induction type, 3 phase, 60 cycle alternating current.

I. Multi-speed motors shall, except as noted, be consequent pole, variable torque, single winding. When the speed ratios or the load characteristic dictates, the multi-speed motors shall be separate winding types. Variable speed motors operating over an adjustable range of speeds shall be motors specifically designed and rated for this duty.

J. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect of the change and shall then coordinate the change and shall pay all additional charges in connection with the change.

2.04 IONIZATION SMOKE DETECTORS:

A. Provide and install ionization smoke detectors in all air handling units. Detectors are to be installed in both the supply and return air duct connections at each unit. Detectors are to be installed by the Mechanical Contractor and furnished and wired by the Electrical Contractor in Division 26.

B. Detectors shall de-energize air systems when and if particles of combustion are detected in the air stream. Detectors shall be fitted with sampling tubes that are sized to fit duct widths. Provide a manual reset switch and interlock with the building fire alarm system if such exists.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide control wiring and install all motor starters, unless integrally factory mounted on a piece of equipment.

B. Provide control wiring to all motors except packaged units that are prewired between the starter and motor.

C. Where line voltage control devices are mounted at or inside a unit, such as aquastats, firestats for single phase devices, etc., the power wiring to the unit shall be connected through such a control device by the work of Division 26.

D. On final inspection, it shall be demonstrated to the Engineer or his representative that each overload relay control circuit is properly wired and functioning correctly by manually tripping each overload relay individually, one at a time. This inspection procedure shall not involve removal of any wiring or disconnecting any current carrying parts.

E. Standard minimum one-year warranty on all electrical equipment provided herein shall apply.

3.02 ELECTRICAL WORK:

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

B. All power wiring and final power connections to the system shall be provided under Division 26.

C. Control wiring (120V. and less) shall be provided under Division 23 and extended from the 120V power circuits indicated on the Electrical Drawings. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

D. All electrical characteristics shall be taken from the Electrical Drawings and Specifications and coordinated before equipment is ordered or submitted.

END OF SECTION

SECTION 23 05 15 DESIGN CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The requirements of the General Conditions, Supplementary conditions, and Section 23 05 10 ”HVAC General Requirements” apply to all work herein.

PART 2 - DESIGN CONDITIONS

2.01 DESIGN CONDITIONS:

A. Outside conditions are as follows:

	Dry Bulb Deg. F.	Wet Bulb Deg. F.
Summer Outside Air Temperature	98	80
Winter Outside Air Temperature	0	

B. The indoor design condition for cooling is 75 deg. F. dry bulb/50% relative humidity.

C. The indoor design condition for heating is 75 deg. F. dry bulb.

D. Range of indoor design goals for HVAC sound control:

1. All occupied space shall have an Noise Criterion (NC) curve range not to exceed NC 32.

E. Building envelope design criteria - these values are repeated here to alert the General Contractor to the properties of materials used in the calculation of heating and cooling loads for this project. It shall be the responsibility of the General contractor to notify the Architect and Engineer if materials with properties other than those stated below are used in the construction of this project:

1. Typical vision glass shading coefficient - 1.0

2. Typical vision glass "U" values - 1.08

3. Insulated exterior walls transmission coefficient-0.075 BTU(hr.) (F deg.)(sq.ft.)

4. Roof heat transmission coefficient - 0.10 Btu/(hr.)(F. deg.)(sq. ft.)

2.02 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

B. Temperature/pressure rating of all components shall meet or exceed design conditions for the system in which they are installed. All components shall be designed for operating conditions of not less than:

	System	Working Pressure PSIG	Temperature Range
1.	All Condenser Water Service	125, 150, 200	200ºF, 220ºF, 250ºF
2.	All Chilled and Heating Water Service	125, 150, 200	42ºF, 220ºF, 250ºF
3.	All Remaining Services	125	200ºF

PART 3 – EXECUTION

3.01 PRESSURE TESTING / RECORDING

A. All pressure tests shall be observed by the Engineer. He may delegate others, i.e. Architect, General Contractor, Clerk of Works, etc., to observe tests in his absence. Said tests and time duration shall be recorded and posted onto the pipe segments as indicated on the project set of construction documents.

END OF SECTION

SECTION 23 05 20 FLOW MEASURING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisional -1 Specification sections, apply to work of this section.

B. All work specified in this Section is subject to the provisions of Section 23 05 10 “HVAC General Requirements”.

C. Refer to Specification Section 23 05 11, titled “HVAC Submittal Data” for the submittal and approval requirements regarding the piping system.

D. Refer to Specification Section 23 05 53, titled "Identification for HVAC Piping and Equipment" for piping systems identification requirements.

E. Refer to Specification Section 23 05 29, titled "Hangers and Supports for HVAC Piping and Equipment" for specification and installation requirements of the pipe hangers and supports.

F. Refer to Specification Section 23 07 00 titled “HVAC Insulation” for specification and installation of thermal insulation for the various types of pipe, fittings, and accessories specified in this section.

G. Refer to Specification Section 23 05 48, titled "Vibration and Seismic Controls for HVAC Piping and Equipment" for the specification and installation requirements of the vibration isolation system.

1.02 DESCRIPTION:

A. Specific requirements for specialties indicated on drawings or in other sections of these specifications shall take precedence over items as specified in this section.

B. Submit brochures and other supportive data as might be required for approval of all items differing from those specified.

C. Ranges for thermometer, gages or similar instruments shall be selected so that normal operation will be near center of scale. Range shall not be longer than required. Use compound gage where vacuum may be encountered.

D. Combination instruments for thermometers and gages will not be acceptable.

PART 2 - PRODUCTS

2.01 AUTOMATIC FLOW CONTROL VALVES:

A. Flow control valves shall be tamperproof, factory calibrated, automatic pressure compensating type. Each valve shall limit flow rates to within a range of ±3%, regardless of system pressure fluctuations. Valve body material shall be suitable for the designed system piping requirements, with internal working parts of stainless steel construction. Each valve shall be provided with a metal tag, chain, and stamped for system identification. Provide nipples and quick disconnect valves for connection of flow measuring instrumentation. All hydronic system flow control valves shall be of one manufacturer. Quantities and flow capacities are to be as indicated on the drawings. Flow control valves shall be as manufactured by FlowSet Flow Design Inc., Dallas, Texas or B&G Auto Flow.

B. The AccuSetter Model AW includes a weld-end venturi on the inlet with a lug type butterfly valve mounted on downstream venturi flange.

C. The AccuSetter Model AP includes a large diameter plated ball, Teflon seats, pressure/ temperature ports and flow lock memory.

D. AccuSetter Model F includes a low loss/high signal venturi flow element, with one to ten range, plated ball, Teflon seats, pressure / temperature ports and flow lock memory.

E. Furnish portable flow measuring apparatus, complete with carrying case, pressure gage, 3-way valve, hoses and connections. Unit to be compatible with automatic flow control valves to indicate pressure differential to determine flow rate through the valve.

PART 3 - EXECUTION

3.01 GAGES, THERMOMETERS AND TEST PLUGS:

A. Provide Flow Measurement devices in all piping systems as required to provide for test and balance contractor to perform his services or as indicated on drawings.

B. Provide gages & Pete’s plugs on inlet and outlet piping of all pumps, except domestic hot water circulators, and elsewhere shown on drawings.

C. Arrange thermometers and gages so that they can be read standing in a normal position on the floor.

D. Provide test plugs (Pete’s plugs) on inlet and outlet piping of all heat exchange equipment not equipped with thermometers.

E. Locate gauges, thermometers and test plugs as close as possible to equipment being monitored.

3.02 FLEXIBLE PIPE CONNECTORS:

A. Install flexible pipe connectors where shown on the Drawings.

B. Install connectors as close as possible to equipment inlets and outlets.

C. Support pipe work independently of flexible connectors. Brace and anchor piping as required to prevent movement of piping ends at flexible connectors. Align all equipment, pipe work, and flanges so that flexible connectors shall be aligned and not stressed beyond the manufacturer's recommended maximum limits.

END OF SECTION

SECTION 23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Motor operated valves are specified in Section 23 09 13 “Instrumentation and Control Devices for HVAC”.

B. The requirements of the General Conditions, Supplementary Conditions, Section 23 05 10 “HVAC General Requirements” and Section 23 05 12 “HVAC Pipe, Fittings and Accessories” apply to all work specified in this section.

C. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

1.02 DESCRIPTION OF WORK:

A. Extent of the work is indicated on the Mechanical Drawings, equipment schedules, and by the requirements of this section.

1.03 QUALITY OF WORK:

A. Codes and regulations referred to are minimum standards. Where the requirements of these Specifications or Drawings exceed those of the codes and regulations, the Drawings and Specifications shall govern.

B. Valve marking and identification shall conform to the manufacturer's Standardization Society for Valves, Fittings, Flanges and Unions (MMS) Publication SP-25, and shall have the name or trademark of the manufacturer and working pressure cast or stamped on the valve body and the manufacture's figure number securely attached to the stem.

C. Provide valves of one manufacturer for each trade application wherever practical to achieve maximum possible uniformity and facilitate maintenance. All grooved end valves shall be supplied by Victaulic.

D. Figure numbers of various manufacturers are designated as conforming to the specific specification. Valves of like characteristics may be furnished provided they meet or exceed the specification in every respect.

E. Control valves furnished with equipment shall be as recommended by the equipment manufacturer.

F. U.S.A. valve manufacturers are preferred. NIBCO, Crane, Powell, Demco, Apollo or Mueller.

1.04 DEFINITIONS:

A. Numbers indicated after manufacturer's name is the manufacturer figure or Series number, or N/A, not applicable.

1.05 GENERAL:

A. All valves requiring packing shall be designed and constructed to allow repacking under pressure.

B. All valve hand wheels shall be malleable or modular iron unless indicated otherwise under the individual type valve specification.

C. Non-slam check valves shall be installed at pumps; swing-check and lift-check valves are not acceptable near pumps. Non-slam checks should be installed at a minimum of 5 pipe diameters from the pump.

D. Underwriter approved valves shall bear the underwriter's label.

E. Valves in Insulated Piping: Valves shall have 2-inch stem extensions and the following features:

1. Gate Valves: Shall be rising-stem type.

2. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-seal handle extension or comparable equal.

3. Butterfly Valves: Shall have extended necks.

F. All valves 4 inches and larger mounted in excess of seven (7'-0") feet above the floor in Mechanical or Boiler rooms shall be equipped with chain operators. Extend chains to within 6'-3" of the floor.

G. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

H. Use Table below to match class ratings of valves with flanges.

Valve Description	Fits steel flange	Fits cast iron flange
Class 125 Cast Iron Gate, globe, check	150	125
Class 150 Ductile Iron Gate, globe, check	150	125
Class 250 Cast Iron Gate, globe, check	300	250
200 PSI CWP Butterfly	150	125

I. Provide the following valve models or manufacturer for the specified services:

SERVICE	GATE		GLOBE		BALL	BUTTERFLY	CHECK	
	2" & under	21/2" & larger	2" & under	21/2" & larger	2" & under	21/2" & larger	2" & under	21/2" & larger
CHILLED AND CONDENSER WATER	T-134	F-617-O	T-235-Y	F-718-B	T-585-70-66	LD-2000	T-433-Y	F-910-B
HEATING HOT WATER	T-134	F-617-O	T-235-Y	F-718-B	T-585-70-66	LD-2000	T-433-Y	F-910-B

SERVICE	LUBRICATED PLUG		CALIBRATED BALANCING		PRESSURE RELIEF	NON-RETURN STOP CHECK	TEMPERATURE REGULATOR
	2" & under	21/2" & larger	2" & under	21/2" & larger		21/2" & larger	
CHILLED AND CONDENSER WATER	142	143	T/S-1710	F-737	Watts	*****	*****
HEATING HOT WATER	142	143	T/S-1711	F-737	*****	*****	*****

PART 2 - PRODUCTS

2.01 CHILLED & CONDENSER WATER, & HEATING HOT WATER:

A. GATE VALVES – 2” AND SMALLER

1. Valves 2" and smaller shall be class 125, 200 PSI CWP, body and screw-in bonnet shall be of ASTM B-62 cast bronze, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, Braided TFE packing, and malleable hand wheel.

RISING STEM	NON RISING STEM
NIBCO T/S-111	NIBCO T/S-113

2. Class 150, 300 PSI CWP, with Union bonnet, valves meeting the above specifications may be used where pressure requires:

RISING STEM	NON RISING STEM
NIBCO T-134	NIBCO T-136

3. Class 300, 600 PSI CWP, SS disc, union bonnet, valves meeting the above specification may be used where pressure requires:

RISING STEM	NON RISING STEM
NIBCO T-174-SS	NIBCO T-176-SS

B. GATE VALVES - 2-1/2" AND LARGER

1. Valves 2-1/2" and larger shall be Class 125, 200 PSI CWP, cast iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, Aramid fibers with graphite packing and two-piece packing gland assembly.

RISING STEM	NON RISING STEM
NIBCO F-617-0	NIBCO F-619

2. Class 150, 285 PSI CWP, valves shall be ASTM A-395 ductile iron where such pressures are required:

RISING STEM	NON RISING STEM
NIBCO F-637-31	NIBCO F-639-31

3. Class 250, 500 PSI CWP, valves meeting the above specification may be used where pressure requires:

RISING STEM	NON RISING STEM
NIBCO F-667-0	NIBCO F-669

C. GLOBE VALVES - 2" AND SMALLER

1. Valves 2" and smaller shall be of Class 125, 200 PSI CWP, body and screw-in bonnet of ASTM B-62 cast bronze, threaded or solder ends, copper silicon alloy stem, brass packing gland, Braided TFE packing, TFE seats and malleable hand wheel.

NIBCO T/S-211-Y

2. Class 150, 300 PSI CWP, union bonnet, valves meeting the above specification may be used where pressure requires:

NIBCO T-235-Y

3. Class 300, 600 PSI CWP, SS disc & seat, union bonnet, valves meeting the above specification may be used where pressure requires:

NIBCO T-276-AP

D. GLOBE VALVES - 2-1/2 AND LARGER

1. Valves 2-1/2" and larger shall be Class 125, 200 PSI CWP, cast iron body, bronze mounted with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, Aramid fibers with graphite packing and two-piece packing gland assembly.

NIBCO F-718-B

2. Class 150, 285 PSI CWP, valves shall be ASTM A-395 ductile iron where such pressures are required.

NIBCO F738-31

3. Class 250, 500 PSI CWP, valves meeting with above specification may be used where pressure requires:

   NIBCO F-768-B

E. BALL VALVES - 2" AND SMALLER

1. Valves shall be full port, 600 psi CWP, 150 psi SWP and have cast bronze, ASTM B-584 alloy 844 body, 316 stainless steel ball and stem, reinforced TFE seats, adjustable stem packing and blow out proof stem. Valve end connections shall have extended solder connections and be manufactured to comply with MSS-SP110. No substitutions will be permitted.

NON-INSULATED VALVES	**INSULATED VALVES**
NIBCO T/S-585-70-66	NIBCO T/S-585-70-66-NS

2. Forged brass body, 2-piece valve with Vic Press 304™ ends, standard post, 300 psi CWP, chrome-plated brass ball and stem, TFE seats and stem washer, flouro-elastomer o-ring seal, zinc plated carbon steel handle and shall be Victaulic Series 589.

3. Bronze body, 2-piece valve with push-to-connect ends, full port, 200 psi CWP, chrome-plated brass ball and silicone bronze stem, TFE packing, no o-ring, zinc plated steel lever handle and shall be NVent PermaLynx PL-200.

F. BUTTERFLY VALVES 2-1/2" AND LARGER

1. Lug type body shall be ductile iron, ASTM A-536, bi-directional, rated for dead end service at 200 psi CWP with the downstream flange removed. Provide valve with EPDM seat, (BUNA-N Seat for compressed air & vacuum service) aluminum bronze disc and stainless steel blowout proof stem. Valve should be provided with upper and lower stem bushings. 2-1/2" – 6" valves should have a 10 position lever handle. Valves 8" and larger will be equipped with an enclosed weatherproof gear operator. Valve shall have extended neck to accommodate 2" of insulation. Manufacturer must certify that valves are bi-directional and will meet bubble tight shut off with downstream flange removed. No substitutions will be permitted.

   NIBCO LD-2000, LD-2100 (Compressed Air & Vacuum Service)

2. Grooved type butterfly valves 2" through 12" sizes: 300 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Disc shall be electroless nickel plated ductile iron with blowout proof 416 stainless steel stem. Disc shall be offset from the stem centerline to allow full 360 degree seating. Seat shall be pressure responsive [EPDM] [Lubricated Nitrile] [Fluoroelastomer]. Valve bearings shall be TFE lined fiberglass, and stem seals shall be of the same grade elastomer as the valve seat. Valve shall be complete with ISO flange for actuation mounting. Valve operators shall be lever handle or gear operator, available with memory stop feature, locking device, chainwheel, or supplied bare. No substitutions will be permitted.

   Victaulic Vic®-300 MasterSeal™.

3. Grooved type butterfly valves 14" through 24" Sizes: 175 psi / 300 psi, grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12), PPS coated ductile iron disc (ASTM A-536), and two piece 17-4 PH S/S stem design. Seat and seal material to suit intended service. Reinforced PTFE bearings and gear operator. Seat tested to MSS-SP-67. Bubble tight, dead-end, or bi-directional service, with memory stop for throttling, metering or balancing service. No substitutions will be permitted.

   Victaulic Series W706 rated to 300 psi.
   Victaulic Series W709 rated to 175 psi

G. CHECK VALVES - 2" AND SMALLER

1. Valves 2" and smaller shall be of Class 125, 200 PSI CWP, threaded ends, body and caps shall be of ASTM B-62 cast bronze, TFE disc, swing type disc.

   NIBCO T/S-413-Y

2. Class 150, 300 PSI CWP, valves meeting the above specification may be used where pressure requires:

   NIBCO T-433-Y

3. Class 300, 600 PSI CWP, bronze disc, valves meeting the above specification may be used where pressure requires:

   NIBCO T-473-B

4. Valves 2" and smaller shall be of Class 125, 200 PSI CWP, threaded ends, body and caps shall be of ASTM B-584 cast bronze, TFE disc, center guided spring type disc:

   NIBCO T-480-Y

H. CHECK VALVES 2-1/2" AND LARGER

1. Valves 2-1/2" and larger shall be of Class 125, 200 PSI CWP, cast iron body, bronze mounted, flanged ends, swing type disc.

   NIBCO F-918-B

2. Class 150, 285 PSI CWP, valves shall be ASTM A-395 ductile iron where such pressures are required:

   NIBCO F-938-31

3. Class 250, 500 PSI CWP, valves meeting the above specification may be used where pressure requires:

   NIBCO F-968-B

4. Grooved end check valves 2-1/2” thru 12” shall have ductile iron body, spring-assisted aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft, PPS coated or welded-in nickel seat, 300 psi CWP.

   Victaulic Series 716

5. Grooved end check valves 14” thru 24” shall have ductile iron body, stainless steel dual disc design, stainless steel spring and shaft, EPDM seat bonded to the valve body, 230 psi CWP.

   Victaulic Series W715.

I. CHECK VALVES 2-1/2" AND LARGER (FOR PUMP DISCHARGE)

1. Valves 2-1/2" and larger shall be of Class 125, 200 PSI CWP, iron body, bronze mounted, flanged ends, BUNA-N seat, globe type silent check valves and stainless steel spring. Valve shall be designed to completely close with a 1/2 psi positive discharge head.

   NIBCO F-910-B

2. Class 150 valves meeting the above specification may be used where pressure requires:

   NOT AVAILABLE

3. Class 250, 400 PSI CWP, valves meeting the above specification may be used where pressure requires:

   NIBCO F-960

4. Valves 2-1/2" and larger shall be Class 125/250, 200 PSI CWP, cast iron body bronze mounted, wafer check valve, with ends designed for flanged type connections, Buna-N seats, aluminum bronze disc, 316 stainless steel torsion spring, and hinge pin, double disc type.

   NIBCO W-920-W

J. LUBRICATED PLUG VALVES 2" AND SMALLER

1. Valves 2" and smaller shall be of class 175 semi-steel body, tapered Teflon coated plug, lubricated under pressure, threaded ends conforming to ASTM A-126, Class B, with adjustable memory stop, wrench operated.

   Powell 2200
   Nordstrom 142

2. Class 200 valves meeting the above specification may be used where pressures require:

   Powell 2202
   Nordstrom 114

3. Class 500 valves meeting the above specifications may be used where pressures require:

   Powell 2210
   Nordstrom 524

K. LUBRICATED PLUG VALVES 2-1/2" AND LARGER

1. Valves 2-1/2" and larger shall be of class 175, semi-steel body, tapered Teflon coated plug, lubricated under pressure, flanged ends, conforming to ASTM A-126, Class B, with adjustable memory stop, wrench operated.

   Powell 2201
   Nordstrom 143

2. Class 200 valves meeting the above specification may be used where pressure requires:

   Powell 2203
   Nordstrom 115

3. Class 500 valves meeting the above specification bay be used where pressure require:

   Powell 2211
   Nordstrom 525

L. NON-LUBRICATED PLUG VALVES 3” AND LARGER

1. Grooved end non-lubricated eccentric plug valves, ductile iron body, bonnet and plug. Plug encapsulated with synthetic rubber suitable for intended service. Welded-in nickel seat, stainless steel backed TFE self-lubricating bearings, 175 psi CWP.

   Victaulic Series 377

M. CALIBRATED BALANCING VALVE – 2 " AND SMALLER

1. Valves 2” and smaller shall be bronze body, globe type design. Valves to have differential pressure read out port with check valves across the valve seat area and be rated at 240 psi at 250 Deg. F. Valves to have memory stop feature to allow valve to be closed for service and reopened to set point without disturbing balance position. Valve shall have visual position readout to indicate the degree of closure.

   NIBCO T or S1710
   Armstrong CBV
   Tour & Anderson STAD / STAS

N. CALIBRATED BALANCING VALVE – 2½ " AND LARGER

1. Valves 2½” and larger shall be Class 125 / 150 cast iron or ductile iron body, y-pattern, globe type design, flanged or grooved ends. Valves to have differential pressure read out port with check valves across the valve seat area and be rated at

175 psi at 250 Deg. F (flanged), or 230 Deg. F (grooved). Valves to have concealed memory stop feature to allow valve to be closed for service and reopened to set point without disturbing balance position, with locking tamper=proof setting. Valve shall have visual position digital readout to indicate the degree of closure.

NIBCO F-737
Armstrong CBV
Victaulic/Tour & Anderson STAD / STAS Series 786 or 787.

O. DRAIN VALVES

1. Drain valves shall be 600 psi wog, 150 psi SWP, bronze body, full port with chrome plated ball, reinforced TFE seats. Valves will be ¾" NPT inlets x ¾" threaded hose end, equipped with cap and chain.

Nibco T-585-70-HC
Apollo 78-104

P. PRESSURE RELIEF VALVES

1. Relief valves shall be ASME rated and name plated, per ASME Section IV Code requirements, diaphragm operated, differential pressure shall not exceed 3 psi from opening to closing. Valves shall be sized for 1.25 times the BTU rating of the system in which they are installed, but shall not be less than 3/4 inch.

Bell & Gossett Series 400, 700, 1000, 3000 and 4000
Watts Series 174A and 740
Spirax-Sarco Series 252 or 6010

Q. NON-RETURN STOP AND BOILER CHECK VALVE:

1. Valves shall be Class 250, 500 PSI CWP, iron body, bronze mounted, bolted yoke bonnet, flanged ends, angle or globe configuration, iron hand wheel, body and bonnet conforming to ASTM A-126, Class B.

2. Angle	or-	Globe
NIBCO F-869-B		NIBCO N/A
Powell 368		Powell 367

R. TEMPERATURE REGULATORS:

1. Valves shall be of Class 125, bronze body, union of flanged ends, removable stainless steel seat, disc and balancing piston, double seat, self sensing in self powered, direct acting, temperature, range 180 degrees F. - 220 degrees F., pilot operated.

Hoffman 1150
Spirax-Sarco 25-T
Strong-DT

S. PILOT ACTUATED PRESSURE REDUCING VALVES

1. Pressure reducing valves shall be of the pilot actuated diaphragm operated type with the pilot mounted on the upper body and the diaphragm below. The main valve shall be single seated with stainless steel trim, and cast iron body. The valve seat and plug shall be replaceable. The pilot shall be capable of being repaired without removing from the system.

   ITT-Hoffman 2000
   Spirax-Sarco 25-P
   Watts 127-SS

T. TEMPERATURE AND PRESSURE RELIEF VALVES

1. Valves shall be A.G.A. temperature rated and ASME pressure rated and name plated, and shall conform to ANSI Z21, 22. The operating limit of the relief valve shall not exceed 200 Deg. F. Valve shall be bronze body, non-stick or freeze seat to disc alignment, fully automatic, self closing.

   Watts Series 40, 1450, 240 and 340
   A.W. Cash FV, Series

2.

Valves Size	Equipment Max. BTU/Hr input
1/2"	15,000
3/4"	200,000
1"	2,000,000
1-1/2"	3,000,000

U. PRESSURE REDUCING VALVES - 2" AND SMALLER

1. Valves shall be bronze body, screwed ends, renewable seat and disc, high temperature diaphragm for hot and cold water service, Y type strainer, water tight cage assembly, adjustable outlet pressure.

   Watts Regulator 223-58
   Wilkins Regulator 500-YS-BR
   Mueller H-93000 Series
   A.W. Cash E-55 Series

V. PRESSURE REDUCING VALVES - 2-1/2" AND LARGER

1. Valves shall be iron body, flanged ends, renewable seat and disc, high temperature diaphragm for hot or cold water service, Y type strainer, water tight cage assemble, pilot operated.

   A.W. Cash Type B-70
   OCV Series 127
   Clayton 91-A or 91-G

W. BACKFLOW PREVENTERS

1. Provide reduced pressure principle backflow preventers consisting of assembly including shutoff valves, strainer on inlet. Backflow preventers shall include test cocks, air-gap drain funnel, pressure differential relief valve located between two (2) positive seating check valves. Backflow preventers shall conform to ASSE Standard 1013.

   Watts Regulator 909
   Hershey Products FRP-11
   Wilkins 575-RP
   Clayton RP-1
   Ames Colt or Maxim Series

X. MISCELLANEOUS VALVES

1. Drain Valves:
   a. Drain valves shall be 600 psi CWP, bronze body, full port with chrome plated ball, reinforced TFE seats. Valves will be ¾" NPT inlet x ¾" threaded hose end, equipped with cap and chain.
      (1) NIBCO T/S-585-70-HC

PART 3 - EXECUTION

3.01 GENERAL:

A. Valves in horizontal piping shall be installed with stems at or above the pipe centerline.

B. Automatic air vents shall be installed with gate valves.

C. Lubricated plug type combination balancing, indicating, and shut-off valve shall be provided in the return connection to each unit heater, reheat coil, each run of finned tube radiation and elsewhere as required to balance the piping system.

D. Provide gate, globe and check valves throughout the piping systems where shown and where necessary to properly regulate and control the systems. Valves shall be the full size of the lines and shall be designed for low pressure drop. Gate and globe valves shall have provision for repacking when open and under pressure.

E. Adjust pressure reducing valve serving compression tanks to maintain between 5 and 10 psig at the highest point in the system.

F. Grooved end valves shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved end valves shall be supplied by a single manufacturer. Grooved end shall be clean and free from indentations and projections. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

G. Push-to-Connect Valve Installation: Prepare copper tube and install in strict accordance with NVent installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by NVent to clean and make installation mark. Push copper tube into fittings to installation depth mark, per NVent installation instructions. Keep fittings free of dirt and oil; use on water, water-glycol, and clean, dry, hydrocarbon-free air systems.

H. Vic Press 304™ Valve Installation: Pipe shall be certified for use with the Vic Press 304™ system. Pipe shall be square cut, +/- 0.030", properly de-burred and cleaned. Pipe ends shall be marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the coupling or fitting during assembly. Use a Victaulic "PFT" series tool with the proper sized jaw for pressing.

END OF SECTION

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions, and - Section 23 05 10, ”HVAC General Requirements” apply to work of this section.

B. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. Refer to Specification Section 23 05 48 “Vibration and Seismic Controls for HVAC Piping and Equipment" for the specification and installation requirements of the vibration isolation system.

1.02 DESCRIPTION OF WORK:

A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.

B. "C" CLAMPS may be used as point of attachment to building structure for pipe hangers and/or all-thread rods; however, piping shall not be supported directly by “C” clamps.

C. Do not pierce waterproofing with support bolts.

D. All ferrous metal hangers and supports, not otherwise coated, shall be provided with a field-applied coat of zinc chromate primer prior to any installation. In lieu of field painting, the contractor may furnish cadmium plated, or galvanized hangers and supports.

1.03 QUALITY ASSURANCE:

A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.

B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories. Submit fastening methods to the Structural Engineer for approval and as approved copy to the engineer.

C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel straps are not acceptable.

D. For the purpose of this specification, Grinnell product figure numbers are given. Equal products by B-Line and Michigan Hanger Co. (M-Co) are acceptable.

1.04 DESIGN:

A. Supporting steel not shown for the equipment will be designed, supplied and erected by the Contractor; the supporting steel is that steel which is connected to the structural steel shown on the drawings and carries the weight of the mechanical items. This supporting steel design must carry the dead weight and dynamic load imposed by the equipment, piping and other mechanical components.

B. The supporting steel shall be connected to the structural steel in such a manner as not to overload the structural steel. It is the responsibility of the General Contractor, Mechanical Contractor and the steel fabricator to verify that this purpose is accomplished. It is the responsibility of the General Contractor to call to the attention of the Architect-Engineer any deficiency prior to bidding.

C. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger in order to prevent excessive stress in either pipe or connected equipment.

PART 2 - PRODUCTS

2.01 UPPER ATTACHMENTS:

A. Existing Concrete Construction:

1. Support piping in existing concrete construction with Cadmium plated, malleable iron, expansion case, Grinnell Fig. 117.

2. Where hangers are required between structural members (beams) side beam brackets Grinnell Fig. 20, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

B. Steel Construction:

1. Support piping in steel construction with adjust-able beam clamps and tie rods, Grinnell Fig. 218, or side beam brackets bolted or welded to the side of the beam.

2. Where hangers are required between structural members (beams or joist) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC steel Handbook and shall receive a field coat of zinc chromate primer.

C. Wood Construction:

1. Support piping in wood construction with Side Beam Bracket, Grinnell Fig. 202 or Hanger Flange, Grinnell Fig 128R, using lag screws.

2.02 WALL SUPPORTS: Where piping is run adjacent to walls or steel columns welded steel brackets Grinnell Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

2.03 FLOOR SUPPORTS:

A. Where pipe lines are located next to the floor and no provision for expansion are required support piping with Grinnell Fig. 258, pipe rest with nipple and floor flange.

B. Where provisions for expansion are required support piping with Grinnell adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.

C. Vertical piping shall be supported at every other floor using riser clamps Grinnell Fig. 261, for steel and cast iron pipe, and copper clad riser clamp Grinnell Fig. CT-121 for all copper piping.

2.04 SUPPORTS FOR PIPING OUTSIDE THE STRUCTURE: Support piping outside the structure on adjustable pipe supports Grinnell Fig. 264.

2.05 INTERMEDIATE ATTACHMENTS:

A. Supports for horizontal piping shall be all-thread galvanized steel rods, ASTM A-107, Grinnell Fig. 146, of the following sizes:

Pipe Size	Hanger Rod Diameter
2" and smaller	3/8"
2-1/2" and 3"	1/2"
4" and 5"	5/8"
6"	3/4"
8" to 12"	7/8"
14" and 16"	1"

2.06 PIPE ATTACHMENTS:

A. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.

B. Hangers for steel and cast-iron horizontal piping where provision for expansion are not required shall be Grinnell Fig. 260, clevis type with vertical adjustment.

C. Hangers for uninsulated copper pipe 4" and smaller shall be copper plated adjustable band hangers Grinnell Fig. CT. 99C, for pipe sizes over 4" provide Grinnell copper clad clevis type hanger with a copper clad saddle at each hanger location.

D. Hanger for PVC pipe shall be Grinnell Fig. CT. 99, adjustable band hanger.

E. Hangers for steel and copper piping where provisions for expansion are required shall be Grinnell Fig. 171 or Fig. 181, adjustable roller hanger with Grinnell Fig. 160, pipe covering protection saddles.

F. Pipe guide shall be Grinnell Fig. 256.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Support horizontal equipment such as in-line pumps, strainers, air separators, independently of the piping system.

B. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.

C. Provide a hanger within one foot of each elbow.

D. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.

E. Unless specified otherwise, provide the following support spacing.

1. Pipe Size	Support Spacing
1" and smaller	5’-0”
1-1/4" and larger	10’-0”

END OF SECTION

SECTION 23 05 33 HEAT TRACING FOR HVAC PIPING

PART 1 – GENERAL

1.01 RELATED SECTIONS: Section 15180 - Thermal Insulation for Mechanical Systems.

1.02 REFERENCES:

A. NEC – National Electrical Code.

B. ASTM – E84 – Surface Burning Characteristics of Building Material.

C. NFPA 255 – Surface Burning Characteristics of Building Material.

D. UL 723 – Surface Burning Characteristics of Building Material.

1.03 SUBMITTALS:

A. Product Data: Provide a description, list of materials for each product and/or piece of equipment.

B. Manufacturer shall provide written procedures which describe the minimum acceptable workmanship and industry standards for this installation.

1.04 QUALITY ASSURANCE: Flame spread/smoke development rating of 25/50 or less in accordance with ASTM E84 and NFPA 255.

1.05 QUALIFICATIONS: Installing Contractor specializing in this work shall have a minimum of five (5) years experience.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site in factory-fabricated water resistant packaging, labeled with manufacturer's identification, including product description.

B. This Contractor shall store heating cable and components in a clean and dry space that protects from weather.

PART 2 – PRODUCTS

2.01 MATERIALS AND COMPONENTS:

A. Manufacturers: Provide products complying with these specifications. The following is an approved list of manufacturers.

1. Chromalox Division, Emerson Electric Company

2. Raychem Corporation.

3. Dekoron, DeKoron – Furon, Inc.

4. Thermon Manufacturing Company.

B. UL Standards: Electric heating cable shall conform to all applicable standards and shall be UL-labeled.

C. Provide heat tracing cable as specified herein and as indicated on the drawings. Heat trace the entire length of the pipe including all valves, fittings, and accessories. Provide all associated accessories including thermostats, termination kits, cold lead kits, end seal kits, and fiberglass tape as recommended by the manufacturer.

D. Self-regulating Freeze Protection Heat Tracing Cable: Provide self-regulating heat tracing cable rated at 5 watts/foot, 120 volts and the amount and length required. Heat tracing cable shall consist of twin copper conductors encased in a conductive polymer core matrix whose resistance varies with temperature.

E. Electric heating Cable Thermostats: Provide rain tight NEMA 4X enclosure electric heating cable thermostats with a temperature setpoint of 40°F, 22 ampere contacts, remote sensing bulb/capillary tube and as recommended by the cable manufacturer for freeze protection applications. Thermostats shall be used in the ambient sensing mode with the sensor bulb exposed to ambient air. Contractor shall verify power requirements.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. General: Install electric heat tracing cable in accordance with the manufacturer's written instructions, the applicable portions of the NEC, and recognized standards. Furnish, install and connect the heat trace cable and all required accessories in accordance with the manufacturer's instructions. All metallic piping which is heat traced shall be grounded per NEC requirements.

B. Contractor shall install electric heat trace cable for freeze protection of piping systems where indicated on the drawings. Maintain a 40°F water temperature within the traced pipe with an ambient temperature of 0°F.

1. Secure cable to the traced pipe in the 5 o'clock or 7 o'clock position with fiberglass tape on 12" centers. Loop cable at valves, flanges, and unions to allow adequate slack cable such that the valve flanges and unions can be removed without removing the cable.

2. Where the traced piping is PVC, install heat transfer foil as recommended by the manufacturer.

C. Thermostats: Install ambient sensing thermostats for control of freeze protection heat cable in locations where shown on the drawings or as directed by the Engineer.

D. This Contractor shall coordinate installation of power connections to thermostats and heat cable with EXISTING CONDITIONS.

E. Provide insulation and jacketing for the traced piping as specified in Section 15180. Do not install insulation until the heat cable has been tested.

F. Labeling: Install labels on heat traced piping that indicates that the pipe is electrically traced.

3.02 TESTING: Test heating tape and cable to demonstrate proper operation. Repair or replace damaged tape and cable. Retest to ensure proper operation.

END OF SECTION

SECTION 23 05 48 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10 “HVAC General Requirements” apply to all work specified in this section.

B. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

1.02 DESCRIPTION:

A. Provide vibration isolators for mechanical equipment to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected by the isolator manufacturer in accordance with the weight distribution of the actual equipment provided so as to produce a uniform deflection.

B. Special care should be taken when selecting vibration isolators and housekeeping pad thickness to insure sufficient height to the drain pan outlet of air handling equipment to allow installation of the water seal and sufficient slope to the drain.

C. There shall be no direct contact of isolated piping or equipment with partitions, conduits, floor slabs or walls.

D. Where spring isolators are exposed to the outside, spring shall be neoprene coated or cadmium plated.

1.03 COORDINATION:

A. The isolation devices and channel frames shall be products of a single vibration manufacturer. Submittal data shall include size, type, load and deflection of each isolator selected. Submittal data shall also include clearly outlined procedures for setting and adjusting all isolation devices. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of the type used so that any changes required during construction and checking can be accomplished promptly.

B. Coordinate the vibration supports with the manufacturer of the equipment to be isolated. Prior to submitting detailed shop drawings to the Engineer for review, the equipment manufacturer shall approve the shop drawings in writing.

1.04 QUALITY ASSURANCE:

A. Where shown, scheduled, or specified, provide specific vibration isolation equipment, manufactured by Amber-Booth, Consolidated Kinetics Corp., Korfund Dynamics Corp., Mason Industries, Inc., or Vibration Eliminator Co. Where specific type of vibration isolation equipment is not shown or specified, furnish isolators as recommended by one of the isolation manufacturers listed above, compatible with equipment arrangements shown.

PART 2 - PRODUCTS

2.01 MOUNTINGS:

A. Type "A" double deflection neoprene mountings. Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered and have friction pads at both top and bottom. Bolt holes shall be provided as required. Mounting shall be equal to Mason type ND or DNR.

B. Type "B" Spring Mountings. Spring isolators shall be free-standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the base-plate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 80% of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height, and solid spring height. Spring mounting shall be equal to Mason type SLF.

C. Type "C" housed spring mounting with limit stop. Springs in housing shall be as specified above. Housing shall include vertical resilient limit stops to prevent spring extension when weight is removed as when equipment is drained. The housing shall serve as blocking during erection and the installed and operating heights shall be the same. Spring diameters shall be no less than 80% of the compressed height of the spring at rated load. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Mountings used outside shall be hot dipped galvanized.

2.02 ISOLATION HANGERS:

A. Type "D" Isolation Hangers. Vibration hangers shall contain a spring and a double deflection neoprene element in series. Neoprene elements shall have a minimum defection of 0.30 inches. Spring diameter shall be no less than 50% of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Spring diameter and hanger box lower hole shall be larger enough to permit the hanger rod to swing thru a 30 deg. arc before contacting the hole and short circuiting the spring**.** Isolation hanger shall be equal to Mason Type 30N or PC30N.

B. Rigid type couplings equal to Victaulic Style 005, 07 and W07, may be used on IPS steel piping systems, which meet the support and hanging requirements of ASME B31.1, B31.9 and NFPA 13. An adequate number of flexible type couplings equal to Victaulic Style 75 or 77 shall also be used to compensate for thermal expansion/contraction of the pipe.

2.03 BASES:

A. Type "G" Steel Base. All mounts shall be spring type as specified herein. Height saving brackets shall be employed in all mounting locations. Furnish integral structural steel bases. Bases shall be rectangular in shape. All perimeter members shall be WF beams with a minimum depth equal to 1/10th of the longest dimension of the base. Base mounting to be equal to Mason Type WF.

B. Type "H" Cradle Base-Steel. Provide steel members welded to height saving brackets for machines having legs or bases that do not require a complete supplementary base. Members shall be sufficiently rigid to prevent stress in the equipment**.** Cradle base shall be equal to Mason Type ICS.

C. Type "J" Floating Concrete Base. Furnish rectangular structural channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. Channel depth shall be a minimum of 1/12th of the longest dimension of the base but not less than 6". Forms shall include 1/2" reinforcing bars welded in place on 6" centers running both ways in a layer 1/2" above the bottom and drilled steel members with sleeves welded below the holes to receive the equipment anchor bolts. Floating concrete bases shall be equal to Mason Type K.

D. Type "K" curb mounted aluminum bases. Curb mounted roof top equipment shall be mounted on vibration isolation bases that fit over the curb and under the isolated equipment. The extruded aluminum top member shall overlap the bottom member to provide water runoff independent of the seal. The aluminum member shall house cadmium plated springs having a 1" minimum deflection with 50% additional travel to solid. Spring diameter shall not be less than 80% of the spring height at the rated load. The weather seal shall be a continuous closed cell sponge material above and below the base and a flexible connection joining the outside perimeter of the aluminum member. Aluminum bases shall be equal to Mason Type CMAB.

2.04 FLEXIBLE PIPE CONNECTORS:

A. Flexible connectors shall be the twin-sphere type, made of multiple plies of nylon cord fabric and neoprene, hydraulically molded. Connectors through 1-1/2" shall have threaded ends and connectors 2" and larger shall have flanges with recessed groove to receive the connector's raised neoprene face. Connectors 12" and larger operating above 100 psig shall have isolated limit stops to prevent over-extension and over-compression. Limit stops shall be either control cables with neoprene isolated end fittings and anti-compression stops, or spring loaded control units. Connectors shall be line size and shall be designed for the pressures and temperatures encountered in the system, minimum 150 psig and 220 deg. F. Flexible pipe connectors shall be equal to Mason Type MFTNC.

B. Type "M" flexible metal hose. Flexible stainless steel hose shall have stainless steel braid and carbon steel fitting. Flexible metal hose connectors shall be equal to Mason Type BSS.

C. Flexible type grooved joint mechanical couplings equal to Victaulic Style 75 or 77 may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration

2.05 FLEXIBLE DUCT CONNECTORS:

A. Flexible duct connectors shall be non-combustible. Material shall be glass fabric double coated with neoprene (30 ounce per square yard minimum). Flexible connectors shall be a minimum of 4 inches long. Flexible connectors shall be pre-assembled metal-to-fabric-to metal; fabric shall be attached to metal with a double lock grid. Provide flexible connectors to meet or exceed the requirements of the Contract Documents as made by Duro-Dyne, Young Regulator or Vent Fabrics.

2.06 PIPE ANCHORS:

A. Acoustical pipe anchor shall consist of telescopic arrangement of two steel tubing separated by minimum half inch thickness of heavy duty neoprene. Vertical restraints shall be provided to prevent vertical travel in either direction. Allowable loads on the isolation material shall not exceed 500 psi; the design shall be balanced for equal resistance in any direction.

2.07 PADS:

A. Pads shall be of the neoprene waffle type with identical rubber grids molded back to back. The interconnections shall form suction pockets for gripping smooth steel as well as rough surfaces regardless of how the pad is cut. The square waffle pattern shall be layered out on 1/2 inch centers. Provide pads equal to Mason Type W.

2.08 PIPE/DUCT LAGGING:

A. Barrier shall be constructed of .10" thick barium sulphate loaded limp vinly sheet bonded to a thin layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 1 psf and shall have a minimum STC rating of 28. The barrier shall exhibit a minimum flammability rating of0.0 seconds for flame out and afterglow and 0.2 inches for char length when tested in accordance with Federal Test Standard Number 191-5903. The barrier shall have a minimum thermal conductivity "K" value of 0.29 and a rated service temperature if 40°F to 220 °F. When tested for Surface Burning Characteristics per ASTM E-84, the barrier will have a Flame Spread Index of no more than 10 and a Smoke Development Index of no more than 40.

B. The decoupling layer shall be a combination of 2" fiber glass batting, non woven porous scrim-coated glass cloth, quilted together in a matrix of 4" diamond stitch pattern which encapsulates the glass fibers. The barrier shall be type KNM and the decoupling layer shall be type KFA by Kinetics. The composite material shall be fabricated to include a normal 6" wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints. Nominal barrier width 54", nominal decoupler with 48".

C. Provide pipe/duct lagging materials equal to Kinetics Noise Control.

PART 3 - EXECUTION

3.01 GENERAL:

A. Furnish mounting type and static deflection as follows:

Type of Equipment			Type Mounting	Minimum Static Deflection Inches
1.	Refrigeration Machines			
	a.	Reciprocating Compressors	A	0.35
		Or	B-H	1.50
	b.	Reciprocating Condensing	C	1.50
	c.	Pad Mounted Condensing	Unit	PAD
	d.	Air Cooler Chillers	B-K	1.50

2.	Pumps			
	a.	Close Coupled To 7-1/2 HP and over	B-J	0.75
	b.	Flexible Coupled To 125 HP	B-J	1.50
3.	Fans and Air Handling Equipment Up to 50 HP			
	a.	Suspended Units	D	1.00
	b.	Utility Set Floor Mounted	B	1.50
4.	Utility Sets			
	a.	Suspended	B-H	1.00
	b.	Utility Set Floor Mounted	B	1.00
5.	Packaged Air			
	a.	Handling Equipment Up to 10 HP	B	0.75
	b.	15 HP and Over	B	1.50

B. Piping shall be isolated with "D" hanger within the mechanical room or within 50 feet of the vibrating equipment which ever is greater. Maximum deflect shall not exceed 2".

C. Provide type M-L flexible pipe connectors on the equipment side from shut off valves at the pump suction and discharge and at other locations shown on the Drawings.

D. Provide waffle type pads under chiller and condenser water riser clamps. On risers exceeding stories or 80 feet in height, piping shall be supported by Type B spring mountings.

E. After installation, verify that isolators are properly adjusted, with springs perpendicular to base housing, adjustment bolts are to be tightened up on equipment mountings. Insure that all hangers are not cocked.

F. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. All grooved joint couplings shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

END OF SECTION

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABILITY:

A. All work specified in this Section shall comply with the provision of Section 15010, “Mechanical General”.

B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take-off, and 40'-0" maximum spacing on exposed straight pipe runs.

C. All new underground plastic piping outside the building shall have #14-copper (TW) tracer wire attached to pipe. Install directly above pipe a continuous 6-inch wide vinyl plastic tape with printing identifying buried service, 12 inches below finished grade, during backfilling operation.

PART 2 - PRODUCTS

2.01 PIPE MARKINGS: Pipe markings shall be manufactured preprinted markings may be used in accordance with the following:

1. No tape or self-adhering markers will be allowed.

2. Snap on pipe markers, W. H. Brady Co. or approved equal are acceptable.

3. Markers shall be strapped on with nylon fasteners.

4. Markers will be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

2.02 BAND AND LETTER SIZE: Band and letter sizes shall conform to American Society of Heating, Air Conditioning Engineers (ASHRAE) standards of the following table:

O.D. of Pipe	Width of Color Band	Size of Letter/Numbers
1-1/4” and smaller	8”	½”
1-1/2” to 2”	8”	¾”
2-1/2” to 6”	12”	1– ¼”
6” to 10”	24”	2– ½”
Over 10”	32”	3- ½”

2.04 IDENTIFICATION:

A. Band legend and color and letter color shall conform to the following table:

Piping Band	**Legend**	**Letters**	**Band Color**
Chilled Water Supply	CHWS	White	Aqua Green
Chilled Water Return	CHWR	White	Aqua Green
Condenser Water Supply	CWS	White	Light Blue
Condenser Water Return	CWR	White	Light Blue

Piping Band	Legend	Letters	Band Color
Boiler Make-up Water	BW	White	Green
Hot Water Heating Supply	HWS	Black	Yellow
Hot Water Heating Return	HWR	Black	Yellow
Drain	D	Black	Green

B. All equipment, such as air units, condensing units, pumps, chillers, fans, etc., furnished by this Contractor, shall be permanently labeled, in an approved manner, corresponding to the mark or name shown on the drawings and/or specifications, or Owners' sequences.

C. For applications where existing color schemes may already be in place, all new work requiring identification and color coding shall match the existing color schemes.

PART 3 - EXECUTION

3.01 EXECUTION:

A. Locate pipe identification in the following areas:

1. Each riser and each valve,

2. One on each side where piping pass thru walls and floors,

3. Locate at or near each change in direction,

4. Every 40 feet along continuous runs,

5. Located within 4 feet of exit or entrance to a vessel or tank.

B. Indicate pipe content flow direction with arrows of matching style and placed so the arrow points away from the legend.

C. If manufactured preprinted markings are used they shall be attached to the piping with self-locking nylon fasteners.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General Requirements and Division 01 00 00 Specification Sections apply to work in this section.

1.02 SUMMARY:

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Airside systems: Supply air, return air, relief air, exhaust air, and outside air systems, all pressure ranges; Waterside systems: pumps, boilers, chillers, air system units, unit heaters, etc.; Verify temperature control systems operations.

C. This Section does not include:

1. Specifications for materials for patching mechanical systems; specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.03 SCOPE OF WORK:

A. A Test and Balance Agency that is independent of the HVAC contractor or manufacturer shall perform the testing, adjusting and balancing and prepare reports, and deliver them to the Architect. The independent Test and Balance Agency shall be a certified member of the Associated Air Balance Council (AABC). The Test and Balance Agency contract shall not be assigned to any Subcontractor; the Agency shall work directly under the General Contractor.

B. Total System Balance shall be performed in accordance with the 6th edition of the AABC National Standards for Total System Balance, and in accordance with the scope of work defined by the Contract Documents.

C. Testing and Balance Agency as part of its contract shall act as an authorized inspection agency, responsible to the Owner's Representative, and shall, during the test and balance, list systems that are installed incorrectly, require correction, or have not been installed in accordance with Contract Drawings and Specifications.

D. Upon the completion of the test and balance work, the Agency shall compile the test data and submit the specified number of copies of the complete report to the Owner's Representative for his evaluation and approval.

E. Test, adjust and balance the air and water systems. After testing, adjusting, and balancing is complete, the Contractor shall visit the job during the heating cycle and during the cooling cycle to make adjustments to provide uniform temperatures throughout the building. Schedule the trips during the months of December through February for the heating cycle, and June through August for the cooling cycle. Obtain signed statements from the Using Agency acknowledging these two trips and subsequent adjustments. Submit statements to the Architect.

F. General contractor shall furnish test and balance contracting agency for this project. The Test and balance agency shall work under the direction of the Professional.

1.04 DEFINITIONS:

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air and water distribution systems;

2. Adjustment of total system to provide design quantities;

3. Electrical measurement;

4. Verification of performance of all equipment and automatic controls;

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns as applicable at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (sub-mains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets and return outlets on air terminals and exhaust or return inlets on air terminals such as fans, rooftop units, registers, grilles, diffusers and louvers.

H. Main: Duct containing the system's major or entire air flow.

I. Sub-main: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct serving two or more terminals.

K. Branch: Duct serving a single terminal.

1.05 SUBMITTALS:

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Certified Representative and Technicians Data:

1. Submit proof that the Test and Balance certified representative assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Certified Reports: Submit testing, adjusting, and balancing reports bearing the certified seal and signature of the Test and Balance representative. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 3 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 4 complete sets of final reports.

3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

    a. General Information and Summary
    b. Air Systems
    c. Temperature Control Systems
    d. Special Systems

4. Report Contents: Provide the following minimum information, forms and data:

    a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Owner, Owner's Representative, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance registered representative. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

D. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.06 QUALITY ASSURANCE:

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems specified to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The independent testing, adjusting, and balancing agency certified by Associates Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one registered in the State in which the services are to be performed, certified by AABC as a Test and Balance representative.

C. Codes and Standards:

1. AABC: "National Standards For Total System Balance".

2. ASHRAE: ASHRAE Handbook, 2007 HVAC Applications Volume, Chapter 37, Testing, Adjusting, and Balancing.

1.07 FINAL INSPECTION:

A. All systems, when completed, shall be operated by the organization to test the performance as directed by and to the satisfaction of the Using Agency.

B. Systems shall be balanced within the stated tolerances at the design conditions. The Owner's Representative may request or perform a check reading on up to 10 per cent of the outlets and duct traverses. If any reading varies beyond the stated tolerances, the system will be considered out of balance and the entire system be readjusted and a new report prepared at no additional cost to the Owner.

C. Heating, ventilation and air conditioning systems shall maintain uniform temperatures without drafts through the normal change of seasons. The Owner's Representative may request new design settings on up 20 per cent of the air outlets and coil connections for final adjustment of the system during the first year of operation at no additional cost to the Owner.

D. Air ducts shall circulate without excessive noise.

E. All defects demonstrated by inspections and tests shall be remedied immediately to the Architect' satisfaction.

1.08 PROJECT CONDITIONS: Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS: Except as otherwise indicated, use same products as used by original Contractor for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

PART 3 - EXECUTION

3.01 REQUIRED DOCUMENTS:

A. The Contractor shall provide the following, in a timely fashion, to the Test and Balance Agency:

B. Contract drawings (complete set)

C. Applicable specifications (Div. 23 & 26, as a minimum)

D. Related addenda

E. Related change orders

F. Related reviewed shop drawings

G. Related reviewed equipment manufacturer's submittal data

H. Reviewed equipment control drawings

3.02 COOPERATION:

A. The Contractor and his subcontractors shall cooperate fully with the Test and Balance Agency and provide:

1. Completely operable systems

2. The right to adjust the systems

3. Access to systems components

3.03 BELT DRIVES:

A. Adjustable speed drives are to be adjusted by the Test and Balance Agency. In cases where the specified capacities cannot be obtained with the original adjustable sheave or original fixed drive sheave, the Agency is to report to the Contractor the sheave size required to obtain the specified capacity.

B. Where larger or smaller sheave sizes are required, the Contractor shall provide new sheaves and, if required, new belts at no additional cost to the Owner.

3.04 CONTROL PERFORMANCE CHECK: The results produced by the operation of rooftop and fan systems controls shall be checked by the testing agency; controls requiring adjustment shall be listed and reported to the Contractor. This does not reduce the responsibility of the Contractor for the checking and adjustment required for a fully operational control system. The Test and Balance Agency is responsible only for final settings; the Contractor is responsible for completeness and correctness of all the control systems.

3.05 SETTINGS: The Test and Balance Agency shall permanently mark the settings of all dampers, valves and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.

3.06 MEASUREMENTS:

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

E. Take all reading with the eye at the level of the indicated value to prevent parallax.

F. Take measurements in the system where best suited to the task.

3.07 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Cut insulation and ductwork, for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

B. Patch insulation, ductwork, and housings, using materials identical to those removed. Seal ducts, and test for and repair leaks. Seal insulation to re-establish integrity of the vapor barrier.

C. Mark equipment settings, including damper control positions, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

D. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.08 RECORD AND REPORT DATA:

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.09 REPORT:

A. The following items shall be tested, recorded, and incorporated in the test and balance report. The report shall not be limited to these items, but shall include these tests as minimum requirements.

1. Record each equipment manufacturer, model numbers and serial numbers.

2. Test, adjust and record required and measured total CFM and GPM for each air and water system and component. Test and record quantity of exhaust or relief air in CFM.

3. Test, adjust and record all required and measured outside air quantities and return air CFM.

4. Test and record required and measured system static pressures; filter differential, air and water coil differential, and fan total static pressure. Test and record water pressure drop through the water coils and air system units.

5. Record all installed fan drive assemblies; fan sheaves, motor sheaves, and belts.

6. Record each installed motor manufacturer.

7. Record each installed motor horsepower.

8. Test and record each motor name plate and measured voltage and full load amperage.

9. Test, adjust, and record each blower RPM.

10. Test and adjust the CFM delivery of each diffuser, grille, and register.

11. Identify the location of each diffuser, grille, and register.

12. Record the size, type, and manufacturer of each grille, register and diffuser.

13. Data obtained for each diffuser, grille and register shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.

14. All diffusers, grilles, and registers shall be adjusted to minimize drafts.

15. All tests shall be made with supply, return, relief and exhaust systems operating, and all doors, windows, etc. closed or in their normal operating condition.

16. All damper positions shall be permanently marked after air balancing is complete.

17. The final balanced condition of each area shall include the testing and adjusting of pressure conditions. Front doors, exits, etc., should be checked for air flow so that exterior conditions do not cause excessive abnormal pressure conditions.

18. Indicate on floor plans the locations and results of the sound measurements taken.

3.10 SYSTEM BALANCING REQUIREMENTS: Testing, adjusting and balancing shall be provided for all airside and waterside systems and equipment specified and indicated in the Contract Documents.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. All work specified in this Section is subject to the provisions Section 15010, “Mechanical General”.

1.02 DESCRIPTION:

A. All insulation products used outside of mechanical rooms shall meet NFPA requirements for Flame Spread Rating 25, Smoke Developed Rating 50, and Fuel Contributed 50.

B. Staples shall not be used for securing insulation. All insulation shall be installed in accordance with the insulation manufacturer's recommendations. Insulation shall be continuous through wall, ceiling, floor and roof openings and sleeves, except at fire/smoke dampers.

C. Supports for insulated piping shall be outside the insulation. Inserts shall be provided at hangers. Inserts shall be Foamglass Insulation, Calcium Silicate or Perlite and shall be 2" longer than the pipe shields. Pipe shoes welded to the pipe shall be used for roll type hangers.

D. All required tests of the relevant section of pipe, ductwork, or equipment shall be completed before insulation is applied.

E. Do not store materials in building until it is enclosed and dry. Wet insulation shall not be installed.

F. Insulation products with self-sealing type jacket shall not be applied at temperatures below 40°F.

G. Clean and dry all surfaces to be insulated from loose scale, dirt, oil, rust, moisture and other foreign matter.

H. Insulate completely all metal surfaces of piping, and pumping equipment other than hangers.

I. Surface finishes shall present a tight smooth appearance.

J. Permit expansion and contraction without causing damage to insulation or surface finish.

K. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation.

L. Vapor barriers must be continuous and uninterrupted throughout the system where specified except where insulation is interrupted for fire dampers. See details for special conditions.

1.03 PIPING:

A. Insulate all valves, strainers, pumps and fittings. For the purposes of this Specification, fittings include unions and flanges. Use premolded material where available. Insulate valves up to and including bonnets.

B. Pipe Hangers that are installed in direct contact with the surface of the pipe, such as a pipe clamp shall have the insulation applied over the hanger as well as the pipe. Provide a rain shield on piping supported on hangers outdoors to prevent bulk water from entry.

1.04 DUCTWORK: Insulation shall cover all standing seams and metal surfaces. Materials shall be applied subject to their temperature limits.

1.05 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations. Insulation shall be applied by experienced workers regularly employed for this type of work. Material shall be furnished to the job bearing the manufacturer's label.

C. Insulation products shall be as manufactured by Pittsburgh Corning Corporation, Knauf, Resolco, Owens-Corning, Certainteed or Armstrong.

1.06 FITTING COVERS AND JACKETS: Where applicable, provide and install PVC covers and jacketing on fittings with fiberglass insulation as manufactured by Johns Manville Zeston 300 Series.

PART 2 - PRODUCTS

2.01 CELLULAR GLASS PIPE INSULATION:

A. Insulation shall be cellular glass insulation as manufactured by FOAMGLAS® in accordance with ASTM C552, “Standard Specification for Cellular Glass Thermal Insulation, by Pittsburgh Corning Corporation whose quality system for manufacturing, inspecting and testing of FOAMGLAS® insulation is certified to meet the requirements of ISO 9002.

B. Jacketing for indoor applications shall be fire retardant, all purpose jacketing of kraft paper/aluminum foil/vinyl coating construction available from sources and provide PVC jacketing.

C. Joint Sealant shall be PITTSEAL® 727, non-curing butyl sealant as manufactured by Pittsburgh Corning Corporation and is the preferred sealant for chilled water applications.

D. Vapor Retarder Mastic Finish shall be PITTCOTE® 300 Finish, an asphalt mastic coating as manufactured by Pittsburgh Corning Corporation.

E. Weather barrier mastic shall be PITTCOTE® 404 coating, an acrylic latex mastic coating as manufactured by Pittsburgh Corning Corporation.

F. Tape shall be 0.75∀ wide fiber reinforced tape such as Scotch #880 or equal.

G. Provide pipe saddles on all FOAMGLAS piping. The insulation shall not bear the weight of the piping. Where the piping is supported on the exterior of the insulation, provide a load bearing insert on the pipe bottom to support the pipe weight.

H. Cellular glass pipe insulation equal to FOAMGLAS® shall be used on the following pipe systems:

INSULATION THICKNESS IN INCHES FOR PIPE SIZES

	Temperature Up to	**Up to 1"**	**1 ¼" to 2"**	**2 ½" to 3 ½ "**	**4" & Over**
Condenser water supply and return piping	85-95°F	½"	1"	1 ½"	2"
Heating water supply piping	250ºF	1"	1 ½"	1 ½"	2"
Heating water return piping	250ºF	1 ½"	2"	2 ½"	3 ½"
Chilled water supply and return piping	40-55°F	½"	1"	1 ½"	1 ½"

2.02 PREMOLDED RIGID PHENOLIC PIPE INSULATION:

A. Thermal insulating materials shall be CFC free and comply with ASTM C1126-00. The thermal insulation materials shall not exceed a flame spread or smoke development index of 25/50 when listed in accordance with ASTM C84-002.

B. Insulation shall be equal to Resolco Insul-phen rigid phenolic manufactured in accordance with ASTM C1126-00 (Types II and III, Grade I).

C. Pipe insulation shall be fabricated in half sections for smaller size piping. For larger diameter piping where half sections are not practical, curved sidewall segments may be utilized.

D. Pipe supports shall be Resolco Insul-phen Insulated Pipe Support Inserts, which shall be constructed from a full circumference of Resolco Insul-phen high density rigid phenolic insulation to withstand the bearing loads transmitted from the pipe to the support.

E. Insulation shall have service jacketing (ASJ) finish. Provide and install a 180° metal support saddle bonded to the bottom section of the support. The support saddle may also be factory applied between the insulation and ASJ.

F. Vapor retarder jacketing, depending upon application, shall be flexible, low permeance vapor retarder jacket, which meets or exceeds the requirements of ASTM C1136-00 (Type 1). Jacketing shall be selected from commercially available fire retardant all service jacketing (ASJ) made of kraft paper/aluminum foil (minimum, 1 mil)/vinyl coating, or foil reinforced kraft jacketing (FRK).

G. Vapor retarder mastic shall be solvent based or water based mastic per manufacturer's recommendations, e.g. Foster Monolar II Mastic 60-38 (solvent based – outdoors), Foster Vapor Safe Coating 30-80 or 30-90 (water based – indoors) or equal as approved by the Engineer of Record.

H. Joint Sealant/Vapor Stop shall be a high solids containing non-setting butyl rubber product e.g. Foster Flextra Vapor Stop Sealant 95-50 or equal as approved by the Engineer of Record. For applications outside of the limiting temperatures of this product, please refer to the manufacturer for alternatives.

I. Insulation adhesive shall be e.g. Foster Stic-Safe Adhesive 95015 (solvent based), Foster Multi-Purpose Adhesive 97-15 (water based) or equal as approved by the Engineer of Record. For applications outside of the limiting temperatures of these products, please refer to the manufacturer for alternatives.

J. Caulking Sealant for Hot Insulation Systems to Seal Seams and Around Protrusions on Metal Jacketing – Where non-PVC jacketing is used, shall be silicone or butyl rubber compound e.g. Foster Elastolar metal sealant 95-44 or equal as approved by the Engineer of Record. For applications outside of the limiting temperatures of this product, please refer to the manufacturer for alternatives.

K. Metal bands shall be ½∀ or ¾∀ aluminum or stainless steel, to be determined by type and size of application.

L. Fiber reinforced strapping tape shall be 1∀ wide high tensile strength fiber reinforced strapping tape.

M. PVC cement shall be e.g. Proto PVC Cement or equal as approved by the Engineer of Record.

N. 2 mil foil tape shall be minimum 3∀ wide contact adhesive 2 mil aluminum foil tape, e.g. Compac Corporation STD 120/6 or equal as approved by the Engineer of Record.

O. Material thickness for various pipe diameters shall be as per manufacturer's recommendations.

P. At the contractor's option, rigid phenolic insulation equal to Resolco Insul-phen may be used on the following pipe systems. Contact FGH Fabricators, Inc. 9550 Bamboo Road, Houston, TX 77041, Telephone 713.462.7050.

INSULATION THICKNESS IN INCHES FOR PIPE SIZES

	Temperature Up to	**Up to 1"**	**1 ¼" to 2"**	**2 ½" to 3 ½ "**	**4" & Over**
Chilled water supply and return piping	40-55°F	½"	1"	1 ½"	2"
Heating water supply and return piping	140-250°F	1"	1 ½"	1 ½"	2"
Drains connecting air conditioning equipment	40-55ºF	½"	1"	1"	1 ½"
Domestic chiller water	55-65ºF	½"	1"	1"	1 ½"

2.03 FOAMED PLASTIC SHEET AND TUBING:

A. Sheet Insulation shall be equal to Armstrong Armaflex. Minimum of 4.5 lbs. per cu. ft. Thermal conductivity shall not exceed 0.28 at 75° F mean temperature.

B. Insulate the following products with 1 ½" Armstrong Armaflex insulation. All seams shall be sealed watertight in accordance with manufacturers recommendations.

1. Expansion Tanks
2. Air Separator Tanks

C. Insulate with 1-1/2" Armstrong Armaflex foam plastic sheet adhered to removable 16 gauge galvanized sheet casing:

1. Condenser & Chilled water pumps (including standby)

2.04 EXTERIOR WRAP FOR ROUND DUCTWORK:

A. Insulation equal to Knauf Duct Wrap. Insulate externally, all round ductwork with 2" thick blanket fiberglass duct insulation. All seams to be taped with pressure sensitive tape and banded with nylon ties on 3'-0" centers.

B. The board type shall have a minimum 3# density, 1 ½" thick with ASJ jacket. Insulation board shall have an average conductivity not to exceed 0.27 BTU/inch/ square foot/degree F / hour at a mean temperature of 75°F.

2.05 ACOUSTICAL DUCT LINER:

A. Duct liner shall be equal to Knauf Textile Duct Liner. Acoustical duct liner shall be a flexible type with a minimum 1" thickness using long fiberglass with a smooth firmly bonded fire-resistant surface to prevent erosion of the insulation. Surface not to exceed 25 flame spread and 50 smoke development. Thermal conductivity shall not exceed 0.26 at 75° F. mean temperature.

B. Noise reduction coefficient (NRC) shall not be less than .60 based on acoustical materials test, Mounting No. 6. Completely coat all duct surfaces with Benjamin Foster 85-15 adhesive. Neoprene coated side on liner shall face air stream. Sections shall be jointed by coating the edges with Foster 30-36. Secure liner to duct system with self-adhering pins adhered to clean surface and secure with self locking washers, space pins not more than 4" from the edges and not more than 16" on centers. Lining shall meet National Board of Fire Underwriters' Standards for Internal Duct Application and shall have a minimum density of 3 lbs. per cu. ft. All duct liner shall be marked with the density located so as to be visible on the exposed surface of the liner. Air friction correction factor shall not exceed 1.40 at 2000 FPM and 1.5 at 4000 FPM.

C. Insulate all rectangular supply, return, and outside air ductwork internally as described in Paragraphs A and B.

2.06 ADHESIVES, MASTIC, COATINGS:

A. Benjamin Foster, Childers, Insul-Coustic, EPOLUX, Minnesota Mining and Manufacturing Co.

B. Treatment of pipe jackets and duct facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Vapor barriers shall have a perm rating of not more than .05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than .25 perms.

2.10 TAPE: Wherever tape is used for sealing purposes, it shall be of the type and shall be applied as recommended by the non-conductive covering manufacturer. Where recommendation is lacking, the tape used shall be sealed with Minnesota Mining Adhesive EC-1329.

2.11 INSULATING CEMENT: Insulating cement shall be O-C 110 mineral wool Benjamin Foster or Minnesota Mining, all purpose cement. Where insulating cement is applied to pipe fittings in concealed locations, it shall be "one-coat" cement.

2.12 GLASS CLOTH JACKET: Glass cloth jacket on piping shall be standard weight.

2.13 WEATHERPROOFING: Protect piping insulation exposed to weather outside the building with Pabco Insulating Division corrugated aluminum sheets of .016 thickness and aluminum formed elbows with leak proof beads and epoxy coated interior.

PART 3 - EXECUTION

3.01 GENERAL:

A. Surfaces to be insulated shall be clean, dry, and free of foreign material, such as rust, scale and dirt when insulation is applied. Perform pressure tests required by other Sections before applying insulation.

B. Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.

3.02 INSULATION FOR ALL PIPING SYSTEM:

A. Insulate pipe, fittings, flanges, unions and valves.

B. Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal seams and end laps. Do not use scrap pieces of insulation where a full length section will fit.

C. Install insulation, jackets and coatings continuous through wall and floor openings and sleeves.

D. Fittings, valves and flanges shall be insulated with field fabricated multiple mitered segments of molded fiberglass insulation of the same thickness as adjoining pipe insulation. Secure fitting insulation segments with 20 gauge galvanized steel wire and apply a smoothing coat of insulating cement. White fabric and mastic shall be used on exposed fittings.

E. Application of all materials shall be in accordance with the manufacturer's instructions.

F. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint straps furnished with insulation.

G. Care shall be taken so as not to place insulation over vent and drain inlets and outlets.

H. Staples are not permitted on pipe insulation.

I. Insulate all chilled water and refrigerant piping appurtenances subject to sweating, such as thermometer wells, gauge cocks, and valve stems with preformed and mitered fiberglass pipe insulation. Finish with white vapor barrier mastic.

3.03 CELLULAR GLASS INSULATION FOR PIPING:

A. This portion of the application procedure is applicable for piping in all indoor areas, including concealed spaces, mechanical rooms and inhabited areas.

B. Insulation shall be applied to piping with all joints sealed full depth with joint sealant. All joints shall be tightly filled with no voids. Joint sealer shall not be used to fill voids or cracks. Insulation shall be secured with reinforced tape when jacketing is applied separately, two strips of taper per section of insulation. The tape shall overlay by 50%.

C. Insulation as specified in this section shall be in half sections or curved sidewall segments for larger diameter piping.

D. Apply all-purpose jacketing in accordance with manufacturer's instructions ensuring a minimum 2∀ lap at all joints, both circumferential and longitudinal. Laps shall be either adhesive faced (self-seal) or sealed by field application of appropriate adhesive. Staples shall not be used. Additionally, secure insulation and jacket with two (2) bands per insulation section evenly spaced.

3.04 PREMOLDED RIGID PHENOLIC INSULATION FOR PIPING:

A. Pipe and Small Cylindrical Equipment – Insulation as specified in this section shall be in half sections or curved sidewall segments for larger diameters. Whenever possible the insulation shall have a factory applied flexible, low-permeance ASH vapor retarder over its outlet surface, which meets or exceeds the requirements of ASTM C1136-00.

B. Where as ASJ vapor retarder is installed, apply minimum 3∀ wide matching butt strips to all circumferential joints with a 50% overwrap. It is recommended on pipe with insulation O.D. of greater than 12∀, to apply the strips on 12∀ centers.

C. On components where ASJ vapor retarder may not be available factory applied, it is necessary to field apply the vapor retarder. In these circumstances, cover all insulation with a field applied ASH vapor retarder.

D. Where it is necessary to field apply the vapor retarder, insulation without an ASJ vapor retarder shall be secured with fiber reinforced strapping tape as specified in 4.12 on 9∀ maximum centers.

E. All valves and flanges shall be insulated to the same thickness as the pipe, allowing space for flange and valve bolt removal without disturbing the pipe insulation.

F. Fittings shall be 2-piece preformed insulation. Where formed elbows are unavailable or impractical, fabricated with mitered segments in accordance with ASTM C450-9e1, MICA Standards or TIAC Standards.

G. All terminations shall be sealed with a vapor retarder mastic and fabric system. The mastic shall extend onto the pipe and the insulation vapor retarder.

H. At pipe supports, the insulation and vapor retarder shall be continuous and shall not be interrupted by the support. The pipe support insulation shall extend at least 1∀ on either side of the metal saddle to allow sealing of joints between the pipe support and the adjacent insulation. The vapor retarder shall be completed by the use of an ASJ overlap and factory applied self seal lap tape.

3.05 INSULATION EXPOSED TO WEATHER OUTSIDE THE BUILDING: Finish with standard weight glass cloth set in a 1/16 coat of vapor barrier. After drying, apply a 1/16 coat of weatherproof vapor barrier similar to SEAL KOTE. Protect insulation including elbows with .016" thick corrugated aluminum, overlap two inches, locate seams to shed water, and secure with a minimum of three aluminum bands per section. Oversize insulation to allow for heat tape. Apply insulation after piping has been painted and heat tape has been installed.

3.06 PROTECTION OF UNDERGROUND STEEL PIPING: Under ground piping, not mill coated and wrapped, shall be wire brushed and painted two field coats of cold applied, self priming coal tar equal to Koppers Bitumastic No. 50. After installation and testing, paint all joints and fittings as specified for pipe.

3.07 INSULATION FOR DUCT SYSTEM:

A. Secure insulation to duct with Benjamin Foster 85-15 adhesive applied in 4 inch strips around the duct on 8 inch centers. Nylon cord shall be used to secure the insulation. Where ductwork is 36" wide or more secure insulation to the bottom of the duct using self adhering pins and self locking washers placed not more than 18 inches on center. Insulation shall overlap lining and factory applied insulation a minimum of 2 inches. Vapor barrier at all butted joints or breaks shall be sealed with 4" inch wide foil reinforced tape adhered with Benjamin Foster 82-07.

B. Insulate ductwork exposed to the weather that is not lined with glass fiber semi-rigid board insulation 1½" thick, 3 lbs. per cubic feet density. Secure to metal with self-adhering pins with self locking washers. Finish with standard weight glass cloth set in 1/16" weatherproof mastic similar to Seal-Kote. After drying, apply a 1/16" finish coat of waterproof mastic. Butt insulation joints and seal with mastic.

3.08 INSULATION FOR EQUIPMENT: Secure insulation with insulation hangers and self locking washers, copper weldwire or galvanized bands. Miter to ensure a tight fit. Seal joints with mineral wool insulating cement. Finish with standard weight glass cloth set between two 1/16" coats of white mastic. Insulate flanged ends of strainers, pumps, removable head sections, access plates and coupling with a removable 18 gauge aluminum casing, lined with foamed plastic sheeting adhered to the inside of all surfaces subject to sweating. Casing shall be fabricated in two sections and joined with galvanized steel bolts. Casing shall be removed and reinstalled without damage to surrounding insulation.

END OF SECTION

SECTION 23 07 20 HVAC UNDERGROUND PIPING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the HVAC General Requirements, Section 23 05 10 apply to all work specified in this Section.

B. Refer to Specification Section 23 05 53, titled "Identification for HVAC Piping and Equipment" for piping systems identification requirements.

C. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the HVAC systems.

D. Refer to Specification Section 23 05 29, titled "Hangers and Supports for HVAC Piping and Equipment" for specification and installation requirements of the pipe support system.

E. Refer to Specification Section 23 05 12, titled "HVAC Pipe, Fittings and Accessories" for specification and installation requirements for piping specialties.

1.02 DESCRIPTION OF WORK:

A. Extent of the piping systems work is indicated on the Drawings and schedules and by the requirements of this section.

1.03 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. All welders shall be certified by ANSI B31.1.0-1967 "Standard Qualification Welding Procedures, Welders and Welding Operators" or "Qualification Tests" in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests for positions 2G and 5G shall be made in strict compliance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by the Contractor. Two (2) copies of the qualification test report and certification with welder's identification number, letter, etc., shall be delivered to the Engineer, via the Architect, for his file before any welding commences. Each weld shall bear the welder's identification mark permanently indented in the weld. No welding shall be done when the ambient temperature is below 0°F.

C. Underground conduit system shall be as manufactured by Thermacor Process, Ric- Wil, Perma-Pipe, Rovanco, or approved equal.

PART 2 - PRODUCTS

2.01 UNDERGROUND CHILLED WATER PIPING:

A. Jacket shall be high density, polyethylene (HDPE), conforming to ASTM D1784. Minimum wall thickness for 12” OD and smaller to be 0.125” and sizes larger than 12” to have a minimum thickness of 0.150”

B. Insulation shall be formed in place closed cell polyurethane foam completely filling the annular space between the pipe and outer HDPE jacket with a minimum thickness of one inch. Insulation shall be rigid, 90% minimum closed cell polyurethane with 2.5 to 3.5 pounds per cubic foot density and coefficient of thermal conductivity (K factor) of 0.14 at 75°F. per ASTM C-518, CFC-free and comply with HH-I-1751/4.

C. Carrier pipe equal to Thermacor Ferro-Therm PTS system. Carrier pipe to be Grade B, standard weight schedule 40 black steel enclosed in closed cell polyurethane foam insulation with a high density polyethylene (HDPE) jacket. Insulation shall have a K factor of 0.14 @ 75°F, providing thermal efficiency for temperatures ranging from -300° F to 250° F.

D. Jacket piping ends shall have factory applied mastic coating to assure moisture protection at all couplings.

E. Prefabricated ells, loops and tees shall be furnished where shown and shall consist of carrier pipe, insulation and PVC jacket conforming to the same specification as for straight runs.

F. Provide sleeves at all building and manhole entries. The annular space between the sleeve and conduit shall be sealed with a mechanical rubber seal provided by the conduit manufacturer. The sleeve shall be equipped with a leak plate 4 inches larger in diameter than the sleeve with the plate welded to the sleeve. Terminal ends shall be sealed against moisture with mastic provided by the jacketed piping manufacturer. Connecting piping in building and manholes shall be anchored at a maximum of 5 feet from the point of connection.

G. Provide thrust blocks of the size and location as recommended by the conduit manufacturer.

H. Units and fittings shall be jointed with manufacturer's furnished kits. Field joints shall not be applied until after carrier pipe has been tested and approved.

PART 3 - EXECUTION

3.01 INSTALLATION OF UNDERGROUND CHILLED SYSTEMS:

A. The services of a factory trained employee of the manufacturer shall be present at the job site during critical periods of the installation such as unloading, commencement of installation and testing. Backfill shall not commence until approval of tests by manufacturer's, representative. Upon completion of the installation, the manufacturer shall provide a certificate that the installing contractor has accomplished the working accordance with the manufacturer's directions. Additionally, the installing contractor shall certify that he has complied with the manufacturer's directions. When the manufacturer’s representative is on site, the Contractor must obtain a daily written report from the installation instructor of the system supplier. The written report shall be presented to the Contractor on the same day it is prepared and one copy shall be forwarded to manufacturer's office and the Architect. The report shall state whether or not the condition and quality of materials used and the installation of the system are in accordance with the plans, specifications and published literature and is satisfactory in all respects. The installation instructor shall not be a sales agent or sales representative. He must be employed by the system supplier for the sole purpose of performing installation instructions.

B. Cathodic protection shall be provided for buried conduit. The pipe supplier shall have a sample of earth tested to determine the extent of protection needed and include in pricing.

3.02 TESTING:

A. A hydrostatic test of the piping at 150 psi or one and one-half times the system pressure, whichever is greater, shall be performed for a period of 4 hours. Backfilling shall be in accordance with Division 02.

B. All field welds at conduit closures shall be air tested for leaks before applying final coating and blanket. During test all field welds shall be checked with soapsuds, and re-welded if necessary until air tight at 15 lbs. pressure.

3.03 SUBMITTAL REQUIREMENTS:

A. A 2" x 3" sample cut of the steel pipe and coating must be submitted for approval.

B. Published literature describing the system specified must be part of submittal data.

C. Layout drawings shall be submitted for the following items:

1. Piping system

2. Anchor Details

3. Floor and Wall Seals

3.04 WARRANTY:

A. Underground conduit and piping systems shall have a manufacturer's warranty for 1 year from finished installation.

END OF SECTION

SECTION 23 09 11 VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10, “HVAC General Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. Furnish and install all required equipment, appurtenances, and accessories for a complete heating and cooling system.

D. See other sections of these specifications that may specify accessories or features.

E. Refer to the schedules on the drawings where equipment capacities are not included in this section.

F. Review other sections of the specifications and the plans for services required to each piece of mechanical equipment. Any required accessories, appurtenances, or service omitted from the plans or specifications that are not called to the attention of the Architect at least 72 hours before bidding and corrected by addendum shall be provided as though shown.

1.02 ACCEPTABLE MANUFACTURERS:

A. Acceptable manufacturers of adjustable frequency controllers are Magnetek, Parametric or Eaton provided the equipment meets or exceeds the requirements of the Contract Documents. The manufacturer shall have a local distributor with repair parts in stock.

1.03 COORDINATION:

A. Motors required in connection with equipment shall be of sufficient size and speed for duty to be performed, not exceeding their full-rated load when driven equipment is operated at specified capacity under most severe conditions likely to be encountered.

B. Submit all equipment for approval.

PART 2 - PRODUCTS

2.01 COORDINATION:

A. The units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

2.02 VARIABLE FREQUENCY DRIVES:

A. Provide and install for pumps indicated on drawings variable frequency drives as follows. Install electrical service between motors and drive.

1. Variable Frequency Drives: Each VFD shall have an automatic and a manual bypass switch and contactor mounted within a common, NEMA 1 enclosure.

2. VFD Input Power: Shall be 480/3/60. The VFD shall tolerate plus or minus 10% voltage and plus or minus 5% Hz.

3. VFD Output Power: Shall vary frequency to the motor from 0 to 400 Hz to vary the motor speed in proportion to the motor nameplate rated speed, with output voltage variation from zero to motor rated voltage for optimum voltage per hertz ratio for air handling unit motor loads. Output current shall be rated at 150% of the VFD'S constant torque rating. The output must be voltage source type generating a sine coded pulse width modulated waveform utilizing an asynchronous carrier frequency. The carrier frequency shall be adjustable to minimize harmonically induced noise or vibration. These criteria shall be accomplished by using microprocessor based techniques.

4. VFD Power Structure: The power structure converting AC power to variable frequency output power shall consist of three functional stages:

a. Input Stage: Shall convert three phase AC line power to a fixed DC bus voltage with a solid state, three phase full wave diode rectifier with metal oxide varistor three phase protection. Displacement power factor shall be .98 throughout the speed range.

b. Intermediate Stage: Shall be interfaced with the VFD diagnostics to provide continuous monitoring for power component protection. The DC bus shall be fused for short circuit protection and shall have capacitive filtering to provide smooth DC power to the output stage.

c. Output stage: Shall utilize switching transistors to convert DC bus power to sine coded pulse width modulated output current of all three phases to the motor. Current transformers shall be provided to detect current utilization by the microprocessor to provide information generation for overload protection, three phase current limit, ground fault and short circuit protection.

5. Operation and Protective Functions:

a. Provide adjustable DC injection braking, selectable for deceleration braking or braking before start (anti-windmill).

b. Provide with three (3) adjustable prohibited frequency ranges to avoid mechanical resonant vibration.

c. Provide with auto speed reference loss detection which shall automatically drop the VFD to a present speed until auto speed command is restored.

d. Provide with programmable automatic restart for up to ten attempts of automatic restart.

e. The VFD shall "ride through" a power loss of up to two (2) seconds.

f. Provide with reverse run inhibit which shall prevent reverse rotation even if started into a reverse wind-milling load.

g. Provide with input electrical power protection, including phase reversal, phase loss, under and over voltage protection, etc.

6. Bypass Control shall be provided within a common NEMA enclosure which shall allow the motor to run at full speed with line power while the VFD is being serviced or is out of service. The bypass and the VFD shall be electrically interlocked to prevent line power and the VFD output being connected to the motor at the same time. The unit shall be so constructed that the VFD can be removed and the bypass remain in service.

NOTE: VFD shall default in the full run mode meaning motor shall be fully powered.

7. Quality Assurance

a. All printed circuit boards shall utilize surface mounted devices to provide higher reliability and strengthened printed circuit assembly. Printed circuit boards shall be “burned in” for at least 96 hours. Circuit boards shall be tested to accepted quality level (AQL) of .5%.

b. The fully assembled VFD shall be factory tested with fully loaded induction motor.

c. The VFD shall be UL listed, and constructed per NEMA and IEEE standards.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.

C. Coordinate all work with other trades as necessary for proper interfacing.

D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 AIRFLOW CONTROL SYSTEM INSTALLATION:

A. The electrical contractor shall wire a dedicated 120 VAC single phase power circuit to each wall-mounted power supply. ATC contractor shall install all wall-mounted power supplies.

B. The ATC contractor shall install 20 psi clean, pneumatic supply air to all airflow control valves.

C. The ATC contractor shall terminate and connect all cables for the airflow control system. All cable and connectors shall be furnished by the ATC Contractor. Each signal wire shall be tagged with an alpha-numeric code specified on Phoenix Controls' wiring diagrams.

D. The mechanical contractor shall install all airflow control valves in the duct work. After said installation, the mechanical contractor shall make all clevis and cotter pin connections for actuators and reversing linkages, as well as pivot arm pin connections for constant volume valves. All reheat coils, transitions and insulation shall be furnished by the mechanical contractor.

3.03 START-UP:

A. The initial start-up shall be made by an authorized representative of the equipment manufacturer. System start-up shall be provided by a factory authorized representative of the isolation room airflow controls manufacturer. Said start-up shall include verification of proper installation and wiring and verification of proper operation of the airflow control systems. The balancing contractor shall be responsible for final verification and reporting of all airflows and pressurization.

B. The airflow control system manufacturer shall furnish a minimum of four hours of owner training to provide an overview of the job specific airflow control components, general troubleshooting procedures, and operation of the isolation room monitor.

3.04 ADJUSTMENT:

A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section is subject to the provisions of Section 23 05 10 and Electrical Division 26.

B. The Control Contractor shall furnish all labor, materials, wiring, equipment and services necessary for proper extension of the existing Building Management System (BMS). The existing BMS system is a **Trane Tracer Summit** and it is intended that this system be extended to control all new equipment as indicated on the plans and in the specifications.

1.02 SECTION INCLUDES:

1. Products Furnished But Not Installed Under This Section
2. Products Installed But Not Furnished Under This Section
3. Products Not Furnished or Installed But Integrated with the Work of this Section
4. Related Sections
5. Description
6. Approved Control System Contractor
7. Quality Assurance
8. Codes and Standards
9. System Performance
10. Submittals
11. Warranty
12. Ownership of Proprietary Material

1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION:

A. Division 15 - Hydronic Piping:

1. Control Valves
2. Flow Switches
3. Temperature Sensor Wells and Sockets
4. Flow Meters

B. Division 15 - Ductwork Accessories:

1. Automatic Dampers
2. Airflow Stations
3. Terminal Unit Controls

1.03 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Division 15 – Heat Generation Equipment

1. Boilers

B. Division 15 – Refrigeration Equipment

1. Chiller controls

C. Division 15 – Air Conditioning Equipment

1. Discharge Air Temperature Control
2. Economizer Control
3. Air volume control

D. Division 15 – Variable Frequency Drives

1. Pump controls

E. Division 16 – Utility Metering Equipment

1. Electrical meters

1.04 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 1.

B. The following sections constitute related work:

1. Division 15 - Basic Mechanical Requirements
2. Division 15 - Air Distribution Materials and Methods
3. Division 15 - Refrigeration Piping
4. Division 15 - Valves, Fittings, and Piping Accessories
5. Division 15 - Refrigeration Equipment
6. Division 15 - Air Handling Equipment
7. Division 15 - Air Distribution
8. Division 15 - Test and Balance
9. Division 16 - Basic Electrical Requirements
10. Division 16 - Basic Electrical Materials
11. Division 16 - General Wiring
12. Division 16 - Equipment and Motor Wiring
13. Division 16 - Uninterruptible Power Supply
14. Division 16 - Emergency Systems
15. Division 16 - Fire Alarm Systems

1.05 DESCRIPTION

A. General: The control system shall be as indicated on the drawings and described in the specifications, and consist of a peer-to-peer network of digital building control panels and operator workstation(s). The operator workstation shall be a personal computer (PC) including a color monitor, mouse and keyboard. The PC shall provide users an interface with the system though dynamic color graphics of building areas and systems.

B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.

C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by operator password. An operator shall be able to log onto any workstation of the control system and have access to all designated data.

D. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.

E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. A modem or network communications card shall be provided to for remote access to the system.

1.06 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. Approved Control System Contractors and Manufacturers:

Manufacturer Name	Product Line	Contractor Name/Address	Contact
Trane	Tracer Summit	Terry Trane Service Agency	Chad Moore

1. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.07 QUALITY ASSURANCE

A. System Installer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years.

2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.

3. The installer shall have an office within 50 miles of the project site and provide 24-hour response in the event of a customer call.

1.08 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state and federal authorities. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)

3. International Mechanical Code (IMC)
4. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
5. ANSI/EIA/CEA-709.1 (LonTalk)

1.09 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points with current data displayed within 20 seconds of the request.

2. Graphic Refresh. The system shall update all dynamic points with current data within 30 seconds.

3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.

4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.

5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

8. Multiple Alarm Annunciation. All workstations on the network shall receive alarms within 5 seconds of each other.

9. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C[±0.25°F]
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading *Note 1
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale *Note 2
Electrical Power	± 5% of reading *Note 3
Carbon Monoxide (CO)	± 5% of reading
Carbon Dioxide (CO2)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)
Note 2: for both absolute and differential pressure
Note 3: * not including utility supplied meters

1.10 SUBMITTALS

A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications. Six (6) copies are required. All shop drawings shall be provided to the Owner electronically as .dgn or .dxf file formats.

B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.

1. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.

2. Submit the following within 60 days of contract award:

a. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
b. A schedule of all control valves including the valve size, model number (including pattern and connections), flow, CV, pressure rating, and location.
c. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.

d. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:

1) Building Controllers
2) Custom Application Controllers
3) Application Specific Controllers
4) Operator Interface Computer(s)
5) Portable Operator Workstation
6) Auxiliary Control Devices
7) Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling
8) Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled
9) Points list showing all system objects, and the proposed English language object names
10) Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project
11) Color prints of proposed graphics with a list of points for display

C. Project Record Documents. Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.

2. Testing and Commissioning Reports and Checklists.

3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:

a) Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
b) Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
c) Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
d) Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.

e) A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
f) One set of electronic media containing files of all color-graphic screens created for the project.
g) Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.
h) Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
i) Licenses and warranty documents for all equipment and systems.
j) Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

D. Training Materials: The Contractor shall provide a course outline and training material for all training classes at least six weeks prior to the first class. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.11 WARRANTY

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.

2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.

3. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.

4. The system provider shall provide a web-accessible system and support on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.

1.12 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed hardware and software shall become the property of the Owner. These items include but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code
5. All documentation

PART 2: PRODUCTS

2.0 SECTION INCLUDES

A. Materials
B. Communication
C. Operator Interface
D. Application and Control Software
E. Building Controllers
F. Custom Application Controllers
G. Application Specific Controllers
H. Input/Output Interface
I. Auxiliary Control Devices

2.1 MATERIALS

A. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 2 years. The installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing. Spare parts shall be available for at least 5 years after completion of this contract.

2.2 COMMUNICATION

A. LonTalk sub-networks shall be used for communications between Building Controllers, Custom Application Controllers and Application Specific Controllers.

B. The controls Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the DDC system internetwork.

C. All Building Controllers shall have a communications port for connections with the operator interfaces. This may be either a network interface node for connection to the Ethernet network or an RS-232 port for Point to Point connection.

D. Remote operator interface via a 56K baud modem shall allow for communication with any and all controllers on this network as described in the following paragraph.

E. Communications services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:

1. Connection of an operator interface device to any one building controller on the internetwork will allow the operator to interface with all other building controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all building controllers shall be available for viewing and editing from any one building controller on the internetwork.

2. All database values (i.e., points, software variable, custom program variables) of any one building controller shall be readable by any other building controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to a point name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communications services to perform internetwork value passing.

F. The time clocks in all controllers shall be automatically synchronized daily.

2.3 OPERATOR INTERFACE

A. Operator Interface. Furnish 1 PC based workstations as shown on the system drawings. Each of these workstations shall be able to access all information in the system. These workstations shall reside on the Enterprise wide network, which is same high-speed network as the building controllers. The Enterprise wide network will be provided by the owner and supports the Internet Protocol (IP). Workstations shall also be able to dial into the system.

B. Workstation information access shall use the BACnet Protocol. Communication shall use Annex J of ASHRAE Standard 135-2004. Local connections of the workstation shall be on ISO 8802-3 (Ethernet). Remote communications shall use either the BACnet Point to Point Physical/Data Link Layer Protocol or IP over Point to point (PTP).

C. Hardware. Each operator workstation shall consist of the following:

1. Personal Computer. Furnish IBM-compatible PCs to be used as DDC system workstation. The CPU shall be a minimum of an Intel Pentium 4 or AMD Athlon 64 processor and operate at a minimum 2.2 GHz. Include a minimum 512 Megabytes of RAM, 48X CD ROM drive, 80 Gigabyte hard disk, and two-button mouse. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. The PC shall include a minimum 17", color monitor with 1024 x 768 screen resolution.

2. Modems. Furnish auto-dial telephone modems and associated cables as required for communication to remote buildings, and workstations. The modem shall be capable of transmitting at up to 56K baud, and communicate over voice-grade telephone lines.

D. System Software

1. Operating System. Furnish a commercially available, concurrent multi-tasking operating system. Acceptable operating systems are Microsoft Windows XP Professional.

2. System Graphics. The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while the system is on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions (V17). Graphics shall be capable of launching other PC applications.

3. Custom Graphics. Custom graphic files shall be created with the use of commonly available graphics packages such as Corel Paint Shop Pro. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as BMP, GIF and JPEG.

4. Graphics Library. Furnish a complete library of standard HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators, including 2-dimensional and 3-dimensional graphic depictions. The library shall include a minimum of 300 such files available for use by the Owner. This library shall also include standard graphical representations of equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

5. Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be Inch Pound.

E. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation.

1. Automatic System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any panel in the system. The storage of this data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel.

2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.

3. System Configuration. The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.

4. On-Line Help and Training. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all system functions and shall provide the relevant data for that particular screen. Additional help shall be available through the use of hypertext links onscreen.

5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.

6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

7. Alarm Notification. Alarm messages shall use full language, easily recognized descriptors for alarm. System shall allow the user to have up to 10 popup windows appear for incoming alarms. The popup dialog shall allow the user to silence and acknowledge alarms, view an expanded message or graphic, and add and save comments for the alarm.

8. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

9. Alarm Reactions. The operator shall be able to determine what actions, if any, are to be taken, by object, during an alarm. Actions shall include logging, printing, start a custom control program, displaying messages, dialing out to remote workstations, paging or text message to a cell phone, forwarding to an e-mail address, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device. For text messaging, the system shall support TAP protocol including parities 7-E-1 and 8-n-1, such that if the system fails to dial out/connect with one parity it will automatically try the other one.

10. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in up to 5 color-coded categories based on Owner preference (V17). Include an alarm count summary for each alarm category on the system toolbar. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation. Provide a comment field in the event log that allows a user to add specific comments associated with any alarm.

11. Trend Logs. The operator shall be able to define a trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 30 seconds,1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. Each trend shall accommodate up to 64 system objects. The system operator shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the workstation hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. Trends shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages.

12. Dynamic Graphical Trending. The system shall have the ability to save the data collected by a trend object and display that collected data in a graphical chart. Trend viewing capabilities shall include the ability to show up to 10 points on a chart, to include live and/or historical data. Each data point trend line shall be an individual color, and include on-graph icons that represent associated events/alarms, manual overrides, and automated changes that have occurred over the time frame represented on the chart. Navigation and viewing functions shall include scrolling and zooming of x and y axes, and a trace display of the associated time stamp, and values for any selected point along the x-axis. Trend data shall be able to be stored for up to 10 years on the PC workstation.

13. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics or through custom programs.

14. Clock Synchronization. The real time clocks in all building controllers and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks; daily from any operator designated device in the system. The system shall automatically adjust for daylight savings time if applicable.

15. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals. Provide a means to list and access the last 10 reports viewed by the user.

    a) Custom Reports: Provide the capability for the operator to define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title.

b) Standard Reports. The following standard system reports shall be provided for this project. These reports shall be readily customized to the project by the owner.

i. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand for each building meter. Provide an annual (12 month) summary report showing the monthly electrical consumption and peak demand for each meter.
ii. All Points in Alarm Report: Provide an on demand report showing all current alarms.
iii. All Points in Override Report: Provide an on demand report showing all overrides in effect.
iv. Schedule Report: Provide a summary of all schedules including Holiday and Exception schedules.
v. Commissioning Report: Provide a one time report that lists all equipment with the unit configuration and present operation.
vi. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12 month) report that shows the monthly consumption for each meter.
vii. Weather Data Report: Provide a monthly report showing the daily minimum, maximum and average outdoor air temperature and the number of heating and cooling degree days for each day. Provide an annual (12 month) report showing the minimum, maximum and average outdoor air temperature for the month and the number of heating and cooling degree days for the month.
viii. ASHRAE Standard 147 Report: Provide a daily report that shows the operating condition of each chiller as required by ASHRAE Standard 147. At minimum this report shall include:

1. Chilled Water (or other fluid) inlet and outlet temperature
2. Chilled Water (or other fluid) flow
3. Chilled Water (or other fluid) inlet and outlet pressures
4. Evaporator refrigerant pressure and temperature
5. Condenser refrigerant pressure and liquid temperature
6. Oil pressure and temperature
7. Oil level (if applicable)
8. Compressor refrigerant discharge temperature
9. Compressor refrigerant suction temperature
10. Manual entry field for addition of refrigerant
11. Manual entry field for addition of oil
12. Manual entry field for vibration levels
13. Motor amperes per phase
14. Motor volts per phase
15. Purge exhaust time or discharge count
16. Ambient temperatures (dry bulb and wet bulb)
17. Date and time data logged

F. Workstation Applications Editors. Each PC workstation shall support dedicated screens for editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the appropriate controller panels.

1. Controller. Provide a full screen editor for each type custom application, and application specific controller that shall allow the operator to view and change the configuration, name, control parameters, and system set-points.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. An advance and delay time for each object shall be adjustable from this master schedule. An operator shall be able to modify the schedule. Schedules shall be able to be easily copied between objects and/or dates.

3. Manual Control and Override. Provide a means of manually controlling analog and binary output points. Control overrides shall be performed through a simple, graphical on-off-auto editor for binary points, and auto-manual selector for analog control. Provide a icon indicator of override status when a point, unit controller or application has been overridden manually.

4. Air System Equipment Coordination. Provide editor screens with monitoring and control functions that group together and coordinates the operation of air handling equipment and associated VAV boxes as specified in the sequence of operations. For each air system, the editor pages shall include:

   a) System mode of the air handling system
   b) Listing and assignment of the associated air handler and VAV boxes
   c) AHU supply air cooling and heating setpoints
   d) AHU minimum, maximum and nominal static pressure setpoints
   e) VAV box minimum and maximum flow, and drive open and close overrides

5. Chiller System. A chiller plant control application shall be configured using a full screen editor and shall provide operating status for the system. The display shall include:

   a) System mode of the chiller plant
   b) Chiller enable/disable status
   c) System supply water setpoint
   d) System supply and return water temperature
   e) System Chilled water pump status
   f) System Chilled water flow
   g) Bypass pipe flow rate (if applicable)
   h) Messages as to when an additional chiller will be added or removed from operational sequence
   i) Chiller or system failure information
   j) Chiller rotation information
   k) Override capabilities to force an added chiller, subtract a chiller, or change of sequence.
   l) Control to remove a chiller from a sequence temporarily for service purposes.

G. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

H. Portable Operator's Terminal. Furnish a Portable Operator's Terminal that shall be capable of accessing all system data. This device may be connected to any point on the system internetwork or may be connected directly to any controller for programming, set-up, and troubleshooting.

The Portable Operator's Terminal shall be an IBM compatible notebook-style PC including all software and hardware required. The PC shall contain at minimum:

1. 1.7 GHz Intel Pentium Processor
2. 512 MB RAM
3. 40 Gbyte Hard File
4. 24X CD ROM Drive
5. Windows XP Professional operating system
6. 14" color display with minimum 1024 x 768 resolution

2.4 APPLICATION AND CONTROL SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security

1. User access shall be secured using individual security passwords and user names.

2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.

3. User logon/logoff attempts shall be recorded.

4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

1. Weekly Schedule. Provide separate schedules for each day of the week.

2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.

3. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

4. Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

D. Remote Communications. The system shall have the ability to transmit alarms to multiple associated alarm receivers. Receivers shall include PC Workstations, email addresses, cell phones and alphanumeric pagers. The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system utilizing the system Ethernet communications, or dial up communications via modem, in the same format and method used on site as described under the Operator Interface section of this specification.

E. Demand Limiting. The demand limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter, or from a watt transducer or current transformer attached to the building feeder lines.

1. The demand limiting program shall be based on a predictive sliding window algorithm. The sliding window duration and sampling interval shall be set equal to that of the local Electrical Utility.

2. Control system shall be capable of demand limiting by resetting HVAC system setpoints to reduce load while maintaining a widened band of comfort control in the space.

3. Input capability shall also be provided for an end-of-billing period indication.

F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.

G. Chiller Sequencing. Provide applications software to properly sequence the chiller plant to minimize energy use. This application shall perform the following functions:

1. The chiller plant control application shall have the ability to control up to 25 chillers as detailed in the sequence of operations.

2. This application shall be able to control both constant and variable flow systems as well as parallel, series and decoupled piping configurations.

3. The chiller plant control application shall be able to control multiple chiller plants per site.

4. Diagnostics/Protection - The chiller plant application program shall be able to integrate individual chiller diagnostics into control action decisions.

5. Event Processing - All chiller plant control and status events shall be recorded, at the operator's selection, in the building management system event log to facilitate troubleshooting.

6. Alarm Indications - The chiller plant control status screens shall display chiller plant and individual chiller alarm messages.

7. Add/Subtract actions - The status screens shall provide information on when the next chiller add or subtract action will occur. The operator shall have the ability to manually force a chiller addition or a chiller subtraction.

H. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.

I. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, workstation, or the operator display. The amount of time that the override takes precedence will be selectable from the workstation.

J. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.

K. System Calculations. Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.

L. Anti-Short Cycling. All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

2.5 BUILDING CONTROLLERS

A. General. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.

1. The Building Automation System shall be composed of one or more independent, standalone, microprocessor based Building Controllers to manage the global strategies described in System software section.

2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

3. The controller shall provide a communications port for connection of the Portable Operators Terminal.

4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

5. Controllers that perform scheduling shall have a real time clock.

6. Data shall be shared between networked Building Controllers.

7. The Building Controller shall utilize industry recognized open standard protocols for communication to unit controllers.

8. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:

   a) Assume a predetermined failure mode.
   b) Generate an alarm notification.
   c) Create a retrievable file of the state of all applicable memory locations at the time of the failure.
   d) Automatically reset the Building Controller to return to a normal operating mode.

B. Communications. Each Building Controller shall perform communications to a network of Custom Application and Application Specific Controllers using LonTalk FTT-10 and LonMark profiles.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 32 F to 120 F.

D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. The Building Controller shall have a display on the main board that indicates the current operating mode of the controller. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable. The primary logic board shall be removable without disconnecting field wiring.

E. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage

G. Building Controller Operator Display. Each building controller shall include an operator display allowing the user to perform basic daily operations tasks on the building automation system. At a minimum this operator display shall:

1. Be installed on the building controller and require no additional power source.

2. Consist of a one-quarter VGA touch screen with 320 X 240-pixel resolution. The brightness and the contrast of the backlit touch screen shall be adjustable to allow for easy reading of information on the screen.

3. Be capable of having unique user identification and passwords that can be programmed to limit access to the system and operator functions.
4. Display the current state of an input/output point and equipment controller connected to the system.

5. Give the operator the ability to override the current state of an output point or HVAC equipment controller connected to the building controller.

6. Allow the operator to modify the start and stop times of any time-of-day schedule within the system.

7. Provide a visual indication that a system alarm exists and allow for an optional audible alarm annunciation.

8. Provide the ability to view and acknowledge alarms that are annunciated at that building controller.

9. Allow the operator to view custom graphical displays with dynamic status information.

10. Automatically update displayed system information every 10 seconds.

As an alternative to providing Building Controller Operator Displays, the DDC contractor may provide one additional Portable Operators Terminal (as specified in section 2.3 - Operator Interface) for each room where Building Controllers are to be located. Include a plug-in communications port for connection of a Portable Operators Terminal in each location.

2.6 CUSTOM APPLICATION CONTROLLERS

A. General. Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.

1. The Controller shall have sufficient memory to support its operating system, database, and programming requirements.

2. Controllers that perform scheduling shall have a real time clock.

3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

4. The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode, and generate an alarm notification.

5. Custom application controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall be with the use of LonMark-approved SNVTs.

B. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 32 F to 120 F.

2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 158 F.

C. A local operator interface shall be provided at building locations where specified in the sequence of operations or point list. The operator interface shall be provided for interrogating and editing data. A system security password shall be available to prevent unauthorized use of the keypad and display.

D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.

E. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

2.7 APPLICATION SPECIFIC CONTROLLERS

A. General. Application specific controllers (ASC) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

1. Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.

2. Each ASC will contain sufficient I/O capacity to control the target system.

B. Environment. The hardware shall be suitable for the anticipated ambient conditions.

1. Controller used in conditioned ambient spaces shall be mounted in NEMA 1 type rated enclosures. Controllers located where not to be disturbed by building activity (such as above ceiling grid), may be provided with plenum-rated enclosures and non-enclosed wiring connections for plenum cabling. All controllers shall be rated for operation at 32 F to 120 F.

2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 150 F.

C. Serviceability. Provide diagnostic LEDs for power and communications. All wiring connections shall be clearly labeled and made to be field removable.

D. Memory. The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.

E. Immunity to Power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.

F. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

G. Application Specific Controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall follow LonMark profiles. ASCs which do not have a profile that applies must comply with LonMark standards, utilize SNVTs for all listed points, and be provided with a XIF file for self-documentation.

2.8 INPUT/OUTPUT INTERFACE

A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.

B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.

D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and also accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.

E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.

F. Binary outputs shall provide for on/off operation. Terminal unit and zone control applications may use 2 outputs for drive-open, drive-close (tri-state) modulating control. Binary outputs on custom application controllers shall have 3-mode (on/off/auto) program override control from the panel with output status lights.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the output device. Optional: Analog outputs on custom application controllers shall have a 2-mode (auto/manual) program override control, with manual output adjustment over 0-100% of range.

2.9 AUXILIARY CONTROL DEVICES

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.

2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.

3. Damper shaft bearings shall be as recommended by manufacturer for application.

4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.

5. All leakage testing and pressure ratings will be based on AMCA Publication 500.

6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.

B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.

C. Electric damper/valve actuators.

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.

3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.

4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.

6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

7. Actuators shall be Underwriters Laboratories Standard 873 listed.

8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

D. Control Valves

1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.

2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

a) Water Valves:
   i. Two-way: 150% of total system (pump) head.
   ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

3. Water Valves:

a) Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
b) Sizing Criteria:
   i. Two-position service: Line size.
   ii. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
   iii. Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), [5] psi maximum.
   iv. Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
   v. 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
c) Water valves shall fail normally open or closed as scheduled on plans or as follows:
   i. Heating coils in air handlers - normally open.
   ii. Chilled water control valves - normally closed.
   iii. Other applications - as scheduled or as required by sequence of operation.
d) Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

E. Binary Temperature Devices

1. Low-Voltage Space Thermostats shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented cover.

2. Line-Voltage Space Thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented cover.

3. Low-Limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

F. Temperature Sensors

1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.

2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5m [5 feet] in length.

3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.

4. Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings.

5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1 C [0.2 F].

6. The space temperature, setpoint, and override confirmation will be annunciated by a digital display for each zone sensor. The setpoint will be selectable utilizing buttons.

G. Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of ±5% R.H.

2. Duct sensors shall be provided with a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40 F to 170 F.

4. Humidity sensor's drift shall not exceed 1% of full scale per year.

H. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.

2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.

4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

I. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 20 ft minimum length. Element shall respond to the lowest temperature sensed by any one foot section.

2. Low limit shall be manual reset only.

J. Carbon Dioxide (CO2) Sensors

1. Carbon Dioxide sensors shall measure CO2 in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.

K. Flow Switches

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.

2. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified:

3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.

4. Current sensing relays may be used for flow sensing or terminal devices.

L. Relays

1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.

2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

M. Transformers and Power Supplies

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.

2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.

3. Unit shall operate between 0 C and 50 C.

4. Unit shall be UL recognized.

N. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

O. LOCAL CONTROL PANELS

1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide on/off power switch with over-current protection for control power sources to each local panel.

PART 3: EXECUTION

3.0 SECTION INCLUDES:

A. Examination
B. Protection
C. General Workmanship
D. Field Quality Control
E. Wiring
F. Fiber Optic Cable
G. Installation of Sensors
H. Flow Switch Installation
I. Actuators
J. Warning Labels
K. Identification of Hardware and Wiring
L. Controllers
M. Programming
N. Cleaning
O. Training
P. Acceptance

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The contractor shall inspect the site to verify that equipment is installable as shown, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.2 PROTECTION

A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 GENERAL WORKMANSHIP

A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.4 FIELD QUALITY CONTROL

A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.

C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.5 WIRING

A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these specifications. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence.

B. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:

C. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

D. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.

E. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).

F. Where class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 10 ft intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 5 ft intervals or more often to achieve a neat and workmanlike result.

G. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

H. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.

I. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

J. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.

K. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.

L. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.

M. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.

N. Adhere to Division 16 requirements for installation of raceway.

O. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

P. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

3.6 FIBER OPTIC CABLE SYSTEM

A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fibber bend radii as specified by cable manufacturer shall be maintained.

B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacture's specifications.

C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.7 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequate for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Install duct static pressure tap with tube end facing directly down-stream of air flow.

F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

G. All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.

H. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.

I. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.8 FLOW SWITCH INSTALLATION

A. Use correct paddle for pipe diameter.

B. Install and adjust flow switch in accordance with manufacturers' instructions.

C. Assure correct flow direction and alignment.

D. Mount in horizontal piping - flow switch on top of the pipe.

3.9 ACTUATORS

A. Mount and link control damper actuators per manufacturer's instructions.

1. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.

2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

3. Valves - Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturer's recommendations.

3.10 WARNING LABELS

A. Affix labels on each starter and equipment automatically controlled through the DDC System. Warning label shall indicate the following:

CAUTION This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Affix labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects. Labels shall indicate the following:

CAUTION This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.11 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1/2" letters on nameplates.

D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.12 CONTROLLERS

A. Provide a separate Controller for each major piece of HVAC equipment. A custom application controller may control more than one system provided that all points associated with that system are assigned to the same controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.

1. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.13 PROGRAMMING

A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming

1. Provide programming for the system as written in the specifications and adhere to the sequence strategies provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into any custom-written control programs sufficient comment statements or inherent flow diagrams to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. Operators' Interface

1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These standard graphics shall show all points dynamically as specified in the points list.

2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.

3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of 16 hours on-site. Tests shall be made in the presence of the Owner or Owner's representative.

E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.14 CLEANING

A. This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.

B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.

C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.15 TRAINING

A. Provide a minimum of 4 classroom training sessions, 4 hours each, throughout the contract period for personnel designated by the Owner. Computer-based audio-visual training may be substituted for up to 8 hours of hands on training.

B. Train the designated staff of Owner's representative and Owner to enable them to proficiently operate the system; create, modify and delete programming; add, remove and modify physical points for the system, and perform routine diagnostic and troubleshooting procedures.

C. Additional training shall be available in courses designed to meet objectives as divided into three logical groupings; participants may attend one or more of these, depending on the level of knowledge required:

1. Day-to-day Operators
2. Advanced Operators
3. System Managers/Administrators

D. Provide course outline and materials as per Part 1 of this Section. The instructor(s) shall provide one copy of training material per student.

E. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

F. Classroom training shall be done using a network of working controller's representative of the installed hardware or at the customer's site.

G. This training shall be made available in addition to the interactive audio-visual tutorial, provided with the system.

3.16 ACCEPTANCE

A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

ANNEX 1: INSTRUCTIONS TO OTHER CONTRACTORS

CONTROL VALVE INSTALLATION

A. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

B. All control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position.

C. Valves shall be installed in accordance with the manufacturer's recommendations.

D. Control valves shall be installed so that they are accessible and serviceable, and such that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

E. Isolation valves shall be installed such that control valve body may be serviced without draining the supply/return side piping system. {Note to designer: this must also be shown.} Unions shall be installed at all connections to screwed type control valves.

F. Provide tags for all control valves indicating service and number. Tags shall be brass, 1-1/2" in diameter, with 1/4" high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

ANNEX 1: INSTRUCTIONS TO OTHER CONTRACTORS

CONTROL DAMPER INSTALLATION

A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4" larger than damper dimensions and shall be square, straight, and level.

C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be equal ±1/8".

D. Follow manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

E. Install extended shaft or jackshaft per manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to assure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

G. Provide a visible and accessible indication of damper position on the drive shaft end.

H. Support duct-work in area of damper when required to prevent sagging due to damper weight.

I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

ANNEX 1: INSTRUCTIONS TO OTHER CONTRACTORS

DUCT SMOKE DETECTION

A. Provide complete submittal data to controls system contractor for coordination of duct smoke detector interface to HVAC systems. This contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

PART 4 - CONTROL SEQUENCE

4.01 EQUIPMENT ROOM VENTILATION CONTROL:

A. Room thermostat starts ventilation fans and opens motorized dampers on rise in temperature.

4.02 BUILDING EXHAUST FAN CONTROL:

A. Provide time of day control to start building exhaust fan. Fans shall operate only during occupied cycle.

4.03 BOILER CONTROL:

A. Boilers shall be enabled by an outdoor thermostat set at 65°F (adjustable from BMS) and shall operate under control of boiler-mounted panels. A three-way valve shall be provided to vary the discharge temperature inversely with outdoor temperature at a 1:1-1/2 ratio to provide 180°F water at 10°F outdoor temperature. A differential pressure switch shall verify operation of hot water pumps.

4.04 HEATING WATER PUMPS CONTROL:

A. Hot Water Heating System - The BAS shall start the lead pump below 65 F outside air temperature. After proof of flow, the boilers packaged safety and operating controls shall be enabled to maintain their setpoint.

1. The BAS shall reset hot water supply temperature by modulating a 3-way hot water valve. Reset schedule to be 180° F to 130 F hot water supply temperature as outside air varies from 10 F to 65 F (adjustable).
2. If the lead pump fails for 15 seconds or more, the lag pump shall start and an alarm shall be sent to the BAS.

3. Secondary Heating Water Pumps shall control system pressure to a setpoint of 15 psi (adj.) as required to provide sufficient flow to the heating coils. System pressure shall be maintained via Variable Frequency Drive control of pump volume. Syste Pressure and/or pressure differential shall be maintained as required. Provide necessary pressure transducers, etc. for a complet working system.

4.05 FIRE SAFETY INTERFACE CONTROL:

A. Duct mounted smoke detectors (furnished by Division 16), located as shown on plans, shall signal the fire alarm system upon detection of products of combustion. On indication of alarm, temperature controls shall be overridden on alarm floor. See smoke purge cycle described in Section 2.03 N.

4.06 SYSTEM OVERRIDE CONTROL:

A. Override cycle for any air handling system shall be initiated by telephone dial-up. During the override cycle, the self-contained VAV unit supplying the floor on which the suite is located shall be enabled. The hot water pump shall also be started if the outdoor temperature is below 65°F. All VAV terminals served by the system in the suite will revert to "occupied" status. The building exhaust fan and outside air supply fan will remain de-energized. The length of time for override cycle shall be pre-programmed and may be changed at any time. At the conclusion of override cycle, the system will return to its programmed normal status.

4.07 AIR COOLED CHILLER(S) SYSTEM CONTROL

A. General - The chiller plant control system shall monitor and control the chilled water system including the chiller(s), pump(s), and variable speed drives as appropriate.

B. The chiller plant control system shall have a fully editable user interface set-up via point and click on a standard windows screen. It shall not require special software tools or a building automation system technician to operate.

C. The chiller plant control system shall include the following features:

1. Operator interface
2. System Start/Stop
3. Chiller and pump sequencing
4. Chiller minimum flow by-pass valve control
5. System soft start
6. Automatic rotation of chillers and pumps
7. Failure recovery diagnostics/protection
8. Energy optimization routines
9. Chiller freeze protection
10. System and chiller status reports
11. Demand limiting

D. System Control Configuration Overview – Control of the system components shall be as follows:

1. The chillers shall receive enable/disable signals either through a command via a communication link or via a hardwired binary input.

2. A chiller binary output shall control the operation of the chiller evaporator isolation valve and/or call for pump operation.

3. The pump(s) speed shall be modulated to control the chilled water system supply / return pressure differential to the required setpoint.

4. The system minimum flow by-pass valve shall be a normally open valve.

5. The system minimum flow by-pass valve shall be modulated to the fully open position whenever the system is shutdown to ensure minimum flow and prevent the possibility of water hammer whenever a pump is started.

6. The system minimum flow by-pass valve position shall be modulated to ensure operating chiller(s) flow does not drop below the manufacturer's minimum recommended flow. Control shall be based on flow through the chiller evaporator by measuring pressure drop across the evaporator and calculating evaporator flow from manufacturer's data OR direct measurement using a calibrated flow meter.

7. Flow rate fluctuation through the chiller shall not exceed 30 percent of the design flow rate per minute.

E. Operator interface - The chiller plant control system shall include the following operator interface elements:

1. Operational status screen to include:

- Chiller System Status (Off/Soft Start/Normal/Ambient Lockout/Shutdown in Progress)
- Chiller Plant Supply Water Setpoint
- Chilled Water System Supply Water Temperature
- Chilled Water System Return Water Temperature
- Predictive chiller addition / subtraction status messages (i.e. "Next Chiller will be added if the system supply water temp 41.7 exceeds 43.5 degrees for 10 minutes.")
- Individual Chiller Failure Reset (Push Button)
- All Chiller Failure Reset (Push Button)
- System Pump Failure Reset (Push Button)
- Manual Addition of Chiller (Push Button)
- Manual Subtraction of Chiller (Push Button)
- Manual Rotation of Chiller Sequence (Push Button)

2. Screen that allows editing of the following data (to be performed without entering program code editor):

- Supply Water Setpoint
- System Soft Loading Parameters
- Ambient Lockout Parameters
- Chiller Addition Parameters
- Chiller Subtraction Parameters
- Auto Rotation Parameters
- Alarm Handling Setup
- Security Setup

3. Individual Chiller Graphic(s) to include all data listed on the supplementary Chiller System Point List, including:

- Chiller Name
- Chiller Operating Mode
- Chilled Water Setpoint
- Chiller RLA %
- Entering Chiller Water Temperature
- Leaving Chilled Water Temperature
- Evaporator Flow Rate
- Evaporator Flow Status

F. System Start/Stop - The chilled water system shall start in response to a binary signal from an external source such as the building automation system or the chilled water system shall start in response to a need for chilled water from any system load, with the option to use outside ambient temperature lockout.

1. Upon the start of the chilled water system the chiller plant control system shall automatically start Trend Log Reports to include:

a. Hourly logging of system shall include the following points:
- Outside Air Dry Bulb
- System Chilled Water Setpoint
- System Chilled Water Supply
- System Chilled Water Return Temperature
- Operating Status of each chiller
- Operating Status of system pumps

G. Sequencing - The chiller plant control system will start and stop the chilled water pumps and chillers based upon system load.

1. When the chilled water system is enabled the chiller plant control system shall:

a. Send and enable signal to the lead chiller
b. Upon receiving the enable signal the chiller shall enable the chiller evaporator isolation valve.
c. The isolation valve shall be controlled to 100% open.
d. When the isolation valve is confirmed to be 100% open, the chiller plant control system shall start the lead chilled water pump in the sequence.
e. The chilled water pump shall be controlled to maintain the design pressure setpoint for the system.
f. Upon confirmation of chilled water flow, the chiller shall continue its pre-start sequence and start its compressor(s).
g. Upon the start of each chiller the Chiller Plant Control system shall automatically start chiller specific Trend Log Reports to include:

1) Hourly logging of chiller
- Unit Chilled Water Setpoint
- Compressor(s) RLA
- Evaporator Entering Water Temp
- Evaporator Leaving Water Temp
- Evaporator Flow Rate
- Evaporator Approach Temp

2) Five-minute logging of chiller:
- Unit Chilled Water Setpoint
- Compressor(s) RLA
- Evaporator Entering Water Temp
- Evaporator Leaving Water Temp
- Evaporator Flow Rate

2. The chiller plant control system shall initiate the start of the next system chilled water pump when the pressure setpoint is not met for 5 minutes.

a. The active pumps shall run at the same speed.

3. The chiller plant control system shall initiate the shutdown of the next system chilled water pump whenever excess pump capacity exists for 5 minutes as determined by the pump speed, the system pressure, and the number of pumps running.

4. The chiller plant control system shall initiate the start of the next chiller in the sequence whenever the chilled water load, as determined by the system supply water temperature, is not met for 20 minutes.

   a. The chiller plant control system will unload operating chillers to an operator editable current limit prior to starting a lag chiller.
   b. Lag chillers shall start in a similar manner to the lead chiller start sequence.

5. The chiller plant control system shall initiate the shut down of the next chiller in the sequence whenever excess chilled water capacity exists, as determined by percent run load amps, for 20 minutes.

6. Upon sensing a chiller failure the chiller plant control system shall shut down the failed chiller immediately and initiate the start of the next chiller in the rotation sequence.

7. The chiller plant control system shall control individual chiller setpoints to maintain the system supply water temperature at setpoint.

8. The design system chilled water setpoint shall be 42 degrees F and editable by the operator.

H. Chiller Minimum Flow By-Pass Valve Control

1. The Chiller Minimum Flow By-Pass line and valve shall be sized to allow for the manufacturer's recommended minimum flow, with all load control valves closed, for the chiller with the largest minimum flow rate in the system.

2. The "Chiller Minimum Flow By-Pass Valve" shall be a normally open valve.

3. The "Chiller Minimum Flow By-Pass Valve" shall be modulated to the fully open position when the system is shutdown. This shall be done to prevent water hammer when a pump is started and to allow for minimum flow in the event the chiller calls for pump operation.

4. Following the confirmed start of the lead chiller and whenever system is enabled, the chiller plant control system shall modulate the "Chiller Minimum Flow By-Pass Valve" such that the chilled water flow through any operating chiller(s) shall not drop below the manufacturer's recommended minimum flow.

5. The chiller minimum flow shall be determined based on the pressure drop across the chiller evaporator barrel using a high accuracy pressure differential sensor. The differential pressure setpoint shall be determined based on the manufacturer's chiller pressure drop rating curves. ***OR*** The chiller minimum flow shall be determined by direct measurement using a flow meter on each chiller. The flow meter setpoint shall be determined based on the manufacturers recommended minimum chiller flow rate.

Note: If flow meter(s) are used, high accuracy flow meter(s) (±0.5% at calibrated flow, ±2% at other flow rates) should be specified. Flow meter(s) should be installed according to the manufacturer's specifications.

I. System Soft Start - The chiller plant control system will initiate a "soft start" mode whenever the system chilled water temperature exceeds the specified chilled water system setpoint by 20 degrees F at system start-up. The chiller plant control application will add cooling capacity during soft start mode only if return water temperature is not declining at a rate of at least 0.5 degrees F per minute. This prevents the unnecessary operation of chillers and limits system electrical demand during chilled water loop pull down.

J. Automatic rotation of chillers and pumps.

1. Chiller rotation shall be initiated based on an operator entered day interval or by the cycling of a binary point. The method of sequence shall be operator selectable.

2. Chiller cycling caused by normal system load fluctuations shall cause the chillers to change rotation sequence or at the operator's option chillers may be forced into the new rotation sequence at the time of sequence change.

3. Pump rotation shall be initiated by a schedule or by the cycling of a binary point.

K. Air-cooled chiller freeze protection

1. If required by the chiller manufacturer the chiller shall be permitted to start a pump for unit freeze protection.

L. Diagnostics/Protection - the Building Automation System shall be able to alarm from all sensed points and diagnostic alarms monitored by the chiller controller.

M. Chiller Status Report - Provide an operating status report for each chiller. The report(s) shall provide the present status for the following information to provide the operator with critical chiller operating data.

- Compressor On/Off Status
- Compressor Starts/Run Hours
- Compressor Phase 1/2/3 Percent RLA - separate for each compressor
- Compressor Current Draw - RLA Percent
- Active Chiller Diagnostics or Alarms
- Leaving Chilled Water Temperature
- Entering Chilled Water Temperature
- Evaporator Flow Rate
- Chilled Water Setpoint
- Refrigerant Temperature Evaporator - Separate for each circuit
- Operating Mode
- Chiller Model and Serial Number
- Outside Air Dry Bulb

N. Demand Limiting - As part of the demand limiting scheme on the building, the chiller plant control system shall be able to monitor and reduce peak power demand through the limiting of chiller current draw.

4.08 AIR HANDLING UNIT - 4 PIPE CHANGE OVER WITH ASC (APPLICATION SPECIFIC CONTROLLER)

A. Occupancy - The occupancy mode can be communicated or hardwired to the ASC via a binary input. Valid Occupancy modes for the ASC shall be:

1. Occupied: Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the ASC shall maintain the space temperature at the active occupied heating or cooling setpoint. The occupied mode shall be the default mode of the ASC.

2. Unoccupied: Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the ASC shall maintain the space temperature at the stored unoccupied heating or cooling setpoint. The hardwired or communicated setpoint shall not be used in unoccupied. When the space temperature exceeds the active unoccupied setpoint the ASC shall bring on 100% of the primary heating or cooling capacity.

3. Occupied Bypass: Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (configurable). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall run in occupied mode.

B. Heat Cool Mode- The Heat Cool mode can be set by a communicated value or automatically by the ASC. In standalone or auto mode the ASC shall automatically determine the Heat Cool mode by integrating over time between the active setpoint and the space temperature.

1. Heat Cool Setpoint- The space temperature setpoint shall be determined either by a local hardwired setpoint, the ASC default setpoint or a communicated value. The ASC uses the locally stored default setpoints when neither a local hardwired setpoint nor communicated setpoint is present. If both a hardwired setpoint and communicated setpoint exist, the ASC shall use the communicated value.

C. Cooling Operation - When the unit is in cooling mode, the ASC shall maintain the space temperature at the active cooling setpoint. Based on the ASC occupancy mode, the active cooling setpoint shall be one of the following:

Setpoint	Default Value
Occupied Cooling Setpoint	74°F
Unoccupied Cooling Setpoint	85°F
Occupied Standby Cooling S	78°F

The ASC shall use the measured space temperature, the active cooling setpoint and the discharge air temperature to determine the requested cooling capacity of the unit (0-100%). The outputs shall be controlled based on the unit configuration and the requested cooling capacity.

D. Heating Operation - When the unit is in heating mode, the ASC shall maintain the space temperature at the active heating setpoint. Based on the ASC occupancy mode, the active heating setpoint shall be one of the following:

Setpoint	Default Value
Occupied Heating Setpoint	71°F
Unoccupied Heating Setpoint	60°F
Occupied Standby Heating Setpoint	67°F

The ASC shall use the measured space temperature, the active heating setpoint and the discharge air temperature to determine the requested heating capacity of the unit (0-100%). The outputs shall be controlled based on the unit configuration and the requested heating capacity.

E. Transition from Unoccupied to Occupied - When the unit transitions from unoccupied mode to the occupied mode, morning warm-up/cool down and random start routines shall be activated.

1. Morning Warm-Up - When there is a call for heating and the space temperature is two degrees F or more below the occupied heating setpoint a morning warm-up sequence shall be activated. During warm-up the fan shall be turned on, the outside air damper shall remain closed, and the heating capacity shall be enabled at full capacity. When the space temperature reaches the occupied heating setpoint the ASC shall operate in occupied mode.

2. Morning Cool-down - When there is a call for cooling and the space temperature is two degrees F or more over the occupied cooling setpoint a morning cool-down sequence shall be activated. During morning cool-down the fan shall be turned on, the outside air damper shall remain closed, and the cooling capacity shall be enabled at full capacity. When the space temperature reaches the occupied cooling setpoint the ASC shall operate in occupied mode.

3. Random Start - A randomly generated 3-32 second delay shall be activated when electric power is applied to the ASC or after receiving a communicated occupied command.

F. Fan Operation - The fan shall always operate continuously in all occupied modes. During Unoccupied operation, the fan shall cycle between off and high regardless of the fan configuration. The fan can be configured to auto, to a specific fan speed, or to off. Configured as auto and with multiple speeds available, the fan shall automatically switch speeds depending on the difference between the zone temperature and the active zone temperature setpoint. The fan speed shall increase as the difference increases and decrease as the difference decreases. If the fan speed is configured as off, the ASC shall turn the fan off, close the valves, and close the outdoor air damper. The fan shall be configurable as off in either heating or cooling.

G. Hydronic Cooling Valve Control- If the unit is in the cooling mode the ASC shall modulate the cooling valve to maintain the space cooling setpoint. If the economizer function is enabled the cooling valve shall be closed. The cooling valve shall be closed if the fan is off or if the heating valve is open unless the unit is in the dehumidification mode. The cooling valve will be fully open if the outside air temperature is below the freeze avoidance setpoint 40°F, operator adjustable, and the fan is off.

H. Hydronic Heating Valve Control- If the unit is in the heating mode, the ASC shall modulate the hydronic heating valve to maintain the space heating setpoint. The heating valve shall be closed if the outside air damper is open past its minimum position or if the cooling valve is open unless the unit is in dehumidification mode. The heating valve shall be positioned to an operator configured position if the supply fan is off and the outdoor air temperature drops below the freeze avoidance temperature setpoint 40°F, operator adjustable.

I. Outside Air Damper Control - During all occupied modes the outside air damper shall be controlled to the effective minimum position 15% operator adjustable, unless ASHRAE Cycle I, ASHRAE Cycle II or economizing modes are active. During Unoccupied mode the outside air damper shall be closed. The ASC shall automatically adjust its minimum position when the fan speed is changed to ensure a constant minimum ventilation rate. The configured alternate minimum outside air damper position for low fan speed is 40%, operator adjustable.

J. ASHRAE Cycle II - The ASC shall allow the outdoor air damper to close when the zone air temperature is 3°F below the effective heating setpoint. Normal outdoor air damper operation shall return when the zone temperature is warmer than the heating setpoint minus two deg F.

K. Entering Water Temperature Sampling - Units with 4 pipe or 2 pipe changeover require a hardwired or communicated entering water temperature value to determine if the appropriate water temperature is present for the requested mode. To ensure a correct reading of supply water temperature, in case no water flow is present when the control valve is closed (2 way modulating valves), a sampling function shall open the control valve until the appropriate temperature is sensed or until the 3 minutes time limit expires. If the timer expires and the water temperature is still unsuitable the ASC shall close the valve and the routine shall be repeated one hour later.

L. The Building Automation System (BAS) shall send the ASC the occupied space heating and cooling temperature setpoints. The BAS shall also send the following commands:

Occupied
Unoccupied
Heat/Cool Mode
Economizer Enable
Priority Shutdown Commands

If communication with the BAS is lost, the ASC shall use predetermined default setpoints and operate in the occupied mode.

4.09 SAFETIES AND ALARMS

A. Space Sensor Failure - If there is a fault with the operation of the zone sensor module, it shall be feed back to the BAS. Zone sensor failure shall cause the unit to shutdown.

B. Fan Status - The ASC shall monitor the fan outputs to determine fan status and support a positive proof fan switch. If after a minute of energizing the fan output or during normal operation the fan status switch indicates no fan operation, the ASC shall perform a shutdown and generate a Fan Failure diagnostic. The diagnostic shall be reset manually.

C. Filter Status - A maintenance timer shall be incorporated into the ASC to signal a filter change after a configurable number of fan run hours.

D. Reset - All diagnostics shall be capable of being reset through the zone sensor, service tool, BAS, or by cycling power to the unit.

E. Low Temperature Detection - A binary signal will shut the unit down, close the outside air damper, and open all valves when the discharge air temperature falls below 35 °F. A Low Coil Temperature Detect diagnostic shall be generated.

F. Unoccupied Freeze Avoidance - The ASC shall open all valves when the outside air temperature drops below 38° F (operator configurable) during the unoccupied mode.

G. Discharge Air Tempering - The ASC shall prevent the discharge air temperature from falling below the discharge air control point low limit 45°F, operator configurable, allowing the unit to provide heating (when available) to raise the discharge air temperature to the discharge air control point low limit.

H. Fan Off Delay - After heating has being controlled off, the ASC shall keep the fan energized for an additional 30 seconds. The purpose of this action is to remove residual heat from the heating source.

I. Condensate Overflow - When the condensate overflow switch trips, the ASC shall close all valves, shut off the unit fan and close the outside air damper (if present).

J. The BAS system shall provide alarm messages for the following ASC diagnostics. The ASC shall initiate a failsafe operational sequence based on the diagnostic condition.

Diagnostic	Manual Reset required
Condensate Overflow	Yes
Low Coil Temperature Detection	Yes
Low Airflow- Fan Failure	Yes
Space Temperature Failure	No
Entering Water Temperature	No
Discharge Air Temp Limit	No
Discharge Air Temp Failure	Yes
Outdoor Air Temp Failure	No
Humidity Input Failure	No
Generic AIP Failure	No
Defrosting Compressor Loc	Yes
Maintenance Required	No
Local Fan Mode Failure	No
Local Setpoint Failure	No
Generic Temperature Failure	No

4.10 TROUBLESHOOTING

A. Manual Output Test - The ASC shall be able to manually exercise all outputs for troubleshooting. This shall be done directly from the controller board with no need of additional tools.

B. Unit Identification - The ASC shall have the capability of flashing and LED upon receiving a command from a service tool or BAS. The ASC shall also be able to send the unit neuron ID and Program ID to a service tool or BAS for unit identification from the controller board or space sensor with no need of additional tools.

C. Water Valve Override - This command from a service tool or BAS shall cause all valves to stroke fully open for water balancing.

4.11 COMMUNICATIONS

A. Data Sharing - All ASC's shall be able to communicate in a peer-to-peer environment over a twisted pair of communications wire.

B. Master/Slave - Master/Slave shall be used for operating multiple units from a single space sensor. The Master unit shall share space temperature, setpoint, heat/cool mode, occupancy, fan speed, entering water temperature, economizer, and capacity control algorithm data over a twisted pair of communication wire to ensure seamless cooperation between the units.

4.12 CHILLER PLANT VENTILATION CONTROL SEQUENCE:

A. Multi-port refrigeration monitor will monitor for the presence of refrigerant in two (2) different locations in the chiller plant. Upon detection of a refrigeration leak, audio/visual alarm (Qty. 1) will be started.

B. Upon detection of a refrigeration leak, the control system will start the refrigeration evacuation fan on the roof, and open outside air louver control dampers to provide proper ventilation for the chiller in leak alarm.

PART 5 - CONTROL POINTS

5.01 CONTROL POINTS:

A. Furnish as a minimum the points as shown on the point schedule on the next page(s).

END OF SECTION

SEE ATTACHED POINTS LIST (3 PAGES)

SYSTEM POINT LIST

SYSTEM POINT DESCRIPTION	POINT TYPE					ALARMS							NOTES:
ASC 4-Pipe Changeover terminal unit with Economizer and Dehumidification	GRAPHIC	HARDW. INPUT	HARDW. OUTPUT	SOFTWARE POINT	DEFAULT VALUE	HIGH ANALOG	LOW ANALOG	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMM. FAIL	DIAGNOSTICS	
Space Sensor – Temperature	X	AI							X	X		Temp Sensor Fail	Required
Space Sensor – Setpoint	X	AI								X		Local Setpoint Failure	
Space Sensor – Fan Switch	X	AI								X		Local Fan Mode Failure	
Space Sensor – On/Cancel		BI											
Fan			BO										
ChW/HW Valve	X		AO										Tri wire floating Point
Electric Heating	X		BO										up to two stages
Outside Air Damper	X		AO										
Supply Air Temp. Sensor	X	AI				110°F	35°F		X	X		Discharge Air Temp Failure, Discharge Air Temp Limit	Required
Fan Status	X	BI							X	X		Low Airflow Failure, Fan Failure	DPS or Current Sensor Switch
Space Relative Humidity Sensor	X	AI				10%	90%			X		High/Low Relative Humidity Alarm. RH Sensor Failure	Note 2
Low Coil Temp. Detector		BI						X				Low Coil Temperature Detect	Capillary device
Changeover Temp. Sensor	X	AI								X		Entering Water Temp Failure	Note 2
Condensate Overflow Switch		BI						X	X			Condensate Overflow	
Outdoor Air Temp. Sensor	X	AI								X		Outdoor Temp Sensor Failure	Note 2
Occupied Cooling Setpoint	X			AV	74°F	110°F	40°F						
Occupied Heating Setpoint	X			AV	71°F	105°F	40°F						
Occupied Standby Cooling Setpoint				AV	78°F	110°F	40°F						
Occupied Standby Heating Setpoint				AV	60°F	105°F	40°F						
Unoccupied Cooling Setpoint				AV	85°F								
Unoccupied Heating Setpoint				AV	60°F								
% Relative Humidity Setpoint				AV	50%								
Occupied By-pass Time Override				AV	2 Hours								
Outside Air Damper Minimum Position	X			AV	15%								
Economizer Enable Setpoint				AV	55°F								
BAS Communication State	X			BV							X		Note 3.
Unoccupied Freeze Avoidance Setpoint				AV	40°F	60°F	20°F						
Discharge Air Tempering Setpoint				AV	40°F								
Discharge Air Temperature Control Points						150°F	35°F						
Maintenance Required				BV	2000 Hours							Maintenance Required	Note 3.
OPTIONAL POINTS													
Occupancy Sensor		BI											Note 1
Face and By-Pass Damper			AP										Note 1
Exhaust Air Control			BO										Note 1
Baseboard Heating			BO										Note 1
Generic Binary Output			BO										Note 1
Generic Binary Input		BI											Note 1

GENERAL NOTES:

1. Optional feature.
2. Can be a communicated value
3. Displayed at the BAS user interface

SYSTEM POINT LIST

SYSTEM POINT DESCRIPTION PARALLEL VARIABLE PRIMARY AIR-COOLED *Chilled Water System*	POINT TYPE					ALARMS							NOTES:
	GRAPHIC	HARDW. INPUT	HARDW. OUTPUT	SOFTWARE POINT	DEFAULT VALUE	HIGH ANALOG	LOW ANALOG	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMM. FAIL	DIAGNOSTICS	
UNIT CONTROLLER COMMUNICATIONS													
CHILLED WATER SETPOINT				X									
CHILLED WATER TEMP: ENT		X											
CHILLED WATER TEMP: LVG		X											
CHILLER DESIGN FLOW				X									
CHILLER MINIMUM FLOW				X									
CHILLED WATER FLOW STATUS		X						X					
CURRENT LIMIT SETPOINT				X									
COMPRESSOR CURRENT DRAW		X											
COMPRESSOR POWER				X									
CHILLER ENABLE\DISABLE				X									
CHILLER STATUS				X				X					INDICATION THAT CHILLER IS RUNNING
CHILLER AVAILABLE				X									
CHILLER FAILURE 1				X				X					
CHILLER FAILURE 2				X				X					
CHILLER UNLOAD AT START (ENABLE/DISABLE)				X									
CHILLER UNLOAD CURRENT LIMIT				X									
CHILLER SEQUENCE NUMBER				X									
CHILLER MODE (HEAT RECOVERY)				X									
CHILLER OPERATING MODE				X									
COMMUNICATION STATUS				X				X					
CHILLER CHILLED WATER STPT: MIN				X									
CHILLED WATER PUMP STATUS		X						X					SYSTEM AND CHILLER PUMPS
CHILLED WATER PUMP S/S: OUTPUT			X										SYSTEM AND CHILLER PUMPS
CHILLED WATER PUMP FAILURE				X				X					SYSTEM AND CHILLER PUMPS
CHILLER PRESSURE DROP			X					X					
ADJUSTABLE FREQ. DRIVE: SETPOINT				X									
ADJUSTABLE FREQ. DRIVE: STATUS				X				X					
SYSTEM CHILLED WATER SUPPLY TEMP		X											
SYSTEM CHILLED WATER SUPPLY SETPOINT				X									
SYSTEM CHILLED WATER RETURN TEMP		X											
DESIGN SYSTEM CHILLED WATER TEMP DIFFERENCE				X									
BYPASS FLOW		X											FLOW METER
BYPASS FLOW				X									5 TEMPERATURE SENSOR METHOD
AMBIENT DRY BULB TEMP (LOCKOUT)		X											
SYSTEM ENABLE REFERENCER				X									
SOFT START DEADBAND				X									
ADD TEMP DEADBAND				X									
MINIMUM COOL DOWN RATE				X									
FLOW TYPE (VARIABLE OR CONSTANT)				X									
ADD DELAY INTERVAL				X									
ADD DELAY TIME				X									
EXCESS FLOW PERCENTAGE				X									
SUBTRACT DELAY TIME				X									
SUBTRACT DELAY INTERVAL				X									
BYPASS VALVE			X										
POWER FAIL RECOVERY MODE (ENABLE/DISABLE)				X									

AMBIENT TEMPERATURE LOCKOUT (ENABLE/DISABLE)				X										
AMBIENT LOCKOUT DEAD BAND				X										
AMBIENT TEMPERATURE SETPOINT				X										
START INTERVAL				X										
ADD INPUT				X										
SUBTRACT METHOD				X										
SUBTRACT INPUT				X										
ROTATION SCHEDULE				X										
ROTATION INTERVAL				X										
ROTATION INPUT				X										
ROTATION DAY				X										
ROTATION TIME				X										
FORCE ROTATION				X										
CONTROL FEEDBACK DELAY TIME				X										
FAILURE RESET				X										
FAILURE OUTPUT				X					X					
FAIL ON LOSS OF FLOW				X					X					
NUMBER OF RETRIES IF CHILLER FAILS				X										
CHILLER INDEX NUMBER				X										
CHILLER SEQUENCING TYPE				X										
CHILLER UNLOAD REQUEST				X										
OPTIONAL POINTS														
ISOLATION VALVE			X											
CHILLED WATER PRESSURE: LVG		X												
CHILLED WATER PRESSURE: ENT		X												

GENERAL NOTES:

SECTION 23 21 14 HEATING WATER PIPING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, Section 23 05 10 “HVAC General Requirements” and Section 23 05 12 “HVAC Pipe, Fittings and Accessories” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 53, titled "Identification for HVAC Piping and Equipment" for piping systems identification requirements.

C. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

D. Refer to Specification Section 23 05 29, titled "Hangers and Supports for HVAC Piping and Equipment” for specification and installation requirements of the pipe support system.

E. Refer to Specification Section 23 05 23, titled "General-Duty Valves for HVAC Piping” for specification and installation requirements for Valves.

F. Refer to Specification Section 23 05 48, titled "Vibration and Seismic Controls for HVAC Piping and Equipment" for specification and requirements of the vibration isolation system.

G. Refer to Specification Section 23 07 00, titled "HVAC Insulation" for specification and installation of thermal insulation for the various types of pipe, fittings, and accessories specified in this section.

H. Refer to Specification Section 23 25 00, titled "HVAC Water Treatment” for the specification and installation requirements for the chemical treatment system(s) and for the specification of the various cleaning and degreasing chemicals required to clean the piping system.

1.02 DESCRIPTION OF WORK:

A. Extent of the piping systems work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the piping system is to be connected.

1.03 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Firms regularly engaged in manufacture of piping products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

C. All welders shall be certified by ANSI B31.1.0-1967 "Standard Qualification Welding Procedures, Welders and Welding Operators" or "Qualification Tests" in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests for positions 2G and 5G shall be made in strict compliance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by the Contractor. Two (2) copies of the qualification test report and certification with welder's identification number, letter, etc., shall be delivered to the Engineer of Record, via the Architect, for his file before any welding commences. Each weld shall bear the welder's identification mark permanently indented in the weld. No welding shall be done when the ambient temperature is below 0°F.

D. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

PART 2 - PRODUCTS

2.01 ABOVEGROUND PIPING SYSTEM:

A. Pipe size 2" and smaller

1. Type: Black steel pipe of the sizes indicated.

2. Class: Schedule 40, ASTM-A120

3. Fittings: Standard weight black malleable iron.

4. Joints: Threaded or welded.

B. Pipe sizes 2½" through 8"

1. Type: Black steel pipe of the sizes indicated.

2. Class: Schedule 40, ASTM-A120

3. Fittings:
   a. Schedule 40 steel.
   b. Standard grooved end fittings; ASTM A536 ductile iron, ASTM A234 forged steel, or ASTM A53 fabricated steel with factory grooved ends designed to accept Victaulic standard couplings.

4. Joints:
   a. Butt-welded except connections to valves and equipment shall be flat face slip-on flanges with ASTM-A307 Grade B bolts.
   b. Standard grooved joint couplings consisting of two ductile iron housing segments, a pressure-responsive elastomeric gasket (for heating water services to 230°F), and plated steel bolts and nuts.
      1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME-B31.1 and B31.9. Victaulic Style 07.
      2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 75 or 77.

2.02 "Y" TYPE STRAINERS:

A. All strainers shall be the "Y" type with cast or ductile iron body unless indicated otherwise and shall have a water working pressure suitable for the pressure classification of the piping system in which installed.

B. Strainers 2" and smaller shall be threaded. Strainers 2½" and larger shall be grooved or flanged.

C. Strainers shall have removable stainless steel screens and shall have perforation to provide a net free area through the screen of at least three times that of the entering pipe.

D. Blowdown outlets shall be located at the low point of the strainer. For strainers 2" and smaller provide pipe nipple, ball valve and hose end adapter. For strainers 2½" and larger provide a nipple and ball valve full size of the blowdown outlet.

E. Unless an integral strainer is provided, a strainer shall be installed immediately upstream of all pressure reducing valves.

F. Strainers shall be Sarco, ITT, Hoffman, or Armstrong, or Victaulic Style 732.

2.03 FLANGES:

A. In heating water piping, where specified, required, or shown on the Drawings, provide flanged connections. Flanges shall have a water working pressure suitable for the pressure classification of the piping system in which installed. Where flanges are used at equipment connections, flanges shall match equipment flanges. Flanges shall be forged steel, screwed type (2½" and smaller pipe size), slip-on type or welding neck type (3" and larger), raised face, ANSI B-16.5.

B. Gaskets shall be the compressed fiber ring type asbestos free for use between raised face flanges. Gaskets shall be 1/16" thick for pipe sizes up to 10" and 1/8" thick for pipe sizes larger than 10". A non-stick lubricant coating shall be applied to both sides of the gasket.

C. All flanges shall be mated with properly sized bolts. All-thread bolts or rods are not acceptable.

D. Grooved joint flange adapters shall be ASTM A536 ductile iron, flat face, for incorporating flanged components with ANSI Class 125, 150, or 300 bolt-hole patterns to a grooved piping system. Victaulic Style 741 or 743.

2.04 UNIONS:

A. Material for unions shall match the pipe system category for pressure, temperature and corrosion. Unions shall be:

1. Steel - screwed, Class 150, malleable iron, O-ring or brass seat.

B. Dielectric unions shall be threaded, flanged, brazed, or soldered to match the adjacent piping. The metal parts of all ferrous and nonferrous metals shall be separated so that the electrical current is below one percent of the galvanic current which would exist with metal to metal contact. Where flanges are used, the bolts shall be insulated from the body of the flange.

C. Dielectric waterway fittings shall be grooved, threaded, or plain end to match the adjacent piping. The body shall be ASTM A53 carbon steel or ASTM A536 ductile iron, zinc electroplated with LTHS high temperature stabilized polyolefin polymer liner. Maximum working pressure of 300 psi at 230°F.

2.05 FLEXIBLE PIPE CONNECTIONS:

A. Flexible connections shall be metal hose type and constructed of 320 stainless steel wire braid. Hose shall be designed for working pressure of not less than 125 psig and temperatures up to 250°F and shall be 12" long with screwed or flanged ends for connections to chiller refrigerant relief piping. Diameter shall be the full size of the refrigerant relief connection, or the pipe size, whichever is greater.

B. Flexible type grooved joint mechanical couplings equal to Victaulic Style 75 or 77 may be used in lieu of flexible connectors at equipment connections. Three (3) couplings for each connector shall be placed in close proximity to the source of vibration (for services up to 230°F).

PART 3 - EXECUTION

3.01 GENERAL PIPE SYSTEM:

A. Nonferrous Metallic Pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a separation must be maintained between pipes.

B. Cut pipe accurately to measurements, and ream free of burrs and cutting splatter. Carefully align and grade pipe, and work accurately into place. Fittings shall be used for any change in direction. Make adequate provisions for expansion and contraction. Protect open pipe ends to prevent trash being placed in the lines during installation. Clean all dirt and cutting debris from pipes before making the next joint. Provide for expansion at every building expansion joint.

C. Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

D. Provide offsets as required to maintain ceiling height and to coordinate with other trades. Do not use pieces where a full length will do.

E. All piping shall be installed parallel to or at right angles with the building walls, columns and partitions. It shall be possible to drain every part of the piping system.

F. Locate air vents at all high points of the piping system and at other locations indicated. Pipe automatic air vents discharge to the nearest floor drains in equipment rooms, Janitors sinks, floor sinks or other acceptable receptacle. Discharge piping shall be 1/8" seamless copper tubing for a single air vent and 1/4" seamless copper tubing for multiple vents. Air vents shall be installed with gate valves.

G. Threaded pipe shall be cut square and full threaded with clean out tapering threads, and shall be reamed after threading. All threaded connections shall be made with approved pipe thread compound or Teflon tape applied to the male threads only, and shall be so made up that not more than two (2) threads will be exposed.

H. Do not run piping through any transformer vault, electric switchgear room, electrical closet, or electronic equipment space.

I. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Victaulic factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

1. Install the Victaulic AGS piping system in accordance with the latest Victaulic installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow Victaulic guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could result in joint separation and/or leakage.

L. Push-to-Connect Fitting Installation: Prepare copper tube and install in strict accordance with NVent installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by NVent to clean and make installation mark. Push copper tube into fittings to installation depth mark, per NVent installation instructions. Keep fittings free of dirt and oil; use only on water, water-glycol, and clean, dry, hydrocarbon-free air systems.

3.02 CONNECTION TO EQUIPMENT:

A. It shall be possible to remove any item of equipment to which piping is connected by removing only one or two sections of piping. Unions Victaulic couplings, and/or flanges shall be used at all locations where connections are made to equipment. Install shutoff valves on supply and return and drain valves on drain connections.

3.03 ACCESSORIES:

A. Thermometers installed in vertical pipes shall be installed on a 45° angle and in horizontal piping shall be installed vertical. Thermometers shall be located and mounted to be conveniently read.

B. Install brass unions between each pressure gauge and gauge cock.

C. Install heat tape before insulation is applied. Set controls for 40°F. Wrap pipe with a minimum of 3 spiral turns per linear foot of pipe. Hard wire power connections to the junction box.

3.04 VALVES:

A. Install valves where required and in strict accordance with manufacturer's instructions, for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Valves in horizontal piping shall be installed with stems at or above the pipe centerline.

C. Butterfly valves adjacent to equipment shall be functional when equipment is removed.

3.05 TESTING:

A. Every pipe system shall be tested at 1.5 times its operating pressure, but no less than 125 psi unless the engineer agrees to a lesser pressure.

B. Pipe and fittings shall be tested before any insulation or other covering is applied.

C. Testing may be performed in sections before vital equipment is connected if the test pressure is above the equipment rating.

D. Test medium shall be water under hydrostatic pressure with all air removed from the system. With engineer's consent, the test may be performed with compressed air to prevent danger from freezing. Hydrostatic pressure shall be held for no less than 2 hours, with no drop in pressure. Air test shall be held for no less than 4 hours, and the engineer may require longer test periods. Questionable joints shall be bubble tested to prove tightness.

E. The Architect or his representative shall observe all tests. Notice to the Architect shall be given two full days before the testing is to be performed.

3.06 CLEANING:

A. Every pipe system shall be cleaned to remove trash, mill scale, cutting oil, and welding and burning splatter from the lines before any control devices are installed. If such debris has collected in valves, the valves shall be disassembled and cleaned prior to closing for the first time.

B. After several hours of operation, each strainer shall be blown down. This shall be repeated as often as necessary to produce a clean discharge from the blowdown. Prior to turning system over to the Owner, every strainer shall be removed and cleaned.

END OF SECTION

SECTION 23 21 15 CHILLED WATER PIPING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, Section 23 05 10 “HVAC General Requirements” and Section 23 05 12 “HVAC Pipe, Fittings and Accessories” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 53, titled "Identification for HVAC Piping and Equipment" for piping systems identification requirements.

C. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

D. Refer to Specification Section 23 05 29, titled "Hangers and Supports for HVAC Piping and Equipment” for specification and installation requirements of the pipe support system.

E. Refer to Specification Section 23 05 23, titled "General-Duty Valves for HVAC Piping” for specification and installation requirements for Valves.

F. Refer to Specification Section 23 05 48, titled "Vibration and Seismic Controls for HVAC Piping and Equipment" for specification and requirements of the vibration isolation system.

G. Refer to Specification Section 23 07 00, titled "HVAC Insulation" for specification and installation of thermal insulation for the various types of pipe, fittings, and accessories specified in this section.

H. Refer to Specification Section 23 25 00, titled "HVAC Water Treatment” for the specification and installation requirements for the chemical treatment system(s) and for the specification of the various cleaning and degreasing chemicals required to clean the piping system.

1.02 DESCRIPTION OF WORK:

A. Extent of the piping systems work is indicated on the Drawings and schedules and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the piping system is to be connected.

1.03 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Firms regularly engaged in manufacture of piping products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

C. All welders shall be certified by ANSI B31.1.0-1967 "Standard Qualification Welding Procedures, Welders and Welding Operators" or "Qualification Tests" in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests for positions 2G and 5G shall be made in strict compliance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by the Contractor. Two (2) copies of the qualification test report and certification with welder's identification number, letter, etc., shall be delivered to the Engineer, via the Architect, for his file before any welding commences. Each weld shall bear the welder's identification mark permanently indented in the weld. No welding shall be done when the ambient temperature is below 0°F.

D. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

PART 2 – PRODUCTS AND MATERIALS

2.01 ABOVEGROUND PIPING SYSTEM:

A. Pipe size 2" and smaller:

1. Type: Black steel pipe of the sizes indicated.

2. Class: Schedule 40, ASTM A-120

3. Fittings: Standard weight black malleable iron.

4. Joints: Threaded

B. Pipe sizes 2½" through 8"

1. Type: Black steel pipe of the sizes indicated.

2. Class: Schedule 40, ASTM A-120

3. Fittings:
   a. Schedule 40 steel.
   b. Standard grooved end fittings; ASTM A536 ductile iron, ASTM A234 forged steel, or ASTM A53 fabricated steel with factory grooved ends designed to accept Victaulic standard couplings.

4. Joints:
   a. Butt-welded except connections to valves and equipment shall be flat face slip-on flanges with ASTM A-307 Grade B bolts.
   b. Standard grooved joint couplings consisting of two ductile iron housing segments, a pressure-responsive elastomeric gasket, and plated steel bolts and nuts.
      1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9. Victaulic Style 07.
      2) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 75 or 77.

C. Chilled Water, Riser Piping:

1. Type: Black steel pipe of the sizes indicated.

2. Class: Same as for the pipe sizes scheduled above.

3. Fitting: Mechanical coupling with standard and AGS grooved end fittings.

4. Joints: Ductile iron housings which engage grooved or shouldered pipe ends, encasing an elastometric pressure-responsive gasket.
   a. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9. Victaulic Style 07.
   b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 75 or 77.
   c. AGS grooved joint couplings 14” through 24” consisting of two ductile iron housing segments cast with a wedge-shaped key profile, lead-in chamfer, and flat bolt pads, a wide-width pressure-responsive elastomeric gasket, and plated steel bolts and nuts.
      1) Rigid Type: Provides a rigid joint that corresponds with support spacing as defined by ASME B31.1 and B31.9. Victaulic Style W07.
      2) Flexible Type: Allows for linear and angular movement, vibration attenuation and stress relief. Victaulic Style W77.

5. Grooved end piping system shall be Victaulic.

D. At the contractor’s option, the following may be used:

1. Pipe sizes 2" and smaller:
   a. Type: Copper tubing of the pipe sizes listed.
   b. Class: Type L hard drawn tubing, ASTM B-88
   c. Fitting:
      1) Sweat type wrought copper.
      2) Permanent push-to-connect fittings, ASME B16.22 wrought copper alloy or ASME B16.18 cast copper alloy with push-to-connect ends designed for direct insertion of copper tube. Push-to-connect ends shall be complete with EPDM engineered seal and 301 stainless steel internal components. EPDM engineered seal shall be suitable for water operating temperatures of -30°F to +230°F.
   d. Joints:
      1) Socket brazed with 95-5 tin-antimony
      2) Permanent push-to-connect joints.

2.02 "Y" TYPE STRAINERS:

A. All strainers shall be the "Y" type with cast or ductile iron body unless indicated otherwise and shall have a water working pressure suitable for the pressure classification of the piping system in which installed.

B. Strainers 2" and smaller shall be threaded. Strainers 2½" and larger shall be grooved or flanged.

C. Strainers shall have removable stainless steel screens and shall have perforation to provide a net free area through the screen of at least three times that of the entering pipe.

D. Blowdown outlets shall be located at the low point of the strainer. For strainers 2" and smaller provide pipe nipple, ball valve and hose end adapter. For strainers 2½" and larger provide a nipple and ball valve full size of the blowdown outlet.

E. Unless an integral strainer is provided, a strainer shall be installed immediately upstream of all pressure reducing valves.

F. Strainers shall be Sarco, ITT, Hoffman, or Armstrong, or Victaulic Style 732.

2.03 FLANGES:

A. In chilled water piping, where specified, required, or shown on the Drawings, provide flanged connections. Flanges shall have a water working pressure suitable for the pressure classification of the piping system in which installed. Where flanges are used at equipment connections, flanges shall match equipment flanges. Flanges shall be forged steel, screwed type (2½" and smaller pipe size), slip-on type or welding neck type (3" and larger), raised face, ANSI B-16.5.

B. Gaskets shall be the compressed fiber ring type asbestos free for use between raised face flanges. Gaskets shall be 1/16" thick for pipe sizes up to 10" and 1/8" thick for pipe sizes larger than 10". A non-stick lubricant coating shall be applied to both sides of the gasket.

C. All flanges shall be mated with properly sized bolts. All-thread bolts or rods are not acceptable.

D. Grooved joint flange adapters shall be ASTM A536 ductile iron, flat face, for incorporating flanged components with ANSI Class 125, 150, or 300 bolt-hole patterns to a grooved piping system. Victaulic Style 741 or 743.

2.04 UNIONS:

A. Material for unions shall match the pipe system category for pressure, temperature and corrosion. Unions shall be:

1. Steel - screwed, Class 150, malleable iron, O-ring or brass seat.

B. Dielectric unions shall be threaded, flanged, brazed, or soldered to match the adjacent piping. The metal parts of all ferrous and nonferrous metals shall be separated so that the electrical current is below one percent of the galvanic current which would exist with metal to metal contact. Where flanges are used, the bolts shall be insulated from the body of the flange.

C. Dielectric waterway fittings shall be grooved, threaded, or plain end to match the adjacent piping. The body shall be ASTM A53 carbon steel or ASTM A536 ductile iron, zinc electroplated with LTHS high temperature stabilized polyolefin polymer liner. Maximum working pressure of 300 psi at 230°F.

2.05 FLEXIBLE PIPE CONNECTIONS:

A. Flexible connections for chiller refrigerant relief piping shall be flexible metal hose constructed of 320 stainless steel wire braid. Hose shall be designed for working pressure of not less than 125 psig and temperatures up to 250°F and shall be 12" long with screwed or flanged ends for connections to chiller refrigerant relief piping. Diameter shall be the full size of the refrigerant relief connection, or the pipe size, whichever is greater.

B. Flexible type grooved joint mechanical couplings equal to Victaulic Style 75 or 77 may be used in lieu of flexible connectors at equipment connections. Three (3) couplings for each connector shall be placed in close proximity to the source of vibration (for services up to 230°F).

2.06 HEAT TRACE TAPE: (SEE SECTION 23 05 33 HEAT TRACING FOR HVAC PIPING)

PART 3 - EXECUTION

3.01 GENERAL PIPE SYSTEM:

A. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

B. Copper tubing shall not be installed in the same trench with ferrous piping materials.

C. Nonferrous Metallic Pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a separation must be maintained between pipes.

D. Cut pipe accurately to measurements, and ream free of burrs and cutting splatter. Carefully align and grade pipe, and work accurately into place. Fittings shall be used for any change in direction. Make adequate provisions for expansion and contraction. Protect open pipe ends to prevent trash being placed in the lines during installation. Clean all dirt and cutting debris from pipes before making the next joint. Provide for expansion at every building expansion joint.

E. Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

F. Provide offsets as required to maintain ceiling height and to coordinate with other trades. Do not use pieces where a full length will do.

G. All piping shall be installed parallel to or at right angles with the building walls, columns and partitions. It shall be possible to drain every part of the piping system.

H. Locate air vents at all high points of the piping system and at other locations indicated. Pipe automatic air vents discharge to the nearest floor drains in equipment rooms, Janitors sinks, floor sinks or other acceptable receptacle. Discharge piping shall be 1/8" seamless copper tubing for a single air vent and 1/4" seamless copper tubing for multiple vents. Air vents shall be installed with gate valves.

I. Threaded pipe shall be cut square and full threaded with clean out tapering threads, and shall be reamed after threading. All threaded connections shall be made with approved pipe thread compound or Teflon tape applied to the male threads only, and shall be so made up that not more than two (2) threads will be exposed.

J. Do not run piping through any transformer vault, electric switchgear room, electrical closet, or electronic equipment space.

K. Grooved joint piping systems shall be installed in accordance with the manufacturer's (Victaulic) guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Victaulic factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

1. Install the Victaulic AGS piping system in accordance with the latest Victaulic installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow Victaulic guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could result in joint separation and/or leakage.

L. Push-to-Connect Fitting Installation: Prepare copper tube and install in strict accordance with NVent installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by NVent to clean and make installation mark. Push copper tube into fittings to installation depth mark, per NVent installation instructions. Keep fittings free of dirt and oil; use only on water, water-glycol, and clean, dry, hydrocarbon-free air systems.

3.02 CONNECTION TO EQUIPMENT:

A. It shall be possible to remove any item of equipment to which piping is connected by removing only one or two sections of piping. Unions, Victaulic couplings, and/or flanges shall be used at all locations where connections are made to equipment. Install shutoff valves on supply and return and drain valves on drain connections.

3.03 ACCESSORIES:

A. Thermometers installed in vertical pipes shall be installed on a 45° angle and in horizontal piping shall be installed vertical. Thermometers shall be located and mounted to be conveniently read.

B. Install brass unions between each pressure gauge and gauge cock.

C. Install heat tape before insulation is applied. Set controls for 40°F. Wrap pipe with a minimum of 3 spiral turns per linear foot of pipe. Hard wire power connections to the junction box.

3.04 VALVES:

A. Install valves where required and in strict accordance with manufacturer's instructions, for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

3.05 TESTING:

A. Every pipe system shall be tested at 1.5 times its operating pressure, but no less than 125 psi unless the engineer agrees to a lesser pressure.

B. Pipe and fittings shall be tested before any insulation or other covering is applied.

C. Testing may be performed in sections before vital equipment is connected if the test pressure is above the equipment rating.

D. Test medium shall be water under hydrostatic pressure with all air removed from the system. With engineer's consent, the test may be performed with compressed air to prevent danger from freezing. Hydrostatic pressure shall be held for no less 2 hr., with no drop in pressure. Air test shall be held for no less than 4 hr., and the engineer may require longer test periods. Questionable joints shall be bubble tested to prove tightness.

E. The Architect or representative shall observe all tests. Notice to the Architect shall be given two full days before the testing is to be performed.

3.06 CLEANING:

A. Every pipe system shall be cleaned to remove trash, mill scale, cutting oil, and welding and burning splatter from the lines before any control devices are installed. If such debris has collected in valves, the valves shall be disassembled and cleaned prior to closing for the first time.

B. After several hours of operation, each strainer shall be blown down. This shall be repeated as often as necessary to produce a clean discharge from the blowdown. Prior to turning system over to the owner, every strainer shall be removed and cleaned.

END OF SECTION

SECTION 23 21 24 HYDRONIC PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION: The Contractor shall furnish materials, equipment and labor to furnish, install and test the pumping system complete with the pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the contract drawings and as herein specified.

1.02 INSTALLATION: The Contractor shall insure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.

1.03 RESPONSIBILITY: To assure a properly integrated and compatible system, all equipment described in this section shall be furnished by the Pump Manufacturer, who shall assume full responsibility for the proper operation of the pumps and associated equipment.

1.04 SUPERVISION: The Contractor shall arrange for the Pump Manufacturer to provide a factory-trained representative as required for the purpose of supervising installation, start-up, final field acceptance testing, and providing instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment in this section.

1.05 REFERENCE STANDARDS:

A. The work in this section is subject to the requirements of applicable portions of the following standards:

1. Hydraulic Institute Standards

2. IEEE Standards

3. NEMA Standards

4. OSHA Rules and Regulations

PART 2 - PRODUCTS

2.01 VERTICAL TURBINE CONDENSER WATER PUMPS

A. Furnish and install product lubricated vertical can turbine pumps with aboveground discharge. Pumps shall be as manufactured by Weir Floway, Aurora and PACO pumps model 14FKH single stage and shall provide performance as scheduled on the project drawings. Pump assemblies shall consist of bowl assemblies, mechanical seal assemblies, column assemblies, motors, motor stands and foundation plates, as described below:

1. BOWL ASSEMBLY: Pump bowls, suction & discharge cases shall be of close grained ASTM A48 Class 30 Cast Iron, without imperfections. Discharge case shall be ASTM bronze B-502-932 fitted having a long support bushing extending into the top bowl. Suction case shall be bronze B-502-932 fitted with grease lubricated and shall be provided with an ASTM bronze B-584-836 sand collar to protect the suction bowl bearing from abrasives. Top bowl shall also have a bronze bearing of bronze B-584-836 with a sand collar. Intermediate bowl bearings shall be of fluted neoprene and/or ASTM bronze B-505-932. Impeller shall be made of ASTM bronze B-584-836, enclosed type and shall be fitted with replaceable ASTM aluminum-bronze B-148 grade D wear rings having minimum practical clearance to the mating cylindrical surface of the intermediate bowls and suction case. The impeller shall also be accurately cast, machined, statically balanced, and filed for optimum performance. The impeller shall be securely fastened to the bowlshaft with tapered collets of ASTM steel A-108 grade 1020. The water passages of pump bowls size 6" through 14" shall have vitreous enamel lining and 16" and over shall have ScotchKote 134 Fusion Bonded Epoxy to provided optimum performance. The bowlshaft shall be of sufficient diameter to transmit the pump horsepower with a liberal safety factor. The bowl shaft material shall be ASTM stainless steel A-582 grade 416 with hard chrome plating having a Brinell hardness of no less than 500. The bowlshaft shall have no less than .007" hard chrome per side and shall have pump shaft quality dimensional tolerances of + .000" .002". Only shafts meeting pump shaft quality dimensional tolerances will be acceptable.

2. COLUMN ASSEMBLY: Lineshafts shall be of ASTM A-108 grade 1045 carbon steel. The lineshafts shall have field replaceable raised sleeves, held in position with a suitable adhesive. The sleeve material shall be ASTM stainless steel A-582 grade 416 with hard chrome plating having a Brinell hardness of no less than 500. The sleeve shall have no less than .007" hard chrome per side and shall have pump shaft quality dimensional tolerances of + .000" to -.002". Only shafts meeting pump shaft quality dimensional tolerances will be acceptable. The sleeve shall be located at the bearing supports and packing box bearing surfaces. The shafts shall be of ample size to operate without distortion or vibration. Shaft threads shall be lathe cut and shall be left hand to tighten during pump operation. Shaft couplings shall be threaded from solid bar stock and made of ASTM steel grade A-108 grade 1018. Intermediate shaft sections shall be interchangeable and shall not exceed 10 feet in length. The butting ends shall be machined square to axis of the shaft and faces shall be recessed to insure proper alignment.

   Column pipe shall be of ASTM steel A53 grade B. The column pipe shall be flanged having interchangeable sections not exceeding 10 feet for pump speeds up to 2200 RPM or 5 feet for pumps over 2200 RPM. The column flanges shall conform to ANSI specifications and have a female register accurately machined for drop-in ASTM bronze B-584-836 bearing support housings. The registers and finial facing of the flanges shall be performed after all welding procedures, to maintain proper alignment. The lineshaft bearings shall be field replaceable neoprene, held in place by an ASTM stainless steel A-582 grade 416 lock ring. The neoprene bearings shall have and internal shape of a polygon to provide minimum friction contact.

3. MOTOR STAND: The motor stand shall be ASTM A53, grade B fabricated steel designed with sufficient strength and rigidity to support the motor mounted on it and carry the suspended weight of the attached column and bowl assemblies. The design shall permit a two-piece head shaft to be coupled above the packing box. The bottom face of the motor stand shall be circular and fully finished.

4. MECHANICAL SEAL ASSEMBLY: The design of the mechanical seal system shall provide for easy an visually verifiable pump lateral adjustments. Setting shall not require the disassembly of any portion of the factory preset seal assembly and shall be accomplished without special tooling, gauges, or equipment. For pressures up to 200 PSI, seal should be a John Crane type 21. For pressures in excess of 200 PSI, a John Crane type 1-B shall be used. The rotating face shall be of carbon graphite and the stationary face shall be ni-resist. All metal seal parts should be 18-8 stainless steel. The seal housing shall be ASTM A48 Class 30 cast iron, machined to accept an o-ring face for positive sealing. The housing shall have an 1/8" NPT orifice for seal circulation or lubrication. The seal plate shall be machined from ASTM A36 steel and bored for stationary seat. The sleeve and drive cap shall be machined from ASTM A-582 grade 416 steel. Drive cap shall have a minimum of four (4) locking set screws. An ASTM B-505-932 bronze seal housing bearing shall be provided directly below mechanical seal for stability.

5. FOUNDATION PLATE: A square ASTM A36 steel foundation plate with radius corners shall be provided. The foundation plate shall be uniformly faced on one side and its size shall be equal to or greater than the size of the base of the discharge head. Anchor bolt holes shall be provided at each corner.

6. MOTOR COUPLING: When driven with a solid shaft motor, a flanged adjustable three-piece or spacer type four-piece coupling shall be furnished. The coupling shall be steel designed to transmit the required torque and horsepower. The lower half of the coupling shall be keyed to the headshaft. A threaded adjusting nut shall be located between the lower coupling half and the spacer or upper coupling half and held concentric by means of machined registers. The upper half shall have a circular key to absorb pumping downthrust and a vertical key to transmit torque.

7. SUCTION BARREL: The FKH unit shall be supplied with a fabricated steel suction barrel of the same material as the discharge head. The barrel shall be capable of containing the maximum suction pressure supplied to the suction flange. The bottom end of the suction barrel shall be supplied with a welded plate cap for water service. A weld cap shall be supplied for all hydrocarbon service applications. The exterior of the barrel shall be coated with Sherwin Williams KEM AQUA 70P – Red oxide.

   The barrel shall be equipped with a square base plate, which shall be machined, and tapped to match the discharge head flange supplied. The base shall be drilled to allow the barrel to be secured in place with anchor bolts. Barrel shall be supplied with proper gasket or "O" ring and bolting for application to seal between the barrel flange and the head base flange.

2.02 VERTICAL CLOSE COUPLED END SUCTION CENTRIFUGAL PUMPS:

A. General Description:

1. The pumps shall be vertical close-coupled end suction pumps, equal to Aurora Pump Model 342.

B. Materials of Construction:

1. The pumps shall be constructed of the following materials:

Casing	Cast Iron (ASTM A48)
Impeller	Bronze (ASTM B584)
Shaft	Steel (AISI C1045)
Case Wear Ring	Bronze (ASTM B62)
Shaft Sleeve	Bronze (ASTM B62)
Base Suction Elbow	Cast Iron (ASTM A48)

C. Casing:

1. The casing will be of the end suction design with tangential discharge outlet. For suction piping diameters of 2" or less and discharge piping diameters of 1.5" or less, the suction and discharge connections shall be NPT threaded. For suction piping diameters of 2" or greater, the suction inlet shall be a flat-faced flange connection and the discharge outlet shall be a bolt through flange connection. Flange connections shall be ANSI 125# rated. The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to allow "back pullout" of the impeller without disturbing the casing or suction and discharge piping. The casing shall be supported by the driving unit.

D. Impeller:

1. The impeller shall be of the enclosed type, vacuum cast in one piece. It shall be finished all over, the exterior being turned and the interior being finished smooth and cleaned of all burrs, trimmings, and irregularities. The impeller shall be dynamically balanced. The impeller will be keyed to the shaft, and fastened with a washer, gasket and capscrew.

E. Case Wearing Ring:

1. The pump casing shall be fitted with a case wear ring to minimize abrasive and corrosive wear to the casing. The case wear ring shall be of the radial type, press fitted into the casing.

F. Stuffing Box:

1. The stuffing box shall be integrally cast with a mounting bracket. Flushing of the seal chamber shall be accomplished by means of an external line with fittings between the stuffing box and pump casing.

G. Mechanical Seal:

1. Shaft sealing shall be accomplished by means of a mechanical seal with a Ni-Resist seat, carbon washer, Buna-N elastomers, and stainless steel metal parts.

H. Shaft:

1. The impeller shall be direct-coupled to the motor shaft. The motor shaft shall be machined to provide a keyway, and drilled and tapped to accept the impeller fastener. Stub shafts are not acceptable.

I. Shaft Sleeve:

1. The pump shaft shall be fitted with a shaft sleeve to minimize shaft wear. The sleeve shall be sealed to the impeller hub by an O-ring, and shall be positively driven by a pin to the keyway. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

J. Base Suction Elbow:

1. The pump and motor unit shall be mounted vertically to a combination base and suction elbow. The base shall be rigid, milled flat and have anchor bolt mounting holes provided. The suction inlet flange and casing mounting flange will be 125# ANSI rated flanges.

K. Motor:

1. The motor shall be a NEMA-JM configuration in accordance with the latest NEMA Standards, and shall have the following characteristics:

Enclosure	Open Drip Proof/TEFC/X-Proof
Number of Phases	Three
Cycles	60 Hz.

2. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency.

PART 3 - EXECUTION

3.01 CONDITIONS OF SERVICE: See pump schedule on contract documents for conditions and characteristics.

3.02 INSPECTION AND FACTORY TESTS: Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance (VIP). Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.03 INSTALLATION AND ACCEPTANCE TESTS:

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Contractor.

B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 23 25 00 HVAC WATER TREATMENT

PART 1 - GENERAL

1.01 WORK INCLUDED: Provide a water treatment system for each closed loop heating and chilled water system. Provide water treatment systems as indicated on the drawings and specified herein.

1.02 TESTING EQUIPMENT AND REAGENTS: Furnish water test equipment and reagents in appropriate cases to verify control parameters.

1.03 HVAC WATER TREATMENT SYSTEMS:

A. Work Included: Provide a complete water treatment system for each closed and each open re-circulating HVAC water system. Provide water treatment systems as indicated on the drawings and specified herein.

B. Manufacturers: The water treatment chemical and service supplier shall be a recognized specialist whose major business is in the field of water treatment. The supplier shall have been active in the field of industrial water treatment for at least ten years and shall have a fully staffed laboratory, development facility, service department, and full-time service personnel.

C. Chemicals: Provide, at no additional cost to the owner, all chemicals required for treating water systems for one year of operation.

D. Water Analysis: The appropriate chemicals to be used will be determined by the analysis of a water sample taken from the building site by the system water treatment supplier. Provide ingredients necessary to achieve the desired water conditions.

E. Instructions: Instruction owner's personnel in the use and operation of each water treatment system, including: monitoring equipment, feed equipment, preparation of chemical solutions, charging of the chemical solution reservoirs, proper handling of chemicals, and proper use of charts and logs.

PART 2 - PRODUCTS

2.01 WATER TREATMENT SYSTEM & EQUIPMENT:

A. Provide and install chemical treatment equipment of the appropriate size and type scheduled below as supplied by Anderson Chemical Company. System is to be an ANCO CL40 or an approved equal by the Engineer or Record.

B. Bypass Feeders: Provide chemical feeders of the bypass or shot type for each separate heating and/or chilled water system. Feeders shall be five-gallon capacity complete with drain, inlet and outlet valves and rated for pressures to 200 psig.

C. Pretreatment: All heating water and/or chilled water piping systems and related equipment shall be thoroughly flushed out with cleaning chemicals designed to remove deposits from construction, such as, pipe dope, oils and loose mill scale.

D. Chemicals: Provide chemicals for the control of corrosion and microbiological fouling based on an analysis of the system materials of construction and its makeup water. The chemicals shall be provided in sufficient quantities for startup and one year of operation.

E. Testing Equipment: Provide equipment and reagents to verify the concentration of corrosion inhibitor.

PART 3 - EXECUTION

3.01 GENERAL:

. The equipment and piping shall be kept clean and free of dirt, welding slag, grease, and like debris during installation.

3.02 SUPERVISION:

A. Provide the services of an authorized representative of the water treatment supplier to supervise the installation, operational check out and startup of the water treatment system.

3.03 EQUIPMENT PLACEMENT AND MOUNTING:

A. The equipment and devices shall be located essentially as shown on the drawings; however, actual placement shall be verified using field measurements, installation diagrams and data relating to the equipment actually approved for installation on this project. The equipment, including accessory devices, shall be mounted in strict accordance with the water treatment supplier's instructions.

3.04 OPERATING INSTRUCTION:

A. The contractor shall include in his price the services of an authorized representative of the water treatment supplier to provide on site operating and service instructions to the Owner's designated operating personnel.

3.05 SERVICE:

A. The water treatment supplier shall provide service for one year, conducting at least one service call every twelve weeks and providing to the Owner at the time of the service call a written report which includes water analyses and recommendations. At the completion of the year's service, water samples from each independent closed loop water system will be submitted to the water treatment company's laboratory, and a written report of the findings will be provided to the Owner.

END OF SECTION

SECTION 23 30 00 HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section is subject to the provisions of Division 23.

B. Ductwork shall be provided to meet the minimum capacities indicated, shall meet all constraints of construction, and shall comply with all Specification Sections.

C. See Section 23 07 00, “HVAC Insulation” for ductwork insulation.

D. No ductwork shall be fabricated until fabrication shop drawings have been prepared, submitted and reviewed.

PART 2 - PRODUCTS

2.01 DUCTWORK - GENERAL:

A. SMACNA Standards indicated shall mean standard published by the Sheet Metal and Air Conditioning Contractor's National Association, Inc. Ductwork shall be constructed in complete conformance with the latest edition of the SMACNA Manual. Duct classification shall be as follows:

1. From terminal units to diffusers, toilet exhaust ductwork: Low Pressure - 1" static pressure, Class B seals.

2. All other supply, return, and outside air ductwork: Low pressure - 2" static pressure, Class A seals.

B. DUCTWORK – RECTANGULAR LOW PRESSURE: Provide all ductwork as indicated in these documents for each and every air conditioning system. This includes all mains, all branches, related fittings and accessories. All duct and fittings shall be manufactured by the same company. Ductwork shall be round, oval or rectangular as indicated on drawings. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Low pressure duct including fittings shall be constructed of steel sheet metal. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.

C. ELBOWS: The construction of radius type elbows in rectangular ductwork shall maintain a centerline radius of 1-1/2 times the cross sectional dimension of the duct in the horizontal plane of the duct turn. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Where radius turns are prohibited, hard 90 degree elbows with turning vanes may be installed. All duct fittings (tees, elbows, etc.) metal gauges for the various fittings shall be as listed in the latest edition of SMACNA. Ductwork fabrication shop drawings shall including drawings of fittings as a part of the shop drawing submittal.

D. TURNING VANES: Turning vanes shall be installed in all 90 degree square and rectangular elbows and at other locations as shown. Vanes shall also be installed on all turns greater than 40 degrees in all rectangular supply, return, outside air and exhaust ductwork. All turning vanes shall be constructed of galvanized steel, two metal gauges heaver than that of the adjacent ductwork. All vanes shall have minimum 4" radius of the curvature, a maximum 4" spacing and no less than 3 vanes in each installation. The turning vanes shall be double thickness type, with vanes secured to the runners and runners secured to the duct. Elbows in round ductwork and other radius elbows shall have an inside radius equal to the diameter of the duct. All duct specialties, i.e. turning vanes, shall be as listed in the latest edition of SMACNA.

E. DUCTWORK – ROUND LOW PRESSURE; Low pressure round ducts up to and including 12" in diameter shall be longitudinal lock seam construction. Low pressure round ducts larger than 12" and all medium pressure round ducts shall be spiral lock seam construction. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.

1. Girth joints in ducts up to and including 12" shall be beaded crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of 3 screws in each joint. The beaded-crimp joint shall provide at least a 1" lap to accommodate the sheet metal screws.

2. Girth joints in ducts larger than 12" shall be the beaded sleeve type. The beaded sleeve joints shall be fabricated of the same gauge galvanized sheet steel and the duct shall be a minimum of 3 screws in each section.

F. SUPPORT FOR RECTANGULAR DUCTWORK: For ductwork with static pressures greater than 2", provide and install sufficient angle iron steel supports to maintain the rectangular configuration. The angle iron sizes and the dimensions of spacing of the supports shall be as listed by the latest edition of SMACNA.

G. HANGERS AND SUPPORTS: Duct hangers and supports shall be in accordance with Section IV (pages 4-1 through 4-13) of the referenced SMACNA Standard, except:

1. Hangers shall be spaced not over 8'-0" on centers.

2. For rectangular ducts with longest dimensions up through 60", hangers shall be the galvanized steel strap type; with the longest dimension 61" and larger, hangers shall be trapeze type constructed of galvanized steel angles with round hanger rods. Sizes for strap hangers and trapeze angles and rods shall be based on duct size as scheduled in the SMACNA Standard, Table 4-1 (page 4-8) for strap hangers and Table 4-3 (page 4-10) for trapeze hangers.

3. For round ducts, hangers shall be galvanized steel strap hangers. Sizes and number of strap hangers shall be based on duct size as scheduled in the SMACNA Standard,

   Table 4-2 (page 4-9). For duct sizes requiring 2 hangers, the hanger supports shall be minimum 3/8" round steel hanger rods.

4. Exposed ductwork on the roof shall be welded, watertight construction and shall be painted with an asphaltic based paint to inhibit rust. Ductwork passing through roof curbs shall be flashed watertight.

2.02 MANUAL DAMPERS AND DAMPER HARDWARE:

A. Splitter dampers shall be constructed of not less than 20 gauge galvanized steel sheet. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12".

B. Volume Control Dampers:

1. Dampers shall be single blade butterfly type in ducts up to and including 12" x 12" size; for ducts larger than 12" x 12", in either or both dimensions, the dampers shall be the multi-blade type. All dampers in O.A. ductwork shall shut tightly and have vinyl edge seals.

2. Single blade butterfly dampers shall be constructed of not less than 16 gauge galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator.

3. Dampers larger than 12" in either direction shall be multi-blade dampers and shall be the opposed blade type, constructed of not less than 16 gauge galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6" and the top and bottom edges of the blade shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator.

4. When dampers occur above other than lay-in ceilings, provide Young Model No. 270-275 controller mounted on top of diffuser with the 5020CC damper. Damper assembly complete with supports, bearings and Young No. 1 regulators with an additional end bearing and chromium plated ceiling escutcheon.

C. Hardware for Manual Dampers:

1. Splitter damper hardware - When neither dimension of a damper exceeds 18", the damper shall be provided with a ball joint bracket attached to the outside of the duct. The bracket shall have a setscrew for securing damper rod in position. The damper operating rod shall be not less than 1/4" diameter steel rod and shall be secured to the damper blade with a clip. When either dimension of a damper exceeds 18", the damper shall be provided with 2 ball joint brackets and rods. The rods shall be located at quarter points on the damper.

2. Duct mounted regulators with operating handle and locking quadrant shall be provided on manual volume control dampers.

3. Damper hardware shall be Ventfabrics, Young Regulator of Duro-Dyne provided the equipment meets or exceeds the Contract Documents.

D. Dampers shall be Ruskin or approved equal by Air Balance, Price, or American Warming and Ventilating.

2.03 FLEXIBLE DUCTWORK:

A. Flexible ductwork shall be Class 1, UL 181-air duct with an aluminized mylar or polyester inner liner laminated to a corrosion resistant steel wire helix. Aluminum helix is not acceptable.

B. A 1" thick, one (1) pound density fiberglass insulation and vinyl outer jacket shall cover the wire helix.

C. The maximum allowable length of low pressure flexible ductwork shall be 4'-0" and shall be limited to short run-outs and end runs connected to round neck ceiling supply diffusers. Provide a spin-in fitting with integral volume damper at all flexible run-out connections in low-pressure ductwork.

D. The maximum allowable length of medium pressure flexible ductwork shall be 1'-0" and shall be limited to short run-outs connecting FPB and VAV units to medium pressure sheet metal ductwork.

E. Flexible ductwork shall be designed for pressures up to 4" W.G. for low-pressure ductwork and 10" W.G. for medium pressure ductwork.

F. Low pressure flexible ductwork shall be Clecon Model Flex 28 VF Series or Genflex Type SLS-181 or Wiremold Type WGC and medium pressure flexible ductwork shall be Clecon Model FLEX 28 VF Series, Genflex 1HPL-181 or Wiremold Type WGC.

2.04 FLEXIBLE DUCT CONNECTIONS:

A. Flexible duct connections shall be non-combustible, installed at all belt-driven equipment and where shown. Material shall be glass fabric double coated with neoprene (30 0z. per square yard minimum) and shall be Vent Fabrics, Duro-Dyne or Young Regulator, provided the equipment meets or exceeds the Contract Documents. Provide duct supports on each side of flexible connections.

2.05 FIRE DAMPERS/COMBINATION FIRE/SMOKE DAMPERS:

A. Fire dampers (FD) shall be provided at all penetrations through fire rated walls and partitions. Fire dampers shall be UL labeled and shall be Type B (blades out of the air stream) or Type C (round or oval duct). Damper shall be Ruskin Model 1BD2 or approved equal.

1. Hat channel frame shall be 16 gauge minimum galvanized steel with tabbed corners for reinforcement. Bearings shall be stainless steel sleeve. Blades shall be airfoil shaped double skin construction with 14 gauge equivalent thickness. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in blade edge (adhesive or clip fastened seals not acceptable) and shall withstand 450 F. Jamb seals shall be flexible metal compression type.

2. Each damper shall be 1-1/2 hour rated under UL555, and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems. Leakage rating under UL555S shall be Class 1 (4-cfm/sq. ft. at 1" w.g. and 8" cfm/sq.

3. Dampers shall operate (open and close) under HVAC system operating conditions with pressures of at least 8" w.g. in the closed position and 4000 fpm air velocity in the open position.

4. In addition to the leakage ratings, the dampers and their actuators shall be qualified as a single entity under UL555S to 350 F elevated temperature. Actuators shall be installed at time of damper fabrication. Dampers shall be equipped with factory supplied caulked sleeve. All wiring or piping material required to interconnect the actuator with detection and/or alarm or other systems shall be furnished by others. Damper shall be Model FSD60 or approved equal.

5. FireStat: Each combination fire/smoke damper in smoke exhaust system or smoke wall shall be equipped with a UL Classified FireStat equal to Ruskin Model TS150. The FireStat shall electrically and mechanically lock damper in a closed position when duct temperatures exceed 212 F and still allow appropriate authority to override the FireStat and operate the damper as required for smoke control functions. Damper must be operable while temperature is above 250 F. FireStat package shall include two position indicator switches linked directly to the damper blade to remotely indicate damper blade position. FireStat and position indicator switches shall permit electrical interface with smoke detectors, building fire alarm systems, and remote indicating/control stations. FireStat shall be equipped with High Limit Temperature Sensor that meets all NFPA 92A requirements by returning damper to fire protection mode when temperatures reach 350 F which is the operational limit of the damper and actuator assembly.

6. Electric actuator shall be 120 volts ac, 70 watts running and 25 watts while in the holding mode. The actuator shall be designed to spring the damper closed upon loss of power in less than 20 seconds. Stall type actuators are unacceptable. Damper actuators shall be factory-installed on the damper and tested to verify cycle timing.

B. Combination fire/smoke dampers shall be provided at penetrations through walls, partitions, and floors with fire/smoke rating. Combination fire/smoke dampers shall be UL labeled.

C. Acceptable manufacturers of fire dampers are: Ruskin, or Greenheck provided the equipment meets or exceeds the Contract Documents.

2.06 ACCESS DOORS:

A. Provide a duct access door at each fire and/or smoke damper where required for access. Access doors 18" x 18" and larger shall have a continuous hinge on one side with latch on the other side. Access door shall be designed for five (5) times the pressure of the duct in which it is mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting or replacing thermal links. Access doors shall be double metal faced, internally insulated same as duct, and provided for gasket seal. Access doors downstream of fire dampers in medium pressure ductwork shall be the implosion type.

B. Coordinate the location of access doors above inaccessible ceilings with the Architect.

C. Access doors shall be equal to Ruskin Model ”ADR16” for round duct and Model “ADC22” for square ductwork.

2.07 AIR EXTRACTORS:

A. Provide in duct mounted supply outlets and takeoff or extension collars to supply outlets. Air extractors shall be factory-fabricated and factory or field assembled units consisting of curved turning vanes or louver blades for uniform air distribution and change of direction with minimum turbulence and pressure loss. Where adjustable devices such as air deflectors or extractors are inaccessible they shall be provided with means for adjustment and position lock external to the duct in which they are located. Equal to Young Regulator Model No. 1.

2.8 DUCT INSTRUMENT TEST HOLES:

A. Provide for each system four (4) test holes two (2) in supply duct and two (2) in return air plenum at opposite ends near air handling units with screwed caps. Also, at duct mounted coils and electric duct heaters provide one (1) on either side of the coil or duct heater.

2.9 REGISTER AND GRILLE CONNECTION:

A. Where take-offs are on the side of a duct, clinch lock short tee sections onto trunk. Install collars with slip joints and 3/4" flange at outlet end. At plastered surfaces set collars exactly flush with plaster surface (mechanic must be on job to make adjustments during plaster application). Set flange face so as to receive register gasket, and be concealed by register flange. Collars may be deleted where mounting frames are furnished with registers.

B. Install boots above lay-in ceilings simultaneously with ceiling work; mechanic must be on job during this phase of construction work.

C. At return relief and exhaust grilles 48" or more in either dimension, collars shall be 1 x 2 x 1/8 inch steel angle frames with corners mitered, welded and ground smooth. Frames in ceilings shall be independently suspended from the ceiling structure.

D. Interior of ductwork visible through grilles and diffusers shall be painted flat black.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install all ductwork and accessories as shown and in accordance with applicable SMACNA Standards.

B. All joints in ductwork shall be sealed with a fire retardant duct sealant. Tape is not acceptable.

C. Duct liner shall be cut to provide overlapped and compressed longitudinal corner joints. Liner shall be installed with coated surface facing the air stream. Duct liner shall be adhered to the ductwork with a 100% coverage of the sheet metal surfaces using a fire retardant adhesive applied by spraying. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. All leading and trailing edges shall be secured with sheet metal airfoils.

D. Sound Proof Construction for Duct Penetrations is required for openings between ductwork and interior spaces. The method for soundproofing shall be as follows:

1. Fill openings with fibrous glass blanket or board for full depth of penetration.

2. Caulk each side of opening with non-hardening, non-aging caulking compound equal to Johns-Manville "Duxeal".

3. Penetrations through fire-rated partitions and shafts shall be sealed with Dow-Corning RTV fire-retardant foam.

4. Duct system sound levels shall be maintained at such as level as to not exceed a maximum of NC 35 for all spaces. Duct fabrication and installation shall be altered if noise levels are exceeded at no cost to the Contract.

5. All exterior kitchen exhaust ductwork shall be painted with rust inhibiting primer.

6. Unavoidable obstruction: Where structural elements or pipes must pass through a duct, provide two-piece streamliners, and enlarge duct to compensate for net loss of area. Round pipes and rods smaller than three (3) inches need not have special treatment. Note: This provision will not be used to justify obstructions, which can be avoided.

E. Splitter Dampers:

1. Provide where shown on drawings. Fabricate blades of same thickness galvanized steel as the duct where used; minimum 20 gauge thickness

2. Anchor splitters at the air entering edge by 3/16 inch adjustable galvanized steel rods that pass through set screw clamps on the outside of duct. Use one (1) rod and clamp on splitters with leading edge up to 15 inches, (2) rods up to 30 inches, and on 15-inch centers above 30 inches.

3. When splitter dampers occur above other than lay-in ceilings, provide Young Model No. 270-275 Controller Mounted on Top of Diffuser with the 5020CC Damper. Damper assembly complete with supports, bearings and Young No. 1 regulators with an additional end bearing and chromium plated ceiling escutcheon.

3.02 PRESSURE TESTING OF DUCTWORK:

A. Testing Procedures: All pressure testing of ductwork shall be preformed prior to the installation of external insulation. Duct sealant shall be applied within the factory recommended temperature range and fully cured prior to any tests.

B. The contractor shall determine pressure range and capacity of the test apparatus to insure the pressure is suitable for the ductwork being tested.

C. Allowable leakage chart:

System Types	Minimum Test Press	Max Allowable Leakage
1) Fan coil systems, small exhaust/supply fans. Fractional HP fan systems.	0.5” W.C.	2%
2) Small split D.X systems	1.00” W.C.	2%

3) VAV and constant terminal units including LP downstream ductwork.	1.00" W.C.	2%
4) Single zone systems/ L.P. VAV and CAV systems, RA duct systems.	2.00" W.C.	2%
5) Constant volume ductwork in chases, concealed spaces, main R.A. ducts on VAV and CAV systems & main ducts on exhaust and/or supply systems.	3.00" W.C.	1%
6) Supply air ductwork to VAV and CAV terminal units	4.00" W.C	1%
7) High pressure induction system	6.00" W.C.	0.5%

D. Report of Test Data:

1. Once the testing of all duct systems has been completed, this contractor shall provide a report of leakage results that will include the following:

   a) The project name and location
   b) Date of test
   c) Name of person making test including the name of Architect, Engineers, Contractor, or witness to said test.
   d) Description of test including the sealing clarification and duct classification
   e) The design and actual test static pressure
   f) The design and actual leakage rate
   g) Duct test to conclude if test passed or failed

E. All pressure testing of ductwork shall be in accordance with the Associated Air Balance Council (AABC) standards for Total System Balance, 2002 Edition.

END OF SECTION

SECTION 23 41 00 PARTICULATE AIR FILTRATION

PART 1 – GENERAL

1.01 SCOPE:

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Descriptions:

1. Air filters for Heating, Ventilating and Air Conditioning.

2. Definitions: Refer to ASHRAE 52.2 (MERV) for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), atmospheric dust spot efficiency, dust-holding capacity, etc.

1.02 COORDINATION: The Filters of one manufacturer (Farr) have been used as the basis of design. Any modifications to ductwork, building structure, ect., that result from the use of any other units shall be coordinated with all trades; this coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the Owner.

1.03 ACCEPTABLE MANUFACTURERS:

A. Manufacturers listed below are acceptable: Farr, American Filter, or Cambridge.

B. All devices selected must meet or exceed all the requirements of the Contract Documents.

C. Manufacturer's Literature:

1. Extended surface filters

2. Holding frames

3. Side access housing

4. Throwaway filters (T.A.)

PART 2 – PRODUCTS

2.01 EXTENDED SURFACE AIR FILTERS:

A. Use factory assembled air filters of the extended surface type with externally supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filters shall be disposable type of the pleated or extended type.

B. Filter Classification: Underwriters' Laboratories (UL) approved class 2 conforming to UL's latest Standard.

C. Temporary Filters: For temporary use of HVAC systems during the construction period, all systems shall be equipped with replacement filters as described herein:

1. For HVAC systems with pre-filter and final filter banks, contractor to provide to the owner two complete sets of pre and final sets of replacement filters.

2. HVAC systems with only one filter bank; provide the owner with two complete sets of replacement filters.

3. Refer to Section 23 05 10 “HVAC General Requirements”; paragraph 1.04-Temporary HVAC for the operation of HVAC systems during the construction period.

D. Side Servicing Housing: Minimum 16 gage galvanized steel, or aluminum, completely factory assembled with upstream and downstream flanges for connection into the duct system. Furnish housing with sufficient length to provide for a fully extended filter.

Access Doors: Double skin insulated, on each side of the housing with continuous gasketing on the perimeter a positive air lock.

Filter Slide Channels: Channels shall incorporate a positive-sealing gasket material to seal the top and bottom of the filter cartridge frames to prevent bypass. Provide factory installed gasketing to prevent leakage between cartridges, and between cartridges and doors.

E. Holding Frame System: To be constructed of 16 Gage galvanized steel. Frames to be equipped with polyurethane foam gaskets and filter centering dimples. All framing members shall be permanently gasketed to prevent any bypass of air.

The framing system shall include a factory installed positive sealing device for each row of filters. This device shall allow for easy installation and removal of cartridges and shall insure the seal between the gasketed filter elements while the bank is in operation.

F. Provide Magnehelic Differential Pressure Gauges at each air unit’s filter section. Gauges to be nominal 4” diameter with a zero to 2” range.

2.02 PRE-FILTERS 1” THICK, MERV VALUE 5 (DISPOSABLE):

A. Pre-Filters to be equal to Farr 30/30 series, 1” thick, flat panel type designed and fabricated for disposal. Filters shall consist of a cotton and synthetic media, support grid and enclosing frame. Filter to be listed by Underwriters’ Laboratories as Class (2) (1).

B. Filter media shall have an average efficiency in accordance with ASHRAE Test Standard 52.2 MERV values.

2.03 PRE-FILTER 2” THICK, MERV VALUE 5 (DISPOSABLE):

A. Filter shall be equal to Farr 30/30 series, 2” thick, pleated, of the disposable type. Filter media shall consist of non-woven cotton fabric with supporting grid and frame mounted. The filter shall be listed by Underwriters Laboratories with Class 2 Classification.

B. The filter media shall have an efficiency resistance per MERV standards in accordance with ASHRAE Testing Standard 52.2. The initial resistance shall not exceed 0.28 inches W. G. at 500 FPM velocity.

C. The media shall be supported on a wire grid with an effective free area of 96%. The wire grip to be bonded to the filter to prevent media from pulling away.

D. The holding frame shall be constructed of 16 gauge galvanized steel. The frame shall be gasket equipped and held in place with spring loaded fasteners.

PART 3 – EXECUTION

3.01 INSTALLATION: Install supports, filters, housing and gauges in accordance with manufacturer's instructions.

3.02 START-UP AND TEMPORARY USE:

A. Prior to the start-up of all air handling units, all AHU's, and plenums to be cleaned inside and out to the satisfaction of the ENGINEER.

B. Provide and install new filter media as specified into each air system. Provide and deliver replacement filters to the Owner as directed by the Engineer.

3.03 SPARES: Provide two (2) extra sets of replacement filters of each type for each air system.

END OF SECTION

SECTION 23 51 23 GAS VENTS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section is subject to the provisions of Section 23 05 10, “HVAC Genera Requirements”.

B. Gas vents shall be U.L. listed and provided as indicated, shall meet all constraints of construction and shall comply with all Specifications Sections.

1.02 COORDINATION: The gas vents/flues as manufactured by Metalbestos have been used as the basis of design. Any modifications to roof openings, structural supports, etc., that results from the use of equipment by any other manufacturer, shall be coordinated with all other trades; this coordination shall occur before delivery of the equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the Owner. Any vents selected must meet or exceed all the requirements of the Contract Documents.

1.03 ACCEPTABLE MANUFACTURERS:

A. Factory fabricated gas vents shall be Metalbestos or an approved equal.

B. In lieu of Metalbestos, gas vents may be steel. Steel construction vents shall not be less than 10 gauge carbon steel of all welded construction and provided with hinged cleanout doors and necessary expansion joints. Expansion joints shall be skip type, complete with guides and protected by flexible stainless steel welded covers.

C. If welded carbon steel vent is used, provide two (2) coats of a high temperature rust inhibitive primer and paint to all outside surfaces of vent extending above roof. Color of paint shall be selected by Architect and applied under Mechanical Division 23. Submit color chart for selection and approval by Architect.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The vent supports shall be tested, approved and listed by Underwriter's Laboratories. These supports shall be capable of supporting four times the combined weight of the vent installation.

B. All clearances to combustible material shall be maintained so as to comply with all codes and regulations.

C. Provide weatherproof roof caps. Bird-proof screens on all gas vents.

D. Flues extending above roof surfaces shall terminate in a U.L. listed top or housing assembly, according to Appendix D of NFPA No. 211 or according to local code.

2.02 ATMOSPHERIC NEGATIVE PRESSURE VENT PIPE:

A. Natural draft equipment shall be vented with an approved Type "B" double wall vent piping system, Metalbestos Type QC.

B. The inner vent pipe shall be aluminum surrounded by a 0.5" air space and galvanized steel outer jacket.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Gas vents shall be installed in complete conformance with the manufacturer's recommendations and these Contract Documents.

B. Provide all necessary expansion joints, supports, thimbles, etc., for a complete installation.

END OF SECTION

SECTION 23 52 33 WATER TUBE BOILER (POWER-FIN)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. All work specified in this Section shall be subject to the provisions of Section 23 05 10 "HVAC General Requirements".

1.02 DESCRIPTION OF WORK:

A. Provide gas-fired hot water boilers, as scheduled on the drawings.

1.03 QUALITY ASSURANCE:

A. Manufacturing firms shall be regularly engaged in the manufacture of gas-fired hot water boilers of the type and sizes required whose products have been in satisfactory use in similar service for not less than five (5) years.

B. UL and NEMA Compliances - Provide electric motors and electrical components required as part of water heating equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

C. NEC Compliance - Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components.

D. AGA Label - Provide boilers which are listed and approved by the American Gas Association.

1.04 SUBMITTALS:

A. Product Data - Submit manufacturer's equipment specifications, installation and start-up instructions, and capacity and ratings, with selection points clearly indicated.

B. Shop Drawings - Submit shop drawings indicating dimensions, weights and required clearances.

C. Maintenance Data - Submit maintenance data and parts lists for each item of equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Handle boilers and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged boilers or components; replace with new.

B. Store boilers and components in a clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading and moving boilers to final location.

PART 2 - PRODUCTS

2.01 HEATING WATER BOILERS - GAS FIRED - 84%:

A. Refer to drawings for boiler sizes, capacities and electrical requirements.

B. Basis for design: Lochnivar “Power-fin” Series.

C. Boiler shall be gas fired completely packaged and provided with the following:

1. Copper finned tube heat exchanger.

2. Porcelain coated cast iron or bronze headers rated at 160 psi.

3. 310 stainless steel burners.

4. Electronic intermittent pilot ignition.

5. Integral blowers and multiple gas valves to precisely control fuel/air mixture.

6. Thermal efficiency shall be 84% minimum.

7. Gas shutoff valve, pressure regulator, pilot valve and safety shutoff valve.

8. Combination temperature and pressure gauge.

9. ASME pressure relief valve.

8. AGA listing.

9. 115 volt operation with transformer.

10. High gas pressure switch.

11. Automatic high limit switch, adjustable reset.

12. Flow switch.

13. Re-circulating Pump – Factory Mounted

B. Warranty - Five (5) year limit warranty on heat exchanger and burners.

C. Manufacturer - Subject to compliance with the above requirements, provide gas fired boilers of one of the following manufacturers: Lochinvar, Raypak, or Teledyne Laars

PART 3 - EXECUTION

3.01 GENERAL:

A. Install boiler as indicated, and in accordance with manufacturer's installation instructions. The location and position of boilers shall be as per code to provide adequate clearance for maintenance.

B. Make all water and gas piping; connections as shown on drawings. Provide nipples, dielectric isolators, drip legs, valves and cocks or complete installation as required.

C. Electrical - Coordinate connection of electrical service. Refer to Electrical Division 26 for power wiring; not work of this section.

D. Boiler shall be installed on concrete housekeeping pad. Provide a pad and coordinate exact size and location in field. Orient units so that all controls have proper access for operation and maintenance.

E. Coordinate all boiler piping with flue piping. All piping must be properly supported so that no loads are transmitted to boiler connections.

F. Pipe drain and relief valve, full size to floor drain.

3.02 ADJUSTING AND CLEANING:

A. Startup - Startup, test, and adjust boilers, circulating pumps, safety valves, etc. in accordance with manufacturer's startup instructions. Check and adjust controls, temperature controllers, burners, etc., for proper operation and maximum efficiency. Balance flows through boilers. Provide ball valves with memory stops for boiler control valves.

B. Cleaning - Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 64 26 ROTARY-SCREW WATER CHILLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10 “HVAC Genera Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11 titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. Furnish and install all required equipment, appurtenances, and accessories for a complete heating and cooling system.

D. See other sections of these specifications that may specify accessories or features.

E. Refer to the schedules on the drawings where equipment capacities are not included in this section.

F. Review other sections of the specifications and the plans for services required to each piece of mechanical equipment. Any required accessories, appurtenances, or service omitted from the plans or specifications that are not called to the attention of the Architect at least 72 hours before bidding and corrected by addendum shall be provided as though shown.

1.02 WARRANTY:

A. Rotary screw chiller shall carry manufacturer's non-prorated, five (5) year warranty, including parts, labor and refrigerant.

PART 2 - PRODUCTS

2.01 COORDINATION:

A. The units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

2.02 SUMMARY

A. The contractor shall furnish and install air-cooled water chillers as shown as scheduled on the contract documents. The chillers shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. The contractor shall furnish and install Trane Model RTAA, McQuay Model ALS, York Model YCAS, Carrier Model GX or Dunham Bush Model ACWC air-cooled rotary liquid chiller of size and capacity scheduled. Unit shall be installed in strict accordance with this specification. All units shall be furnished complete with helical rotary compressors, shell and tube evaporator, air-cooled condenser, expansion valves and microprocessor control panel. Total unit shall be UL certified and include the UL label. The unit shall be designed for outdoor application and painted. The unit shall be rated in accordance with ARI Standard 550/590-2003.

2.03 COMPRESSORS

A. Construct chiller using semi-hermetic helical rotary screw compressors with independent circuits.

B. Statically and dynamically balance rotating parts.

C. Provide oil lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation.

D. Provide compressor with automatic capacity reduction equipment consisting of suction valve unloaders or capacity control slide valve (rotary). Use lifting mechanism operated by oil pressure. Compressor must start unloaded for soft start on motors.

E. Provide constant speed 3600 rpm at 60 Hz (3000 rpm at 50 Hz) compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for across-the-line or wye-delta starting. Furnish with starter.

F. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating.

G. Provide field-installed sound attenuator. Sound attenuator shall be manufacturered using flexible barium sulfate material with a foam backing. Attenuating pieces of various shapes and sizes shall be cut and sewn with VELCRO® as an attaching medium. Attenuator shall encompass all suction lines, the compressors, the discharge lines and the oil separators.

2.04 EVAPORATOR

A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless internally finned copper tubes, roller expanded into tube sheets.

B. Design, test, and stamp refrigerant side for 300 psig (2068 kPa) working pressure and water side for 150 psig (215 psig or 1482 kPa in extreme cases) working pressure, in accordance with ANSI/ASME SEC 8.

C. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.

D. Water connections shall be grooved pipe. Evaporator shall have only one entering and one leaving connection. If manufacturer provides 2 separate evaporators, contractor shall provide manifold and pressure gauges to ensure equal flow is provided to each evaporator.

2.05 CONDENSER AND FANS

A. Chiller shall be able to operate in ambient conditions of 25 degrees F (RTAA 70-125).

B. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 506 psig (3488 kPa).

C. Provide coil protection for shipping. Entire condenser coil shall be covered with heavy plastic to prevent inadvertent damage to coil during shipment or rigging.

D. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Entire fan assembly shall be statically and dynamically balanced and fan assembly shall be either painted or zinc coated steel. Fan guard shall be either PVC, chrome or zinc coated.

E. Provide fan motors with permanently lubricated ball bearings and built-in thermal overload protection.

2.06 ENCLOSURES

A. House components in a galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.

B. Unit panels and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.

C. Mount starters and [disconnects] in weatherproof panel provided with full opening access doors. Provide lockable through-the-door disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8 inch). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

2.07 REFRIGERANT CIRCUIT

A. All units shall have 2 refrigeration circuits to provide redundancy, each with one compressor on each circuit. Single refrigerant circuit chillers are not acceptable.

B. Provide for each refrigerant circuit:

1. Liquid line shutoff valve.

2. Filter dryer (replaceable core type).

3. Liquid line sight glass and moisture indicator.

4. Electronic or thermal expansion valve sized for maximum operating pressure.

5. Charging valve.

6. Discharge and oil line check valves.

7. Compressor suction and discharge service valves.

8. High side pressure relief valve.

9. Full operating charge of HCFC-22 and oil.

C. Provide Compressor suction service valves and discharge service valves in order to have the ability to isolate the compressor from the rest of the refrigerant system.

D. Capacity Modulation: Provide capacity modulation by either slide valve or unloader valves. Unit shall be capable of operation down to 15%. In the event manufacturer can not provide a unit with modulation down to 15%, Hot Gas Bypass must be provided.

2.08 VARIABLE EVAPORATOR FLOW CAPABILITY

A. All chillers applied in variable evaporator flow (VPF) system shall be able to withstand a chilled water flow rate-of-change of twenty five percent (25%) per minute while maintaining plus or minus two (+/- 2 F) of design supply chilled water temperature, and fifty percent (50%) per minute at any load above the compressor minimum without cycling "off" on low load (low leaving water temperature) or evaporator refrigerant temperature limit.

1. The chiller manufacturer demonstrate chiller operational stability to the facility owner or his agent with flows varying up to 30% per minute during chiller system commissioning. The chiller manufacturer shall have a chiller technician present along with the owner agent and control system representative during this on-site testing. If the chiller does not pass the validation it shall be the responsibility of the mechanical contractor and chiller manufacturer to modify the chiller and/or chiller system to provide reliable operation with system flow rates-of-change of up to 30% per minute

2. As an alternative to on-site verification the chiller shall be equipped from the chiller manufacturer with flow monitoring that shall provide feed-forward and auto-tuning control input to the chiller compressor capacity control. As flow changes are detected, the feed-forward logic shall work in concert with the water temperature control algorithms to initiate a change in compressor capacity proportional to the flow and resultant load change. In addition the change in flow shall cause the capacity controller to tune its control loop PID loop gains for best accuracy and stability.

2.09 CONTROLS

A. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer. Controls shall include the following readouts and diagnostics:

1. Phase reversal/unbalance/single phasing and over/under voltage protection.

2. Low chilled water temperature protection.

3. High and low refrigerant pressure protection.

4. Load limit thermostat to limit compressor loading on high return water temperature.

5. Condenser fan sequencing to automatically cycle fans in response to load, expansion valve pressure, and condenser pressure to optimize unit efficiency.

6. Display diagnostics.

7. Oil pressure control.

8. Compressors: Status (on/off), %RLA, solid state anti-short cycle timer, and automatic compressor lead-lag.

B. On chiller, mount weatherproof control panel, containing starters, power and control wiring, single point power connection on units with MCA less than 500 amps. Provide primary and secondary fused control power transformer and a single 115 volt single phase connection for evaporator heat tape.

1. The unit controller shall utilize the following components to automatically take action to prevent unit shutdown due to abnormal operating conditions which will perform as follows:

a. High pressure switch that is set 20 PSIG lower that factory pressure switch that will automatically unload the compressor to help prevent a high pressure condenser control trip. One switch is required for each compressor and indicating light shall also be provided.
b. Motor surge protector that is set at 95% of compressor RLA that will automatically unload the compressor to help prevent an overcurrent trip. One protector is required for each compressor and indicating light shall also be provided.
c. Low pressure switch that is set at 5 PSIG above the factory low pressure switch that will automatically unload the compressur to help prevent a low evaporator temperature trip. One switch is required for each compressor and indicating light shall also be provided.

C. In the above case, the chiller will continue to run in an unloaded state, and will continue to produce some chilled water in an attempt to meet the cooling load. However, if the chiller reaches the trip-out limits, the chiller controls will take the chiller off line for protection, and a manual reset will be required. Once the "near-trip" condition is corrected, the chiller will return to normal operation and can then produce full load cooling.

D. For each compressor, provide wye-delta starter on 200-230V units.

E. Provide the following safety controls with indicating lights or diagnostic readouts.

1. Low chilled water temperature protection.

2. High refrigerant pressure.

3. Low oil flow protection.

4. Loss of chilled water flow.

5. Contact for remote emergency shut-down.

6. Motor current overload.

7. Phase reversal/unbalance/single phasing.

8. Over/under voltage

9. Failure of water temperature sensor used by controller.

10. Compressor status (on or off).

F. Provide the following operating controls:

1. Eight (8) or more step leaving chilled water temperature controller which cycles compressors and activates cylinder unloaders or slide valve based on PI algorithms. If manufacturer is unable to provide at least 8 steps of unloading, providing hot gas bypass shall be required.

2. Five minute solid state anti-recycle timer to prevent compressor from short cycling. If a greater than 5 minute solid state anti recycle timer is provided, hot gas bypass shall be provided to insure accurate temperature control in light load applications.

3. Load limit thermostat to limit compressor loading on high return water temperature to prevent nuisance tripouts.

4. High ambient unloader pressure stat that unloads compressors to keep head pressure under control and help prevent high pressure nuisance tripouts on days when outside ambient is above design.

5. Compressor current sensing unloader unit that unloads compressors to help prevent current overload nuisance tripouts.

6. Auto lead-lag functions that constantly even out run hours and compressor starts automatically. If contractor can not provide this function then cycle counter and hour meter shall be provided for each compressor so owner can be instructed by the contractor on how to manually change lead-lag on compressors and even out compressor starts and running hours.

7. Low ambient lockout control with adjustable setpoint.

8. Condenser fan sequencing which automatically cycles fans in response to ambient, condensing pressure and expansion valve pressure differential thereby optimizing unit efficiency.

G. Provide pre-piped gauge board with pressure gauges for suction and discharge refrigerant pressures or digital display of pressures on microprocessor.

H. Provide ammeters for each compressor or digital display of % RLA on microprocessor.

I. Digital Communications to BAS system shall consist of a LonMark certified LonTalk interface supporting all standard and optional points in the LonMark chiller profile. Certification by LonMark is only acceptable if listed on lonmark.org web listing **.**

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.

C. Coordinate all work with other trades as necessary for proper interfacing.

D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 START-UP: An authorized representative of the equipment manufacturer shall provide the initial start-up. The balancing sub-contractor shall be responsible for final verification and reporting of all airflows.

3.03 ADJUSTMENT: The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 81 50 BLOWER COIL UNITS

PART 1 - GENERAL

1.01 UNIT DESCRIPTION: Provide indoor-mounted, draw-thru packaged blower coil unit(s). Unit(s) shall be factory assembled, factory supplied, including direct-expansion evaporator coil, expansion valve(s), check valves, sight glass condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

1.02 RELATED SECTIONS:

A. Section 23 05 10 - “HVAC General Requirements”

B. Section 23 05 13 - “Common Motor Requirements for HVAC Equipment”

C. Section 23 05 12 - “HVAC Pipe, Fitting and Accessories”

D. Section 23 05 48 - “Vibration and Seismic Controls for HVAC Piping and Equipment”

E. Section 23 62 00 - “Packaged Compressor and Condenser Units”

F. Section 23 64 26 - Rotary- Screw Water Chillers”.

G. Section 23 09 13 - “Instrumentation and Controls for Devices for HVAC”.

1.03 REFERENCES:

A. Direct expansion blower coil units rated 60,000 BTU’s and less must be listed by the Air Conditioning and Refrigeration Institute with the condensing units furnished on this project.

B. Products must be manufactured to conform to the applicable standards listed in this Section.

C. Air Conditioning and Refrigeration Institute (ARI) 210, 430.

D. Coils UL 207, UL Report SA 3438.

E. Material Specifications:

1. Sheet Metal ASTM A525, ASTM A527

2. Copper Tubing ASTM B68, B75, B251, B88, B209

3. Motors UL/CSA, NEMA

4. Paint ASTM B-117

1.04 SUBMITTAL:

A. Submit shop drawings under provisions of Section 23 05 11, “HVAC Submittal Data”.

B. Shop drawings must include wiring diagrams, which show the options, or accessories called for elsewhere in the specifications.

C. Submit product data including ratings, dimensions, weights, and mounting details. Show accessories, necessary clearances, electrical requirements, and size and location of field connections.

D. Include manufacturer's installation instructions in the submittal.

1.05 OPERATION AND MAINTENANCE DATA: Furnish operating data, start-up instructions, maintenance data, and parts lists.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Reject delivery if there is obvious damage. Unpack and inspect the unit(s) for transportation damage as soon as they are received. Check for loose components and wiring. Notify the transportation company if any damages are found.

B. Comply with manufacturer's instructions for rigging, unloading, transporting and storing units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Blower Coil Units (BCU) shall be as manufactured by MagicAire, Trane, and First Company or as approved by the Engineer of Record.

B. Substitutions: Requests for approval to bid on other brands must be made in writing ten (10) working days prior to bid date. Furnish complete information on the proposed item including an explanation of how the item differs from the Specification.

C. Check dimensions of any substitute offered to verify that offered units will fit into the space allocated and allow sufficient clearance for removal and service of all components.

D. Furnish BCU units as listed on the schedule. Install where shown on drawings and in accordance with manufacturer's instructions.

2.02 Cabinets:

A. External parts are to be fabricated from heavy gauge, zinc coated galvanized steel. Panels shall be coated with a polyurethane based powder after being formed. There shall be no raw, unpainted edges. Internal parts shall be fabricated from G90 galvanized steel.

B. Large removable panels shall be provided to permit full access to all internal components. The structural integrity of the cabinets shall remain unaffected by the removal of any or all access panels.

C. Insulation shall be ¾ inch dual density, blanket-type made from borosilicate glass fibers bonded with a thermosetting resin. One and a half (1.5) pound density will be used to provide acoustical and thermal control, fire safety and resistance to air erosion.

D. Unit shall be furnished with return plenum.

2.03 COILS:

A. Chilled and Hot water coils shall be of the staggered tube type constructed with seamless copper tubes and headers, deep corrugated aluminum fins with straight edges. Manufacturer shall supply full depth collars, drawn in fin stock to provide accurate control of fin spacing and complete coverage of the copper tubes to lengthen coil life. The tubes are to be mechanically expanded into the fins for a permanent primary to secondary surface bond. Coils are to be tested at 500 psi for operation at 400 psi gauge.

B. Coils shall be suitable for the application and comply with performance as described in the unit schedule.

C. Hot water heating coils shall be 2 row type in the preheat position.

2.04 FANS:

A. Fan wheels shall be double width, double inlet, forward curved, centrifugal type. They shall be statically and dynamically balanced. The housing shall be constructed of heavy gauge steel with die formed inlet cones. Bearings shall be ball bearing, self-aligning, sealed cartridge and permanently lubricated. Mounting shall be in rubber. Bearings shall be designed for 200,000-hour average life. The fan shaft shall be solid cold rolled steel. It shall be designed so that its operating speed is below its first critical speed.

2.05 MOTORS:

A. Motors shall be standard duty, 1725 rpm, open, drip-proof resilient mounted. All motors are to have automatic reset thermal protection. They shall drive the blower wheel by means of a V-belt and sheaves. The platform to which the motor is bolted will be adjustable to facilitate belt tension and alignment. The motor sheave shall be cast iron single groove with split tapered bushing that is keyed to the shaft.

2.06 FILTERS:

A. The filters shall be included in the units as an integral part of the cabinet with easy access provided by the manufacturer. See specification Section 23 41 00 “Particulate Air Filtration” for air filter requirements.

2.07 FACTORY PIPING PACKAGE

A. Unit manufacturer shall provide piping package factory assembled and shipped loose for field installation. Control valves shall be selected with a valve flow coefficient providing a branch authority between 25 and 70% (waterside pressure drop of the valve divided by the waterside pressure drop of the branch circuit piping including the coil). Two-way or three-way piping packages shall be available.

1. Two way piping packages shall include the following component connected in the direction of water flow:

a. Supply ball valve
b. Strainer
c. 2-way control valve
d. Circuit balancing valve

2.08 CONTROLS

A. DDC Controls

1. Space Temperature Control

a. Provide a factory installed DDC controller to reset the discharge air temperature based on space temperature and effective space temperature setpoint. See sequence of operation.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install units where shown on drawings and in accordance with manufacturer's instructions.

B. Do not allow electrical conduit or any piping to block access panels.

C. Power wiring will be done under Division 26, Electrical.

D. Furnish copy of manufacturer's installation instructions to electrical contractor.

E. For horizontal BTU located above ceiling, Contractor shall provide and install insulated 3" deep galvanized drain pan under entire unit with insulated, minimum 1" drain line piped to waste. See plans.

3.02 MANUFACTURER'S QUALIFICATIONS: The manufacturer of the units described in this specification shall have a minimum of 20 years experience in the design, manufacturing, and application of such units.

3.02 WARRANTY: Entire blower coil unit shall carry a full factory warranty for two (2) years. Warranty shall be non-prorated type and shall cover all parts, refrigerant and labor.

END OF SECTION

SECTION 26 05 10 ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE:

A. This Division and the accompanying electrical drawings cover furnishing all labor, equipment and materials and performing all operations in connection with the installation of a complete and operational electrical system.

B. There are many interfaces between the work involved with this Division and the work in other Divisions, particularly with Division 15. Be aware of the responsibilities at the interfaces. The exact locations of apparatus, fixtures, equipment and raceways shall be ascertained from all concerned and the work shall be installed accordingly. In addition, coordinate with all equipment suppliers and other trades to verify the actual installation requirements prior to rough-ins.

C. The plans and specifications are considered cooperative and complementary. Where one contradicts the other the specifications shall govern. In the case of conflicts notify the Design Engineer for clarification prior to any installation.

D. All applicable portions of the General and Specific Conditions are included herein by reference.

1.02 DEFINITIONS:

A. Install: Receive, store, place, fix in position, secure, anchor, etc., including necessary appurtenances and labor so the equipment or installation will function as specified and intended.

B. Furnish: Purchase and supply equipment and components, including shipping and receiving.

C. Provide: Furnish, install, connect, test, demonstrate and leave operational.

D. Wiring: Wire or cable installed in raceway with all required boxes, fittings, connectors, etc.

E. Work: Materials completely installed, including the labor involved.

F. Or approved equal: Equal in type, design, quality and appearance, as determined by the Engineer.

G. Raceway: Galvanized rigid steel conduit (GRC), electrical metallic tubing (EMT), schedule 40 Polyvinyl Chloride (PVC), flexible steel (FLX), sheathed flexible steel (SLT), code gauge wireway (WW).

1.03 CODES AND REGULATIONS:

A. All work shall comply with all local laws, ordinances and regulations applicable to the electrical and fire alarm/life safety system installation, NFPA, OSHA, ANSI, SBC, municipal ordinances governing electrical work, and with the requirements of the latest edition of the National Electrical Code.

B. Where different sections of any of the aforementioned codes and regulations, the specifications, or the plans require different materials, methods of construction, or other requirements, the most restrictive or stringent shall govern. In any conflict between a general provision and a special provision, the special provision shall govern.

C. Obtain all permits and licenses, and pay all fees as required for execution of the Contract. Arrange for necessary inspections required by the Architect, city, county, state and other local authorities having jurisdiction (LAHJ) and present certificates of approval to the Architect or his designated representative.

D. Under no circumstances will asbestos, or asbestos related materials, be allowed on this project.

E. Communicate with all required utility offices to meet utility schedules and regulations. Coordinate the local utility requirements with the requirements of these contract documents. Should conflicts arise, notify the Architect immediately. Acquire services to avoid project delays. Conform to regulations of the local utility company with respect to metering, service entrance and service access.

1.04 SITE VISIT:

A. All parties shall visit the site and thoroughly familiarize themselves with the local conditions and existing conditions which may affect the cost of the Work prior to any project activity or submission of bids.

B. Where work under this Division requires extension, relocation, reconnection or modifications to the existing equipment or systems, the existing equipment or systems shall be restored to their original condition prior to completion of this Project.

C. No allowances will be made for lack of knowledge of existing job conditions which could reasonably be identified during site visit.

1.05 DRAWINGS AND SPECIFICATIONS:

A. The Electrical Drawings are diagrammatic, and are not intended to show the exact location of raceways, outlets, boxes, bends, sleeves, fire sealant, couplings or other such elements except where dimensions are noted. Provide all required offsets, extensions or pull boxes required for a fully coordinated and operational system.

B. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.

C. Should conflicts exist between the Drawings and Specifications, notify the Engineer for clarification prior to installation.

D. Refer to the Architectural {Interiors), Mechanical, and Structural (if applicable) plans in conjunction with other project construction and shop drawings for dimensions, and properly fit the work to conform to the details of building construction.

E. Review the drawings for door swings, cabinets, millwork, counters and other built-in equipment. Coordinate installation of the electrical equipment with structural systems and mechanical systems such that full maintenance access is provided.

F. The right is reserved to shift any switch, receptacle, ceiling outlet or other outlet which has been roughed-in a maximum of 10'-0" from its location as shown before it is permanently installed, without incurring additions to the Contract in time or cost. In addition, refer to the Architectural Drawings for exact location of devices and equipment.

G. All conduit and wiring shown on the Electrical Drawings shall be provided under this Division regardless of its function.

H. Review the drawings and specifications provided for other systems for additional work which may be required under this Division. Provide service to and make connections to all such equipment requiring electrical service.

I. Equipment configuration is based upon one manufacturer's product. Where the equipment selected by the Contractor for use on this Project differs from the configuration shown, the Contractor shall be responsible for coordinating space requirements, connection arrangements, interfaces with mechanical and plumbing equipment and all other affected trades and providing access for future maintenance and repair. Submit proposed revisions for approval by the Architect.

1.06 DEVIATIONS:

A. No deviations from the drawings and specifications shall be made without the full knowledge and consent of the Architect.

B. If it is found that existing conditions make desirable a modification in requirements covering any particular item, report such item to the Architect for their review and instructions.

1.07 EQUIPMENT CONNECTIONS:

A. The horsepower, wattage (or amperes) of mechanical equipment indicated is the estimated requirement of equipment furnished under another Division. All wiring, protective devices and disconnect switches shall be of the voltage, size and ampacity required for the actual equipment installed, when equipment varies from that specified on the drawings, without increase or additional costs. In no case shall these items be of smaller capacity than permitted by EQUIPMENT NAMEPLATE/NATIONAL ELECTRIC CODE.

B. Coordinate with other trades and review the drawings of other divisions and provide suitable control equipment and feeders/branch circuits so that the above requirements shall be met without incurring additions to the Contract in time or cost. Conform with UL Listing and nameplate requirements for equipment furnished. Such adjustments shall be subject to the approval of the Architect.

C. Provide suitable overcurrent protection and disconnecting means in conformance with the requirements of the NEC, for all items or equipment utilized on the project no matter how, or by whom, furnished. However, duplication, or redundancy, is not required. Coordinate said requirements with equipment furnished and with applicable trades.

D. Branch circuits supplying control panels and other equipment master and local unit locations and quantities shall be coordinated at the submittal stage and provided under Division 16. Provide emergency power where required to accomplish emergency equipment operations in accordance with Division 15 requirements. All control wiring for plumbing and heating, ventilation and air conditioning systems shall be installed under Division 15. Review Division 15 specifications and shop drawings for control systems to assure system compatibility between equipment furnished under Division 16 and system wiring and controls furnished under Division 15.

E. Motor controllers shall be furnished and installed by Division 16 where automatic control of equipment is required, unless specified to be furnished as an integral part of packaged equipment. Provide the number and type of auxiliary contacts and relays necessary to interlock the equipment and provide the specified control sequence, reserving spare NO and NC contacts for future use. Power wiring to all motors and motor controllers and between motors and controllers shall be furnished under Division 16.

F. Where drawings indicate or specifications require equipment to be controlled by line voltage interlock, safety device or control, provide line voltage control wiring in Division 16.

G. For each electrical connection required, provide pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire connectors, and other items required to complete splices and terminations of the necessary types. Cover splices or terminations with electrical insulation equivalent to insulation of conductors terminated.

PART 2 - PRODUCTS

2.01 STANDARDS FOR MATERIALS AND WORKMANSHIP:

A. All material shall be new and shall bear the inspection label of Underwriter's Laboratories, Inc. (UL).

B. The published standards and requirements of the National Electrical Manufacturer's Association (NEMA), Underwriters' Laboratories (UL), Electrical Testing Laboratories (ETL), American National Standards Institute (ANSI), Institute of Electrical and Electronic Engineers (IEEE), Insulated Cable Engineers Association (ICEA), National Fire Protection Association (NFPA), Occupational safety Health Association (OSHA) and the American Society for Testing and Materials (ASTM) shall govern and apply where such have been established for the particular material in question.

C. Specified catalog numbers and trade or manufacturers names are intended to describe the material, devices, or apparatus desired for type, construction features, electrical characteristics, ratings, operating functions, style and quality. Similar materials of other manufacturers, not less than specified quality, capacity or character may be substituted in conformity with the provisions of the General and Supplementary Conditions. Materials of the same type shall be the product of one manufacturer. Refer to Shop Drawing requirements.

D. Furnish all materials specified herein or indicated on the drawings.

E. All work shall be installed in a practical and workmanlike manner by competent workmen, licensed and skilled in their trade.

2.02 SHOP DRAWINGS:

A. Provide complete electrical characteristics for all equipment. Submit for approval data of the materials and equipment to be incorporated into the Work. Submittals shall include descriptive materials, catalog cuts, diagrams, performance characteristics, and charts published by the manufacturer indicating conformance to the specification and drawing requirements; model numbers alone will not be acceptable. Submittals shall be made by Specification section number, tabbed, within three ring binders, grouped and submitted in packages as indicated below. Submittals for lighting fixtures shall include full photometric

data. Shop drawings shall be submitted for the following equipment and items suitably bound, and marked:

Package I:
Section 26 05 19 Low Voltage Electrical Power Conductors and Cables
Section 26 05 33 Raceways for Electrical Systems
Section 26 05 34 Boxes and Fittings for Electrical Systems
Section 26 27 26 Wiring Devices
Section 26 28 16 Enclosed Switches and Circuit Breakers

Package II:
Section 28 31 00 Fire Detection and Alarm

B. Shop drawings and/or catalog data submittals on all items of equipment and materials shall be submitted in conformity with requirements of the General and Supplementary Conditions. Do not submit more than the required number of sets as indicated by Architect. Do not submit equipment or materials not requested in the Specifications.

C. All material lists and shop drawing submittals shall include a stamped indication by the Contractor signifying that the submittals have been previously reviewed for complete compliance with the Contract Documents, that all coordination required between trades prior to field installation has occurred and that the material being submitted is approved for installation. The stamped indication shall include the name of the contracting firm, the date of the review and the signature of the contractor. The Engineer will not review the shop drawing submittals without the contractor's stamped approval already on the shop drawings. The responsibility of complying with the Contract Documents will not be relieved by the Architect’s review, which requires 10 working days from the date the shop drawings are received by the Architect.

D. All pricing is to be based upon the products, manufacturers, and processes described in the Contract Documents. Requests for approval of substitutions shall be written and delivered to the Architect's/Engineer's office in conformity with the provisions of the General and Supplemental Conditions. Do not submit any shop drawing or product data that does not conform with the contract documents.

E. Resubmittals, if necessary, shall be made as specified above. Resubmittals will highlight and indicate any and all revisions made there to and will include the following text " Resubmittal #___", typed in a prominent location on the cover sheet.

F. The Contractor shall provide with the shop drawing submittal dimensioned layouts of all electrical rooms and spaces using the equipment he intends to furnish. Switchboard, panelboards, distribution panels, etc., will be rejected without dimensioned room layouts.

G. Samples of all materials proposed for use shall be presented to the Architect/Engineer for his approval when requested.

H. Submittals shall be noted with any deviations, alterations or limitations of product from the specified materials. The product will be rejected upon failure to indicate this information. Any conflict or failure to perform comparably to the originally specified materials will result in product rejection. It will be the Contractor's responsibility to replace the alternate material or equipment with the originally specified one and to demolish, replace, repair and retest the equipment, including repair or replacement of any component of the building, finishes or other systems affected by said replacement, at no additional costs to the Owner.

2.03 SUPPORT FASTENER DEVICES:

A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.

B. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

C. Anchors for wood construction shall be lag bolts or power driven wood screws.

D. Anchors in hollow masonry shall be toggle bolts.

E. Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

F. Equipment mounted to drywall construction shall be secured to power channel (13/16” x 1 5/8” minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

2.04 SUPPORTS:

A. Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall not be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

2.05 IDENTIFICATION:

A. All equipment or devices specified in Division 16 shall be identified with an engraved plastic nameplate. Identification of flush equipment shall be on the inside of the cover. Surface equipment shall be identified on the outside. Plastic nameplates shall be multicolored laminated plastic with engraved lettering. Nameplates shall be provided as scheduled:

1. 208/120 volt normal power equipment shall be white faceplate/black core(1 ½”x 6” with 3/8” high letters).

2. 208/120 volt emergency power equipment shall be white faceplate/red core (1 ½” x 8” with ½” high letters). Face plate shall read “Emergency - 120 Volts”.

3. Junction boxes for emergency power, lighting, fire alarm systems, etc. shall have circuit numbers indicated and labeled as required.

4. Junction boxes for general power, lighting and mise, systems etc. shall have circuit numbers indicated and voltage (system) labeled as required.

2.06 AS-BUILT (RECORD) DRAWINGS:

A. Maintain on the job site at all times during construction a set of "As-Built" Mylar sepias with all changes during construction marked thereon. This set shall be utilized for no other purpose. Include any addenda, change orders, field orders, project sketches or "marked-up" drawing prints as may be generated on the job site to assist in recording the changes.

B. The "As-Built" sepias shall show all changes and deviations from the Contract Drawings including relocation of outlets, conduit and equipment. Record final dimensioned locations

of switchboards, panelboards, transformers, disconnect switches, etc. Make sufficient measurements to locate all underground conduit. Show exact locations of underground cable and conduits, both interior and exterior, fully dimensioned from building column lines or permanent exterior structures. These drawings shall be available for reference at the time of final inspection.

C. At the completion of construction, the Contractor shall purchase a set of reproducibles from the Architect/Engineer at cost of printing and shipping. All changes noted above shall be incorporated thereon by the Contractor. The reproducible drawings, with one set of blue line prints thereof and the original sketches and marked-up "As-Built" prints shall be presented to the Owner.

2.07 MAINTENANCE AND INSTRUCTION MANUALS:

A. Submit to the Architect/Engineer/Owners Representative upon completion of the work and prior to final inspection, copies of maintenance and instruction manuals for equipment provided as outlined below:

1. Three sets of the following data are required:
   a. Operating and maintenance instructions.
   b. Spare parts list.
   c. Copies of approved submittal data.
   d. Copies of panelboard circuit directories reflecting all field changes.
   e. Test reports of all tests performed.
   f. Contact names and phone numbers for parts suppliers of submitted equipment.

B. Arrange each set of data in a orderly way and bind each set in a separate 3-ring hard-cover binder with appropriate label identifying the Project, Architect, Engineer, Contractor, Subcontractor and Date.

2.08 SUBMISSION OF DRAWINGS:

A. Submission of Architect's drawings for shop drawings and unaltered Architect's drawings for "As-Built" will not be acceptable.

2.09 SPARE PARTS STOCK:

A. Prior to final inspection, turn over to the Owner the following materials of the type and quantity specified. Material shall be new, in original shipping containers or cartons, of the same manufacture and type as installed on the Project. Obtain receipt for all materials turned over to the Using Agency.

1. Fuses - Ten percent of each size.

PART 3 - EXECUTION

3.01 COORDINATION:

A. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtenances and wall thickness.

B. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

C. Coordination of space requirements with all trades shall be performed so that:

1. No piping or ductwork, other than electrical, shall be run within 42" of panelboards, switchboards or transformers.

2. No pipes or ducts that operate at a temperature in excess of 120 degrees F. shall be installed nearer than 3" to any electrical conductor.

D. Do not scale drawings. Obtain dimensions for layout of equipment from the Architectural drawings unless noted on the Electrical drawings.

E. Contractor for work under this division shall be fully responsible for determining in advance of purchase that proposed equipment and materials for installation shall fit into the confines indicated and allow sufficient clearance for maintenance and service of all equipment including other trades.

F. Clearances in front of electrical switchboards, panelboards, motor starters, bus plugs etc. (equipment requiring maintenance while energized) shall be installed in accordance with N.E.C. 110-162 condition number 2.

3.02 PROTECTION OF MATERIALS:

A. Refer to the general requirements section of the Specifications for storage, protection and handling requirements.

B. Provide dry, weather-tight staging and storage for materials and equipment requiring protection from weather and moisture per manufacturer's recommendations. Install temporary lighting or heat sources to prevent moisture accumulation. Provide protection against direct sunlight, precipitation, wind, ice, fire or excessive heat. Store materials in original undamaged packaging with manufacturer's labels and seals intact. Containers which are broken, damaged or watermarked are not acceptable and are subject to rejection.

C. Materials and equipment will not be installed until the environmental conditions of the project are suitable to protect same per manufacturer's recommendations. Equipment or materials damaged or subjected to moisture, precipitation, direct sunlight, cold or heat are not acceptable and shall be removed from the project and replaced at no additional costs to the Owner.

D. All conduit and other openings shall be kept protected to prevent entry of foreign matter or construction debris. Fixtures, equipment, and apparatus shall be kept covered for protection against dirt, water, chemical or mechanical damage before and during construction.

E. The original finish, including shop coat of paint of fixtures, apparatus or equipment that has been damaged shall be restored without incurring additions to the Contract in time or price.

3.03 HOUSEKEEPING PADS:

A. Provide 4" minimum height concrete pad, integral with floor, under all floor mounted electrical equipment or apparatus.

3.04 CUTTING AND PATCHING:

A. The Contractor is responsible for all cutting and patching, including escutcheon plates where necessary, whether or not such cutting and patching is shown or indicated.

3.05 CLEANING AND PAINTING:

A. Remove foreign materials, drywall compound, overspray, oil, dirt and grease from all raceway, fittings, supports, boxes, cabinets, pull boxes, panelboard trims and equipment to provide clean surfaces for painting. Remove surface oxidation and restore galvanized surfaces with cold process galvanizing compounds. Touchup marred or scratched surfaces of fixtures, panelboard and cabinet trims, motor control centers, switchboards, cabinets, and equipment enclosures with paint furnished by the equipment manufacturer specifically for that purpose. When touchup is required, provide one base coat over imperfection and subsequent coat over entire side or surface of equipment.

B. Do not paint trim hinges, latches, clamps, locks, device covers or trim covers. Mask or remove such items prior to finishing.

C. Unless otherwise noted herein, all painting shall conform to the "Painting" section of the specifications.

D. Where plywood backboards are utilized to mount electrical or electronic equipment provided under Division 16, finish same with two (2) coats of light gray semi-gloss paint.

3.06 ACCESS TO ELECTRICAL ITEMS:

A. Install all concealed electrical equipment, junction and pull boxes, apparatus, or devices so as to maintain access for maintenance, operations and replacement. Access doors or covers shall be provided where required by NEC or LAHJ and shall be installed in accordance with manufacturer's instructions. Refer to the Architect for approved types, means, methods and appearance. Locate each access unit accurately in relation to electrical work requiring access.

3.07 EQUIPMENT CONNECTIONS:

A. Review all divisions of specifications, where equipment requiring electrical service is specified, to determine the complete scope of work under this division of the specifications. Provide electrical connections and service to all equipment specified elsewhere requiring such connections or service.

B. Connect all equipment requiring electrical connections, in accordance with the equipment manufacturer's requirements. Where equipment connections require specific locations, determine and coordinate same with submittals. Provide concealed service to central plant equipment locations and pads.

3.08 NAMEPLATES AND IDENTIFICATION:

A. Provide and install nameplates for transformers, switchboards, switchgear, power and lighting panels, disconnect switches, time switches, pull boxes, junction boxes, fire alarm equipment, contactors, relays and other unit equipment. Nameplates shall be affixed with epoxy cement. Install nameplates plumb and level.

B. Provide and install sleeve-type or tape-type wire markers on all conductors at all termination points and access points. Branch circuit identification (as LP-21") shall be installed on hot and neutral conductors. Dedicated circuits and isolated ground technical power circuits shall have wire markers installed on ground conductor. Label junction and pull box covers with all circuit numbers contained therein.

3.09 EXCAVATION AND BACKFILLING:

A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.

B. The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp over-excavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.

C. Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.

D. Electrical duct shall be installed a minimum of 24" below finished grade with bottom of duct below geographic frost line. Duct cark shall not be in direct contact with building structure (slab) except for vertical riser supports.

3.10 TESTS AND CERTIFICATIONS:

A. Upon completion of the electrical work and prior to final inspection, conduct an operating test in the presence of the Architect or his designated representative.

B. The installation shall be demonstrated to operate in accordance with the Contract Documents. Any material or workmanship which does not meet with the approval of the Architect shall be removed, repaired or replaced as directed without incurring additions to the Contract in time or cost. All electrical systems shall be tested for compliance with the specifications.

C. Furnish all instructions, tools, test equipment and personnel required for the test. Have sufficient tools and personnel available to remove equipment covers, coverplates, etc., as required for review of internal wiring and proper inspection. Provide hand tools, flashlights, ladders, outlet testers, VOM, meters and keys required to access and observe system

operation and characteristics. Turn circuits on and off as directed and demonstrate operation of equipment as directed.

D. Contractor shall test all wiring and connections for continuity and grounds by Megger testing. Upon indication of defective insulation, Contractor shall remove and replace the defective conductor and demonstrate by testing that the new conductor is acceptable. Record feeder load currents and line voltages measured at each transformer, switchboard and panelboard after installation of all equipment and lighting. Adjust transformer taps as required to provide optimum voltage levels. Adjust single phase load connections to balance feeder load and document on as-built drawings. Provide the Owner with full documentation of all testing for future reference.

E. Refer to the individual specification sections and the electrical systems testing section of the specifications for specific testing requirements.

F. The authorized manufacturer's service representative shall review systems and equipment for correct operation, conformance with specification requirements and manufacturer's requirements and submit certification indicating above mentioned conformances for the following systems:

1. Life Safety System

2. Fire Communications System

3. Interfaces to Mechanical & Building Systems

3.11 DEMONSTRATION AND INSTRUCTION:

A. Present to the Owner and the Architect/Engineer or his designated representative a physical demonstration and oral instructions for proper operation and maintenance of each of the electrical equipment and systems installed. Authorized manufacturer's representatives familiar with the specified equipment shall conduct training for the following systems:

1. Life Safety System

2. Fire Communications System

3. Interfaces to Mechanical & Building systems

3.12 TEMPORARY WIRING:

A. Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the construction requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary work to be installed in accordance with the National Electrical Code, Article 305, and as required by OSHA or applicable local safety codes, rules and regulations.

3.13 WARRANTY:

A. All systems and components shall be provided with a one-year warranty from the time of final acceptance. The warranty shall cover all defects in materials, design and workmanship. During this warranty period, all defects in materials and workmanship shall be corrected without incurring additions to the Contract. The correction shall include removing the defective part(s), replacing and installing the new parts (including shipping

and handling), all required cutting, patching, repainting, or other work involved, including repair or restoration of any damaged sections or parts of the premises resulting from any fault included in the warranty, entirely at the expense of the Contractor.

B. In addition to this general warranty, present to the Architect any other guarantees or warranties from equipment or system manufacturers. These supplemental guarantees or warranties shall not invalidate the general warranty.

END OF SECTION

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Section 26 05 10.

B. This Section covers the furnishing, installation and connections of the building wiring system. Interior wiring, power distribution, lighting, appliance and equipment, motor and exterior wiring systems extending beyond the building are included. The wiring system shall be complete from electrical service entrance to every electrical device requiring an electrical connection.

PART 2 - PRODUCTS

2.01 CONDUCTORS:

A. Conductors shall be copper of 98% conductivity, soft temper, 600 volt insulation. Sizes specified are American Wire Gage (AWG) for No. 4/0 and smaller and thousand circular mils (kcmil) for all sizes larger than No. 4/0. Service entrance conductors shall be 600 volt, type XHHW.

B. Conductors No. 10 and smaller shall be solid and type "THHN" / THWN" insulation. No. 8 and larger shall be stranded and type "THHN" / "THWN" or “XHHW” insulation.

C. All wire and cable shall be U. L. Listed and shall bear the U. L. Label.

D. All conductors shall have size, grade of insulation, voltage and manufacturer’s name permanently marked on the exterior at maximum 24 inch intervals.

E. Conductor size shall be a minimum of No. 12 AWG. Conductor size shall be not less than indicated on the drawings. The minimum size of all emergency circuits shall be No. 10 AWG.

F. Fixture wire shall be No. 14 AWG silicone rubber insulated, stranded fixture wire, Type THAN (90 degrees C.).

G. Control conductors for use on 120 volt control wiring shall be No. 14 AWG stranded Type THHN/THWN, unless indicated otherwise on the drawings or as required for compliance with voltage drop requirements.

H. Where cables are used for switch leg, the white conductor shall be permitted to supply the switch, but not as a return to the switchboard outlet for 277 volt lighting switch legs and phase conductor shall be.

2.02 PREFABRICATED CABLE ASSEMBLIES:

A. Metal clad cable type MC may be utilized for concealed branch circuit wiring only as permitted by local authority having jurisdiction. Insulated ground conductor shall be provided.

2.03 CONNECTORS:

A. Terminations and connections shall be made with U. L. Listed connectors applied per manufacturer's recommendations.

B. Connections of #10 AWG and smaller size power and lighting branch circuit conductors shall be made with insulated spring steel wire nut connectors. Size #8 AWG and larger connections shall be made with hydraulically applied compression type connectors with insulated covers.

C. Connections of special system conductors shall be made via dedicated terminal strips labeled to indicate wire number and system type. Wire nut connections in system junction box are not acceptable.

2.04 ACCEPTABLE MANUFACTURERS:

A. Wire and Cable products:

1. Southwire Co.
2. Rome Cable
3. Alcan Cable
4. Carol Cable
5. AFC Cable Systems
6. American Insulated Wire
7. Cerro Wire & Cable
8. General Cable
9. Triangle PWC
10. Cabelec
11. Okonite

B. Signal Cable products:

1. Belden
2. Continental
3. Dekoron
4. West Penn

C. Connector products:

1. AMP
2. Burndy

3. Eagle

4. Gould

5. Ideal

6. Joslyn

7. O-Z Gedney

8. Thomas & Betts

9. Ilsco

10. Buchanan

11. King

D. Wire management products:

1. AMP

2. Thomas & Betts

3. Panduit

4. Wieland

E. Wire & Cable identification products:

1. Thomas & Betts SM series

2. Wieland C type

3. Brady type XC

F. Wire Pulling lubrication products:

1. Ideal Yellow 77

2. Electro Y ER EAS

3. Burndy Silkon

PART 3 - EXECUTION

3.01 WIRING:

A. All conductors shall be installed in conduit, unless noted otherwise. All conductors shall be pulled in at the same time. No conductors shall be pulled into the conduit until the conduit system is complete and plaster/drywall construction has dried. Clean, swab and evacuate conduit system before pulling in conductors. Do not exceed the manufacturer's maximum pulling tension.

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with proper U. L. Listed connectors. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be secured to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.

C. Each conduit shall have a minimum of three (3) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise. Grounding conductors are not shown in wire count, but are required from circuit origin to last device.

D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt Systems	Type	480/277 Volt Systems
Black Phase A		Brown
Red Phase B		Orange
Blue Phase C		Yellow
White Neutral		Gray
Green Ground		Green/tracer
White/Green Stripe	IG Neutral	Black w/ Black Stripe
Green/White Stripe	IG Ground	Green

E. The feeder and service entrance conductors shall be color coded by the use of one (1) inch wide colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from panel to first device exceeds 60'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment.

H. All conductors shall be identified with proper circuit numbers at all access points, terminals, junction boxes, and at panelboards within 6" of conductor ends.

I. Special systems conductors shall be color coded in accordance with system manufacturer’s recommendations or in a manner approved by the Engineer.

J. Maintain phase rotation established at service entrance point throughout entire project.

K. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.

L. Grounding conductors are not indicated on the drawings, but are required in all branch circuit and feeder installations. Provide insulated ground conductor (sized per NEC requirements) in all raceways.

3.02 CONTROL WIRING:

A. Control wiring is defined as the wiring which provides connections between control circuit elements and does not provide the power circuit.

B. Generally, control wiring is specified in Division 15; however, where a control device such as a push-button, thermostat, firestat, etc. is to be installed in the power circuit, these devices shall be received, stored and installed as part of the work of this Division. Control wiring, conduit etc. shall be coordinated with division 15 and provided as required.

3.03 CONNECTIONS:

A. All connectors shall be U.L. Listed and shall be utilized in full accordance with manufacturer's requirements.

B. Splices shall be made only where specifically approved by the Engineer. Conductors shall be continuous from origin to first outlet box or manhole. Splices made exterior to the structure, or below grade, shall be compression type connections with insulated, waterproof covers. Submit splicing requests for review and approval prior to installation.

C. Termination lugs shall be applied to all single cables #8 and larger, and shall be compression type fittings. The use of mechanical type lugs, kerneys or other pressure type connections will not be permitted.

D. All compression connections shall be long barrel type installed using hydraulic tools designed for the purpose.

E. Insulated spring steel wire nut connectors shall be used for branch circuit connections of #10 and smaller conductors. Connections of #8 and larger sizes shall be made with compression type connections with insulated covers. Where exposed to moisture or corrosion spring steel wire nut connectors shall be silicone filled.

F. Control and special system riser and junction boxes shall be fitted with terminal strips and all conductors shall be labeled per system requirements. The installation of wire nuts in special system riser and junction boxes is not acceptable.

G. Phase rotation at service equipment shall be maintained throughout entire project, color coding of conductors shall be consistent for feeders and branch circuits through out entire project.

3.04 IDENTIFICATION:

A. All conductors shall be identified with full circuit number at all access points, boxes, and at panelboards within 6 inches of conductor end. Identification shall be permanently marked PVC split sleeve, tape type, or tubing type.

B. Permanently mark the junction box cover with the circuit numbers for all conductors contained within. Utilize black marker for normal power and red marker for emergency power and fire alarm.

3.05 WIRE MANAGEMENT:

A. Power and control wiring within all special system cabinets and enclosures, and within switchboards and electrical equipment shall be bundled or routed within slotted wiring duct in a workmanlike manner.

B. Any knockout, cutout or slot containing wiring shall be fitted with bushing or continuous grommet strip to avoid fraying or abrasion.

C. Train and lace all conductors within panelboard or control enclosures with cable ties or spiral wrapping.

D. Spare conductors installed shall be identified and capped.

END OF SECTION

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Section 26 05 10.

B. This section covers the installation of, or additions to, the building grounding system. The grounding system shall be established with equipment grounding conductors; the use of metallic raceways as the only method of equipment grounding is not acceptable.

PART 2 - PRODUCTS

2.01 GROUNDING CONDUCTORS:

A. Grounding electrode conductors shall be bare or green insulated copper conductor sized as indicated on the drawings or as required by the National Electrical Code..

B. Equipment grounding conductors shall be green insulated type THHN/THWN, or XHHW conductors sized as indicated on the drawings. Where size is not indicated on the drawings, conductor size shall be determined from the National Electrical Code table on sizes of equipment grounding conductors.

C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code tables for grounding electrode conductors.

2.02 PANELBOARDS, TRANSFORMERS, MOTOR CONTROLLERS, AND DISCONNECT SWITCHES:

A. Provide a conductor termination grounding lug bonded to the enclosure of each equipment item.

2.03 DEVICES:

A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame.

2.04 GROUND RODS:

A. Ground rods shall be 3/4" x 10'-0 copper clad steel.

B. Sectional ground rods shall be hot dip galvanized 5/8" x 10' sections with an internal stainless steel splined coupling pin.

2.05 HYDRAULIC AND MECHANICAL TERMINATIONS:

A. Acceptable manufacturers for hydraulically applied terminations are Square D, Burndy and Thomas and Betts (T & B).

B. Acceptable manufacturers for mechanically applied terminations are Ideal, Burndy and Thomas and Betts (T & B).

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Ground all non-current carrying parts of the electrical system, i.e. raceways, equipment enclosures and frames, junction and outlet boxes, machine frames and other conductive items in close proximity with electrical circuits, to provide a low impedance path for potential grounded faults.

B. Equipment Grounding Conductor:

1. Grounding conductors for branch circuits are not shown on the drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables. Grounding conductors shall be the same AWG size as branch circuit conductors.

2. Grounding conductors for feeders are typically indicated on the drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.

3. A grounding conductor shall be installed in all flexible conduit installations. For branch circuits, grounding conductor shall be sized to match branch circuit conductors.

4. The equipment grounding conductor shall be attached to equipment with bolt or sheet metal screw used for no other purpose. Where grounding conductor is stranded, attachment shall be made with lug attached to grounding conductor with crimping tool.

5. Ground all motors by drilling and tapping the bottom of the motor junction box and attaching the equipment grounding conductor to the box with a round head bolt used for no other purpose. Conductor attachment shall be through the use of lug attached to conductor with crimping tool.

6. Equipment grounding conductors shall terminate on panelboard, switchboard, or motor control center grounding bus only. Do not terminate on neutral bus. Provide a single terminal lug for each conductor. Conductor shall terminate in the same section as the phase conductors originate. Do not terminate neutral conductors on the ground bus or equipment grounding conductors on the neutral bus.

C. Other Grounding Requirements:

1. Bond all metal at water sources such as hydrants, pools or fountains to grounding electrode system per NEC requirements.

3.02 TESTING:

A. Upon completion of the ground rod installation, the Contractor shall test the installation in accordance with the "Electrical System Tests" section of this Specification. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within forty-eight hours of rainfall. Results of ground resistance readings shall be forwarded, in writing, immediately to the Project Engineer.

B. If the resistance to ground exceeds 5 ohms, additional rods shall be driven and bonded together, until a reading of 5 ohms or less to ground is obtained. After completion of the grounding system, measure the system ground resistance with a "Megger Earth Tester". Submit directly to the Project Engineer two (2) copies of each test report certified by the testing technician and the electrical contractor.

C. All grounding electrode conductors and ground bus shall be measured by the Contractor for objectionable levels of current, and to detect any inadvertent connection of neutral to ground.

D. If the ground current exceeds 10% of the rating of the conductor ampacity, all devices on that feeder or circuit shall be rechecked for proper connection.

E. All grounding system connections shall be rechecked at final checkout for correct wiring termination methods and mechanical strength.

END OF SECTION

SECTION 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Section 26 05 10.

B. This Section covers the complete interior and exterior conduit and raceway systems.

C. This Section covers the installation of all outlet boxes, pull boxes, junction boxes and wiring troughs or other boxes throughout the wiring system, including supports.

D. Outlets are located diagrammatically on the drawings. Outlets shall be located so as to be symmetrical with Architectural details.

PART 2 - PRODUCTS

2.01 CONDUIT:

A. Galvanized rigid steel conduit (GRC) shall be low carbon, hot-dipped zinc galvanized steel to meet U.L. 6 Standards, ANSI C80.1 and shall have NPT (ANSI B1.20.1) full cut threaded joints, galvanized after forming. IMC shall carry U. L. Label. Conduit with integral couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B.

B. Electrical metallic tubing (EMT) shall be high grade mild ductile steel, hot galvanized exterior with a clear organic polymer topcoat to meet U.L. 797 Standards and ANSI C80.3. Interior to be finished with corrosion inhibiting clear organic coating. Conduit with integral set screw couplings may be utilized for 2.5 inch sizes and above provided it conforms to U. L. Safety Standard #514-B.

C. Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type for 4" and smaller, Schedule 20 for 5" and larger. PVC shall be U.L. Listed, NEMA TC 2, sunlight resistant and suitable for use with 90 degree C conductors.

D. Flexible metal conduit (FLX) shall be extra flexible, extra strength galvanized steel conduit tubing and shall meet U. L. Standard for Flexible Steel Conduit and U.L. Standard for Safety #1. The use of aluminum flexible conduit is not permitted.

E. Liquid-tight flexible metal conduit (WFX) shall be UL Listed with galvanized steel core of square locked or interlocked design, integral ground conductor and thermoplastic PVC (polyvinyl chloride) cover. The use of aluminum core or non-metallic types is not permitted.

F. Electrical non-metallic tubing (ENT) shall be UL Listed and manufactured to the requirements of NEMA TC-13. This raceway is permitted to be utilized with concrete encasement or unexposed installations only. Do not install exposed in plenums or other open areas. Utilize steel outlet boxes in all partition construction. Utilize plastic boxes only in concrete encasement.

G. Steel conduit approved manufacturers are Allied, Triangle, Republic, Wheatland and Pittsburg.

H. Flexible conduit approved manufacturers are Anamet (Anaconda) and Republic.

I. PVC conduit approved manufacturers are Carlon, Triangle, and Johns-Manville.

J. PVC coated metallic conduit approved manufacturers are Robroy, Permacote and Occidental.

2.02 CONDUIT FITTINGS:

A. GRC and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type, U. L. Labeled.

B. EMT fittings shall be zinc-coated steel and shall be Type 1 or 2 (raintight compression or concrete tight set-screw type). EMT connectors shall have insulated throats. Die cast, malleable iron or pressure cast material will not be accepted. Fittings shall bear U. L. Label. Two (2) inch and larger fittings shall be compression type or shall utilize dual set screws for each side of fitting.

C. PVC fittings, elbows and cement shall be NEMA TC3, produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

D. Conduit connections to switchboards, motor control centers, transformers, panels, cabinets, and pull boxes shall have locknuts designed to bite into the metal.

E. Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

F. Expansion fittings shall be provided in all conduits which crosses an expansion joint whether in, across, or through same. Fittings shall be U.L. 467 and 514 Listed. Fittings shall contain an internal flexible metal braid to maintain system ground continuity.

G. Flexible conduit fittings shall be cast malleable iron or stamped steel type with integral fastener. Fittings shall be U.L. Listed for the application. The use of “squeeze” type cast or stamped steel connectors is not permitted.

H. Liquid tight flexible metal conduit fittings shall be liquid tight with neoprene bushing, nylon gland, tapered hub threads and outlet bushing. Fittings shall be U.L. Listed for the application. The use of non-metallic or thermo-plastic insert connectors is not permitted.

1. EMT conduit fittings approved manufacturers are Raco, Steel City, Crouse-Hinds, O.Z Gedney, Thomas & Betts, Efcor and Appleton.

2. GRC and IMC fittings approved manufacturers are Appleton, Crouse-Hinds, O.Z. Gedney or Thomas & Betts.

2.03 SMOKE AND FIRE STOP FITTINGS:

A. If and where required, smoke and fire stop fittings shall be U.L. listed for that purpose. The fittings used to seal conduit either on the outside of the conduit or cable or internally shall have heat activated intumescent material which expands to fill all voids and shall be O.Z./Gedney "FIRE-SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type. Penetration of any fire rated wall, floor, or ceiling shall use Through-Penetration Firestop Systems described in the current Underwriters Laboratories Building Materials Directory.

2.04 RACEWAY SUPPORTS:

A. Raceways and systems shall be supported independent of any other equipment or appurtenances except the building structure. Suspended ceiling systems will not be considered as structure for support purposes, even if so rated by the manufacturer.

B. All support components shall be zinc-coated or have equivalent corrosion protection. Unprotected components shall be removed and replaced at no additional costs to the Owner.

C. Conduit support straps shall be single hole cast malleable iron or dual hole stamped steel type with zinc coating sized for type of raceway used. Conduit clamps for single conduit support shall be stamped steel with bolt & nut fastener and threaded rod support. Multiple conduit support channel straps shall be galvanized stamped steel two piece clamps with bolt & nut fasteners.

D. Conduit support channel shall be minimum 1 5/8" x 1 5/8" x 12 gauge roll-formed pre-galvanized steel or painted steel conforming to ASTM A-570 Grade 33 or ASTM A-446 Grade A requirements. Channel cross section shall be increased to provide higher load bearing capability, if required by this installation. Channel shall have elongated holes at two (2) inch centers.

E. Drop wire type hangers will not be permitted. Any hanger which may distort the ceiling support structure will not be permitted. Lathers channel and chain are not acceptable for conduit hangers.

F. Furnish and install under this contract all angle iron, channel iron, rods, threaded rod, supports or hangers required to install or mount all electrical equipment, material or related devices. Conduit shall **not** be supported from steel decking, roof decking, bridging, ceiling or ceiling support wires.

G. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements with all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair. Coordinate the installation of recessed electrical equipment with concealed ductwork, piping, insulation, structural appurtenances and wall thickness.

H. Support branch circuit conduits and raceways at intervals not exceeding ten (10) feet and within three (3) feet of each termination. Support feeder conduit and raceway at intervals not exceeding twelve (12) feet and within three (3) feet of each termination.

I. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform with the above requirements without incurring additions to the Contract.

J. Raceway installed within reinforcing steel of elevated or slab on grade concrete construction shall be tied to the re-steel at intervals not exceeding three (3) feet.

2.05 SUPPORT FASTENER DEVICES:

A. Anchors for post tensioned concrete applications shall be cast in place continuous or spot insert channel providing a safety factor of 3 in 3000 lb hard rock concrete.

B. Anchors for cast in place concrete shall be insert type expansion shields and bolts, lead shields and bolts or self drilling expansion shields and bolts. Powder actuated pins of 1500 pound pull out strength may be utilized in concrete.

C. Anchors for wood construction shall be lag bolts or power driven wood screws.

D. Anchors in hollow masonry shall be toggle bolts.

E. Anchors for steel attachment shall be machine screws, bolts, or beam clamps.

F. Equipment mounted to drywall construction shall be secured to power channel (13/16” x 1 5/8” minimum). Secure channel to a minimum of two (2) dry wall studs with drywall screws and washers.

G. Under no circumstance will nylon or composition type tie wraps or straps be permitted for use in supporting electrical raceway. Utilize galvanized tie wire or prefabricated steel clips for such support.

2.06 BOXES: GENERAL MATERIAL REQUIREMENTS:

A. All boxes shall be U. L. Listed and labeled.

B. Boxes shall be of one-piece construction, fabricated from NEC gauge galvanized steel, unless rustproof cast metal boxes are specified or required by NEC, or unless otherwise shown on the drawings.

2.07 OUTLETS:

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes.

B. Outlet boxes for flush mounted light fixtures shall be four inch square boxes 1 1/2” deep, with blank cover, installed adjacent to fixture served. Connection to fixture shall be with flexible steel conduit and fixture wire.

C. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes, minimum two (2) inch depth.

D. Boxes for devices in unfinished masonry walls or stud walls shall be 4" square boxes with a square cornered tile wall cover (plaster ring), set flush with masonry or drywall construction. Where only one conduit enters box or one wiring device is provided, 2 3/4” deep box may be used. Outlet boxes for dimmers, GFI outlets, and all other conditions shall be full depth. Use multigang boxes where more than one device is mounted together under common coverplate. Do not use sectional switch boxes.

E. Boxes in concrete ceiling slab shall be octagonal, concrete-tight two (2) inch deep concrete boxes. Welded boxes are not acceptable.

F. All outlet boxes in plaster, drywall, stucco or masonry walls or ceiling shall be provided with plaster rings.

G. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

H. Outlet boxes exposed to the weather, under raised floor, used in exterior wiring system and outlet boxes for vaportight lighting fixtures and devices shall be of cast corrosion resistant type.

I. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119 and maintain fire barrier ratings.

J. Utility (handy) boxes with matching covers may be used in mechanical and electrical spaces for switches and 15A/120V receptacles.

K. Where special purpose devices are utilized and require larger outlet box than specified herein, provide outlet box suitable for specific device. These outlet boxes shall be of the same type as specified herein for the installation required. Coordinate requirements prior to rough-in installation.

2.08 JUNCTION AND PULL BOXES:

A. Dimensions of pull boxes and junction boxes shall not be less than those dimensions required by the National Electrical Code for the number, size and position of conductors and raceway entering the box. Only a single extension ring shall be permitted on a box to increase the volume.

B. Pull boxes required in finished spaces shall be installed out of sight lines and located per Architect's direction. Box shall be flush mounted cabinets provided with trim, hinged door and flush latch and lock to match panel trim for flush mounted electrical panelboard.

C. Pull boxes for installation of vertical riser conductors shall be provided with red seal type VVC or approved supports for all conductors as required by the NEC.

D. Pull boxes for horizontal feeders containing more than one feeder (not including parallel conductors) shall be provided with reinforced flange shall be compartmented by barriers (or feeder conductors shall be fire-taped) and provided with minimum 1 5/8" x 1 5/8" fiberglass channel strut (removable) for support of conductors. Wood supports within pull boxes are not acceptable.

E. Provide box covers for all junction and pull boxes of same materials and construction as box. Identify feeder or branch circuit conductors contained within on outside of cover for surface mounted boxes and within cover on flush mounted boxes.

2.09 EXTERIOR PULL BOXES & HANDHOLES:

A. Exterior pull boxes shall be Quazite "PC" style Gasketed boxes, resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size shall be minimum 12"w x 18"d x 12"h unless noted otherwise. Set assembly at final finished grade elevation.

B. Exterior handholes shall be Quazite "PG" style stackable service box assemblies resistant to sunlight exposure, weathering and chemicals, with solid base, penta-head security bolts, heavy duty rated cover with logo to suit purpose, with compressive strength of 11,000 psi, or approved equal. Size shall be minimum 24"w x 36"d x 18"h unless noted otherwise. Provide extensions as required to bring assembly to final finished grade elevation.

2.10 CONDUIT BODIES & FITTINGS:

A. Conduit bodies and fittings shall be NEMA FB-1 zinc coated steel or malleable iron, taper threaded type, of material matching conduit type with gasketed cover containing captive screws.

2.11 WIRING TROUGH:

A. Wiring trough shall be NEMA 1, unless noted otherwise, hinged cover with captive screws, grey enamel finished inside and outside, 16 or 14 gauge steel as per NEC requirements. Size of trough based on NEC requirements.

2.12 PULL BOXES & ENCLOSURES:

A. Pull boxes for feeder and power conductors shall be NEMA 1 with 14 or 12 gauge galvanized steel bodies and 12 or 10 gauge galvanized steel screw covers. Seams shall be continuously welded and ground smooth. Cover screws shall be captive, stainless steel type. Provide oil-resistant gasket and adhesive. Size pullboxes as specified.

B. Enclosures for termination of special systems wiring shall be NEMA 1 panel enclosures with 14 gauge steel bodies and removable hinged doors. Provide back panel of 14 gauge steel construction and wiring terminal blocks. Enclosures shall be painted ANSI 61 and panels shall be white enamel. Size enclosures for quantity of terminations required plus 25% spare capacity.

2.13 ACCEPTABLE MANUFACTURERS:

A. Outlet boxes:

1. Steel City
2. Hubble/RACO
3. Crouse-Hinds
4. Appleton

B. Exterior junction boxes & handholes:

1. Quazite
2. Nelson
3. Killark
4. Associated Plastics

C. Conduit bodies & fittings:

1. Adalet-PLM
2. Myers
3. O-Z Gedney
4. Appleton

5. Efcor

6. Crouse-Hinds

D. Wiring troughs:

1. Electromate

2. Square D

3. Universal

4. Hoffman

5. Wiegmann

6. General Metals

7. Keystone

E. Pull boxes & enclosures:

1. Hoffman

2. Electromate

3. Wiegmann

4. Universal

5. American Electric

6. Crouse-Hinds

7. Square D

PART 3 - EXECUTION

3.01 CONDUIT:

A. Rigid galvanized conduit shall be used for service entrance and all feeders and branch circuits where exposed to damage or moist conditions.

B. EMT shall be used for feeders, branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth. Raceway underground or in concrete in contact with the earth shall be rigid galvanized conduit, intermediate metal conduit or Schedule 40 PVC. Conduit exiting elevated slabs or slab on grade shall be GRS. PVC conduit exiting slab is not permitted.

C. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets. All conduit from cabinets and junction boxes shall terminate in approved outlet box or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknutted and bushing installed.

D. Provide junction boxes or pull boxes where shown and where necessary to avoid excessively long runs or too many bends between outlets. The conduit sizes shown may be increased if desired to facilitate the pulling of cables.

E. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized malleable iron or stamped steel clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed minimum six (6) inches above ceiling structure to permit removal of ceiling panels and lighting fixtures.

F. Use threaded rods and hangers consisting of double-nutted threaded rods and channel or angles of 12 gauge minimum steel for supporting multiple conduit. Refer to drawing details.

G. Minimum size conduit for exposed branch circuits shall not be smaller than 1/2". Raceway installed in concrete slabs shall be minimum 3/4”. Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

H. Type GRC conduit shall be cut and threaded with similar die heads. Deburr outside of all cuts prior to cutting threads. Cut threads one thread short so that they meet in the coupling and all threads are covered when wrench tight. Deburr inside of end after cutting threads. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints. Utilize only rigid type hand benders. DO NOT attempt to bend IMC with “hickey” type hand benders. Any such bends will be replaced at no additional costs to the Owner. Utilize only U.L. Listed conduit fittings, elbows and junction boxes (GRC types).

I. All conduit for future use and for special systems such as telephone, data or TV wire shall be left with No. 16 gauge wire or approved pull cord pulled in them.

J. Expansion fittings shall be installed in all conduit penetrations through, around or in expansion joints, and all straight runs in excess of 150 feet. Watertight flexible metallic conduit, connectors and couplings may be utilized for exposed transitions. U.L. 467 & 514 Listed fittings are required in slab.

K. Provide non-hardening elastic type duct seal compound, Neer No. DC, 3M Co. "Scotchfil," or Gardner Bender duct seal, for each conduit entering the building from outside, for each conduit entering refrigerated spaces, for each conduit entering exterior equipment and for each conduit passing from one space into another which is normally at a lower temperature. Conduits entering refrigerated spaces shall be IMC

L. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an U.L. labeled fire resistive material, or provide mechanical fire stop fittings that will maintain the rating of the barrier penetrated. Conform with local authority requirements and UL Building Materials Directory.

M. Coordinate the conduit routing and installation location with the actual electrical equipment furnished. Review submittals for termination locations. Coordinate with all Specification Divisions and submittals to determine termination and access locations. Coordinate installation sequence with all other trades to avoid conflicts and provide the fastest overall installation schedule.

N. Dented, malformed or flattened conduits are not permitted and shall be removed and replaced.

O. Protect conduits against dirt, plaster, and construction debris with the use of conduit plugs. Tape is not acceptable. Plugs shall remain in place until all masonry or/and drywall construction is complete. Protect conduit stubups during construction from damage, and replace any bent conduits.

P. Conduits serving roof mounted equipment shall pass through roof curb where such is provided. Roof penetrations outside this equipment will not be permitted.

Q. Separate raceway systems shall be provided for power systems and for control, signal and communications systems. Do not install above systems cables in the same raceway as branch circuit or feeder cables.

R. Service entrance and fire pump feeders shall be installed “Outside” of the building as defined by NFPA and the N.E.C. Provide concrete encasement where required to conform with Code requirements.

S. Where hazardous locations, as classified by the National Electrical Code, exist, all raceway and fittings and the installation of these materials shall comply with Article 500 requirements.

T. Maintain minimum three (3) inch clearance when raceway crosses piping and/or systems operating above 75˚F and provide twelve (12) inches separation when installed parallel to hot piping, flues or appliances operating above 75˚F.

U. Nonmetallic fittings shall be applied with compatible solvent welding cement and shall be fitted while solvent is liquid. Overwrap all fittings used in concrete encasement with suitable tape. Provide o-rings at terminal points to provide watertight seal.

3.02 FLEXIBLE CONDUIT:

A. Watertight flexible metallic conduit shall be used in making short flexible connections to all motors, transformers, bus duct switches, kitchen equipment and rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12". Flexible metallic conduit shall be used in making connections to heaters, fixed equipment or flush mounted light fixtures.

B. A green stranded bonding jumper shall be installed inside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine

3.03 CONDUIT PROTECTION:

A. All threaded joints in galvanized rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit inside building is installed below the floor slab, the vapor barrier shall be run below the conduit concrete encasement. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel. No conduit shall be spaced less than 3" apart. Submit conduit layout to structural consultant for review and approval prior to rough-in.

B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduits shall be plugged with suitable caps (not tape) to avoid filling with any foreign matter. All conduits shall be blown out and swabbed clear of water and trash prior to pulling wire.

C. Provide identifying marker tape the entire length of each conduit installed in the ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill. Identify all underground and under slab conduit locations on as-built drawings for future reference.

D. Damaged, oxidized, warped or improperly stored raceway will be removed from the jobsite and replaced with new materials. Non-metallic conduit stored on site prior to installation shall be stored on a flat surface off the ground and shall be protected from direct sunlight and debris.

3.04 CORING, CUTTING AND PATCHING:

A. Perform all coring, cutting and patching of existing walls and floors in order to install the work. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.05 BELOW GRADE RACEWAY INSTALLATION:

A. Provide and perform all excavation required to install conduit, ductbanks and manholes indicated on the drawings and/or specified. Trenches shall be of uniform width required with minimum 8" clearance on both sides. Remove and dispose of all materials not to be used for backfill. Maintain dry excavations for electrical work, by removing water. Grade areas to prevent surface water from entering excavation. Remove any accumulated water by pumping. Perform all excavation by open cut. Excavate with vertical-sided excavations where possible. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and LAHJ. No tunneling shall be permitted.

B. The bottom of all trenches and excavation shall be graded to provide uniform bearing surface for conduits or ductbanks on undisturbed soil at every point along entire length. Tamp overexcavation with specified backfill materials. Remove unstable materials unsuitable for supporting equipment or installation and replace with specified materials for a minimum of twelve (12) inches below invert of equipment or installation.

C. Specified materials shall be utilized for backfilling, in not more than six (6) inch layers and tamped until the installation has cover of not less than the adjacent grade and not more than two (2) inches above same. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Equalize backfilling operation to avoid shifting of materials and equipment installed. Compaction of backfill materials shall be at least equal to surrounding undisturbed material. Backfill trenches with concrete where excavations pass within 18" of footings or other utility lines. Do not settle backfill with water. Conform to compaction requirements and methods specified elsewhere.

3.06 BOXES AND FITTINGS: INSTALLATION:

A. Provide galvanized steel or cast type boxes for all outlets, and for junction or pull boxes. All boxes shall be accessible and sized per NEC requirements. Provide access panels in any non-accessible spaces to allow access to boxes installed.

B. Provide an UL listed outlet box for each ceiling mounted fan assembly shown.

C. Where outlet boxes are used to support lighting fixtures, as junction boxes, or device outlet boxes, the box shall be anchored to the structural members of the building per NEC 370-13.

D. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

E. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

F. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architect's approval, so that the outlet box, top or bottom, will occur at a masonry joint.

G. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the cover plate is installed and the coverplate shall not be used as a means of tightening the devices in place. Provide box extensions as required to permit the above. Coordinate fabric panels, finishes and woodwork provisions in order to determine exact requirements.

H. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed sixteen square inches. All clearances between such outlet boxes and the gypsum board shall be completely filled with joint compound or approved fire-resistive compound. The wall shall be built around outlet boxes larger than sixteen square inches so as not to interfere with the wall rating.

I. Where low voltage device is to be installed in common boxes with line voltage device (or devices of different operating voltage), provide insulated barrier within boxes to establish separate compartments.

J. Remove only knockouts required and plug all unused openings per NEC requirements.

K. Extend branch circuit grounding conductor to each box. Provide grounding pigtail via dedicated fastener.

L. Outlet boxes in the same wall shall not be mounted back-to-back but shall be offset a minimum of six (6) inches, except in acoustical rated walls where 24” is required.

M. Install pull boxes only in unfinished spaces or concealed above accessible ceilings. Provide pull boxes when any of the following conditions apply:

1. Where indicated on the drawings.

2. Where conduit run exceeds 150 feet from access point to access point.

3. Where conduit run contains in excess of 360 degrees bend or offset.

4. To facilitate conductor installation or to insure that manufacturer's maximum pulling tension is not exceeded.

N. Do not splice conductors in pull boxes. Splices are not permitted in pull boxes except where specifically approved in writing by the Engineer. Where splices are permitted, make splices as specified in Wire & Cable Specifications.

O. Where pull boxes are required, multiple circuits within pull box shall:

1. Have circuit conductors and feeders that are individually laced with nylon straps and nylon identification tabs. Conduits shall enter pull box in such manner that conduits enter and exit in the same plane (both horizontal and vertical).

2. Have feeder circuits that are separated by full height and length sheet metal (NEC gage) or polyester resin barrier secured with angle brackets.

P. Where exterior junction or pull boxes are required, install in the following manner:

1. Exterior junction or pull boxes shall be mounted flush with finished grade, unless noted otherwise. Coordinate with the final grade elevation.

2. Heavy traffic rated covers shall be provided in sidewalks, paved areas or within six (6) feet of same.

3. Seal conduit entries into boxes with duct seal to prevent entrance of water, after conductors are installed.

4. Taps and splices, where permitted by these specifications, shall be performed with an encapsulating watertight connection kit which insulates and moisture seals the connection.

Q. After completion, clean all work of dirt, construction debris, paint and refuse.

3.07 COVERS:

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified elsewhere unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

C. Permanently mark each junction box and pull box cover with the circuit numbers for all conductors contained within. Utilize indelible ink black marker for normal power and red marker for emergency power and fire alarm.

D. All junction boxes and pull boxes for wiring systems above 600 volts shall be painted red and identified with high voltage warning labels in accordance with OSHA standards. Raceway shall be identified with the same labels installed every twenty (20) linear feet.

3.08 EQUIPMENT ANCHORING:

A. Support all boxes from structure:

1. Secure to wood with wood or sheet metal screws.

2. Secure to hollow masonry with toggle bolts.

3. Secure to light gage metal with sheet metal screws.

4. Secure to heavy gage metal with bolts or clamps.

5. Anchors for solid masonry and concrete shall be self-drilling or insert expansion shields with bolts or powder actuated drive pin studs (except in post-tension construction).

6. Secure outlet boxes to dry wall studs with steel mounting bracket screwed into stud having support leg to restrain box.

7. Where box is suspended below structure, support from structure with threaded steel rod secured with double nuts. Pull boxes larger than 18” x 18” x 8” shall be supported from power strut and threaded steel rod suspension. Provide seismic bracing where required by local authority.

B. All items of electrical equipment, such as enclosures, panels, troughs, pull boxes, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION

SECTION 26 05 48 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. All work in this section shall comply with the provisions of Section 26 05 10.

B. The Contractor shall install electrical equipment in a manner that prevents transmission of objectionable vibration into the structure. This isolation shall include resilient mounting of racks, conduit, motor starters, cabinets and variable frequency motor controllers.

1.02 SUBMITTALS:

A. Submit shop drawings for conduit passing through isolated block-outs in structure.

B. Variable frequency controller manufacturer shall submit a certification that the controllers are compatible with the motors to be used on this project.

PART 2 – PRODUCTS

2.01 FLEXIBLE STEEL CONDUIT:

A. Flexible steel conduit shall be UL-listed liquid tight flexible metal conduit as manufactured by American Brass, Columbia or approved equal. Fittings shall be single or double set screw type as manufactured by Appleton, Kellum or approved equal.

B. Flexible conduit connectors for conduit sizes greater than 2 inches diameter shall be Crouse-Hinds type XD expansion/deflection coupling, or approved equal.

2.02 NEOPRENE VIBRATION ISOLATORS:

A. Neoprene floor mount isolators shall be Mason Industries type ND, or Kinetics type RD double deflection neoprene mounts, 50 durometer maximum, with 0.2 inch minimum static deflection under actual load.

B. Neoprene floor pads shall be Mason Industries type “Super W” 50 durometer maximum, with 0.15 minimum deflection under actual load.

C. Neoprene wall mount isolators shall be Mason Industries type BRA, RBA, or RCA, or Kinetics type RQ, 50 durometer maximum, with 0.05 inch minimum static deflection under actual shear load.

D. Submit manufacturer’s catalog sheet for all neoprene mounts clearly marked to show equipment tag and weight, mount type and size, actual isolator deflection and maximum rated load for every mount. Submittals based on rated load shall be rejected.

PART 3 – EXECUTION:

3.01 INSTALLATION:

A. Flexible conduit shall be used for all connections to all equipment vibration isolated with springs or neoprene (transformers, pumps, fans, chillers, boilers, motors, etc.). Flexible conduit shall be a minimum of 25% greater length than the separation between the isolated equipment and the termination of rigid conduit. Install the flexible conduit to be slack and not to exceed the manufacturer's minimum recommended bending radius. For conduit sizes greater than 2 inches diameter, use pre-manufactured flexible conduit connectors instead of flexible conduit.

B. Mount all cabinets and variable frequency motor controllers on neoprene floor mount or wall mount isolators. There shall be no rigid connection between isolated equipment and structure.

C. Flexible conduit or a flexible conduit connector shall be used at every location where conduit crosses a building expansion or isolation joint.

D. Conduit connected to vibration isolated electrical equipment shall be resiliently mounted to structure for a distance equal to 200 conduit diameters, and for any additional extent indicated on the Drawings.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Section 26 05 10.

B. This Section covers wiring devices and cover plates including receptacles, switches, plugs, plug connectors, floor outlets, and concealed service floor outlets.

PART 2 - PRODUCTS

2.01 MANUFACTURED WIRING DEVICES:

A. Provide manufactured wiring devices and cover plates, in types, colors, and electrical ratings for applications indicated and complying with NEMA Standard WD 1. Where types and grades are not indicated, provide specification grade selection as determined to fulfill wiring requirements, and complying with NEC and NEMA standards for wiring devices. Provide white color devices and cover plates except as noted otherwise. Color selection shall be verified with the Architect prior to purchase and installation.

B. The devices specified herein are the products of one manufacturer. Provide heavy-duty specification grade devices selected from approved manufacturer listing.

2.02 WALL SWITCHES:

A. Wall switches shall be Institutional, heavy-duty specification grade, plastic body, nylon or lexan toggle, totally enclosed base & cover, quiet type, self-grounding, back wired, 277 volts AC and 20A rating.

1. Single Pole: Hubbell No. 1221

2. Double Pole: Hubbell No. 1222

3. Three-way: Hubbell No. 1223

4. Four-way: Hubbell No. 1224

B. Flush motor switches shall have a red pilot light and overload protection for actual fractional horsepower motors furnished. Square D FSJ-1P or approved equal.

2.03 RECEPTACLES:

A. Duplex receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

1. Duplex NEMA 5-15R Hubbell CR5262

2. Duplex NEMA 5-20R Hubbell CR5362

B. Ground fault circuit interrupting (GFCI) duplex receptacles shall be heavy-duty, specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) or NEMA 5-20R (20A) rating as indicated on drawings.

1. Duplex GFCI NEMA 5-15R Hubbell GFR5262

2. Duplex GFCI NEMA 5-20R Hubbell GFR5362

C. Single receptacles shall be heavy-duty specification grade, plastic base, nylon face, two-pole, three wire, self-grounding, back/side wired, 125 volts AC and NEMA 5-20R (20A) rating.

1. Single NEMA 5-20R Hubbell 5361

D. Special purpose outlets shall be heavy-duty specification grade, plastic base, nylon face, poles as noted, wires as noted, grounding type, back/side wired, with voltage and capacity rating noted. Conform to NEMA configuration requirements.

E. Exterior flush mounted duplex outlets shall be GFCI heavy-duty, industrial specification grade, plastic base, nylon face, two-pole, three wire, supplied with pre-stripped wire leads, feed-through protection, 125 volts AC and NEMA 5-15R (15A) recessed mounted in TayMac gasketed enclosure model Masque 72206 or approved equal. Unit assembly shall protrude no more than 1/2" and shall be rainproof in use per NEC 410-57. Provide color as specified by the Architect.

2.05 COVERPLATES:

A. Coverplates for flush mounted devices shall be one piece standard size high impact smooth stainless steel. Device plates for masonry walls shall be jumbo type.

B. Telephone/data outlet coverplates shall be the same finish as above and have two (2) modular jack openings with blank fillers as required. All Computer Lab coverplates shall have four (4) modular jack openings.

C. Coverplates for flush mounted GFCI devices shall be premarked "GFCI PROTECTED".

2.06 PLUGS & CONNECTORS:

A. Plugs and connectors shall be of nylon construction, heavy duty specification grade, brass contacts and terminations, conforming to UL 94 & 498, with cord grips, 600 VAC working range, straight blade or locking type and NEMA type as noted.

2.07 ACCEPTABLE MANUFACTURERS:

A. Wiring devices & cover plates:

1. Arrow-Hart

2. Sierra

3. Eagle

4. Hubbell

5. Leviton

6. Pass & Seymour

7. Square D

8. TayMac

B. Plugs & connectors:

1. Arrow-Hart

2. Eagle

3. Hubbell

4. Leviton

5. Pass & Seymour

PART 3 - EXECUTION

3.01 STANDARDS COMPLIANCE:

A. Installation and provision of all specified equipment shall be in accordance with the latest editions of:

1. National Electrical Code NFPA 70

2. Underwriters Laboratories (UL) UL 20, 498, 943

3. National Electrical Manufacturer's Association (NEMA) NEMA STDS WD 1, 2, 5

3.02 INSTALLATION:

A. Coordinate installation rough in requirements with architectural and structural features, equipment installed under other portions of these specifications, and electrical equipment.

B. Coordinate the installation of switches and wall dimmers with the door swings to insure that the devices are located on the strike side of the door.

C. Review the architectural and/or interiors drawings and elevations for devices requiring specific locations.

D. The mounting height of devices is indicated in the legend on the drawings and is intended to mean the bottom of the device above the finished floor unless otherwise noted.

E. Mount all devices within outlet boxes to allow device cover plates to be in contact with wall on all sides. Verify all outlet boxes in grouping are at the same elevation.

F. Install vertically mounted receptacles with the ground connection up.

G. Install switches with "Off" position down.

3.03 WIRING DEVICES:

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 standard industry practices to fulfill project requirements.

B. Where more than one wiring device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

C. Install wiring devices only in electrical outlet boxes which are clean, free from construction debris, drywall compound and dirt. At final inspection all wiring devices shall be clean, free of paint overspray, unbroken and in new condition.

D. Ground all wiring devices by electrically continuous, pigtail connection such that removal of device does not open grounding path to any downstream device. Connect the grounding screw of each device to the equipment grounding conductor.

E. Prior to energizing circuits, test wiring system for electrical continuity, freedom from faults, and proper polarity of connections. After energizing circuits, test wiring devices to demonstrate compliance with these requirements.

3.04 COVERPLATES:

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

C. Do not install cover plates until after painting and/or other finish work is complete.

D. Where the cover plate does not completely cover the wall opening, replace the plate with an oversized (midi or jumbo) plate or repair the wall opening. Where one oversize plate is used, replace all cover plates in the room with the oversize plates.

E. At final inspection, all wiring devices and cover plates shall be clean, without paint overspray, undamaged and unscratched or broken.

END OF SECTION

SECTION 28 31 00 FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Electrical Division Section 26 05 10.

1.02 CODES AND STANDARDS:

A. All equipment shall be U.L. listed for its intended use.

B. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code – latest edition).

C. NFPA Standard 71 and 72.

D. NFPA 101, Life Safety Code.

E. American National Standard A117/1.

F. Standard Building Code.

G. Underwriters Laboratories Fire Resistance Directory.

H. Applicable local codes and regulations.

1.03 PERMITS AND APPROVALS:

A. Prior to commencement and after completion of work, notify authorities having jurisdiction.

B. Submit letter of approval for installation and a Certificate of Compliance (NFPA 72-2-2) before requesting acceptance of system.

1.04 SUBMITTALS:

A. Section Cross Reference: Refer to Division 01, General Requirements for Submittals.

B. Provide manufacturer's roughing-in diagrams, written product specifications and instructions for installation:

1. Include copies of manufacturer's published product warranties.

2. Provide data sheets on each item of equipment.

3. Provide list of all types of equipment and components provided.

4. Provide description of operation of system to include any and all exceptions, variances, or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval.

5. A list of any system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls.

6. Complete system wiring diagrams for all components and interfaces to equipment supplied by others.

7. A listing of the manufacturer's representatives responsible for installation coordination and service along with their NICET Certification and Level Numbers.

PART 2 - PRODUCTS

2.01 DESCRIPTION:

A. The work covered by this Section of the Specifications shall include all labor, equipment, materials and services to furnish and install additional components to an existing Fire Alarm System. The system equipment as covered by these specifications, shall be wired, connected, and left in first class operating condition. The components are shown on the drawings and shall consist of, but not be limited to, any of the following:

1. Manual Fire Alarm Stations.

2. Area Smoke Detectors.

3. Duct Mounted Smoke Detectors (Installed by Division 15).

4. Speaker/Strobe Alarm Signals.

B. It shall also include coordination with the design/build fire conduit, wire, connections and all equipment necessary to monitor and annunciate all of the equipment they provide.

2.02 SEQUENCE OF OPERATION:

A. Operation of any building manual fire alarm station or smoke detector shall automatically:

1. Cause electrical power to HVAC units to be disconnected, thereby shutting down air handling functions.

B. Detection of smoke by equipment-mounted duct smoke detectors shall automatically:

2. Cause electrical power to HVAC units to be disconnected, thereby shutting down air handling functions.

2.03 MANUAL STATIONS:

A. Provide addressable manual pull stations as shown on the plans. The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "pull lever" shall remain at a right angle to the station body until reset.

2.04 PHOTOELECTRIC SMOKE DETECTORS:

A. Provide photoelectric smoke detector heads with addressable bases as shown on the plans. Detectors shall be of the solid state photoelectric type utilizing a stable LED light source and a silicone photo diode as the receiving element to form a highly accurate means of smoke detection. Internal detector circuits shall be shielded against electrical

interference and resistant to transients, noise, and RF interference. Detector shall be low profile. Detector shall have a red LED that comes on steady to show that the device is in alarm. Detector shall compensate for environment changes and sensitivity shall be field selectable from .5% obscuration to 3.7% obscuration.

B. Regardless of sensitivity settings, the detector's stability shall be unaffected by high air velocity. Control Panel shall be able to provide average and peak readings of each detector to assure maximum sensitivity.

2.05 ALARM SIGNALS:

A. Provide ADA approved audible/visual strobe units as shown on the plans. These units shall mount to a standard four inch square outlet box. A complete unit shall also include a speaker. The strobe light shall have a white lens with red "FIRE" imprinted on it and shall have a xenon flasher with a minimum intensity of 75 candela and a flash rate of 1 Hz to 3 Hz. 15/75 Candela devices are not acceptable. The speaker shall be red in color, have 1/4, 1/2, 1, and 2 watt tap settings and shall provide at least 82 db at 10 feet when set at a one watt tap as measured.

2.06 DUCT DETECTORS:

A. Provide addressable duct detectors with environmental compensated photoelectric detector heads and sampling tubes as shown on the plans. Duct detectors shall be installed under Division 15 and electrically connected to the fire alarm system under Division 16. Each detector to have an integral relay and be capable of operating a remote LED to indicate its alarm condition. Detectors zoned with other devices shall be capable of operating their integral relay even if all other devices on their circuit have gone into alarm.

2.07 SPRINKLER FLOW SWITCHES:

A. Flow switches and valve tamper switches are furnished and installed by Division 15 and wired under Division 16. Provide addressable monitor interface.

B. Provide Zone addressable modules to monitor each water flow device and tamper switch.

2.08 ACCEPTABLE MANUFACTURERS:

A. Acceptable manufacturers are those whose component are completely compatible with the existing Fire Alarm System: Examples are Simplex, ADT, Edwards, Pyrotronics, Notifier, and Gamewell.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. Provide conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. Wiring shall be of the type recommended by the manufacturer, approved by the local authority having jurisdiction and shall be installed in dedicated conduit throughout.

B. Wiring shall be color coded throughout, to National Electrical Code standards.

C. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

3.02 TESTS:

A. Reports of any field testing during installation shall be forwarded to Project Engineer.

B. Each individual system operation, on an address by address and circuit by circuit basis, shall be tested for its complete operation. Procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Project Engineer and the manufacturer. Use NFPA 72 2-2 documentation.

3.03 DOCUMENTATION AND TRAINING:

A. As a part of the operation and maintenance manuals, provide data to include operating and maintenance instructions, catalog cuts of all equipment and components, all “as-built” wiring diagrams (both floor plan and riser types) and a manufacturer's suggested spare parts list.

B. In addition to the above manuals, the Contractor shall provide the services of trained manufacturer's representative for a period of four (4) hours to instruct the Owner on the operation and maintenance of the entire system.

END OF SECTION

SECTION 31 23 12 EXCAVATION, FILLING AND GRADING

PART 1 - GENERAL.

1.01 SECTION INCLUDES

A. The extent of excavation, filling and grading is shown on the Drawings. Preparation of subgrade for slabs is included as part of this Work.

1.02 QUALITY ASSURANCE

A. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Compaction density shall be 95 percent of the maximum dry density value as determined by ASTM D 698 (Standard Proctor Test) of AASHTO T-99.

1.03 EXISTING UTILITIES

A. Locate existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during earthwork operations. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

B. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by Project Engineer and then only after acceptable temporary utility services have been provided. Demolish and completely remove from site existing underground utilities indicated “To Be Removed”. Coordinate with utility companies for shut off of services if lines are active.

1.04 PROTECTION OF PERSONS AND PROPERTY

A. Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.05 USE OF EXPLOSIVES

A. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 BACKFILL AND FILL

A. Select fill shall be an approved select material free from trash, debris, stones larger than 3 inches, roots and other organic matter.

2.02 GRANULAR FILL

A. Below existing natural grade line: Sandy clay with a liquid limit less than 45 and PI in range of 10 to 22, or clayey sand with PI not less than 7 and liquid limit not greater than 35.

B. Above existing natural grade under slabs and footings: Silty or sandy clay as above or clayey-sand with LL less than 35 and PI of 3 to 15.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Contractor, in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 EXCAVATION

A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.

B. Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Project Engineer. Unauthorized excavation, as well as remedial Work directed by the Project Engineer, shall be at the Contractor's expense.

D. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations.

1. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.03 MATERIAL STORAGE

A. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as herein specified.

3.04 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

3.05 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.06 COMPACTION

A. Control soil compaction during construction providing minimum percentage of density specified.

3.7 BACKFILL AND FILL

A. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

B. Under slab sub-base material, or satisfactory excavated or borrow material, or combination of both. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by Project Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and soil treatment.
2 Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork, shoring and bracing, and backfilling of voids with satisfactory materials.
4. Removal of trash and debris.

3.8 GROUND SURFACE PREPARATION

A. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.9 PLACEMENT AND COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

3.10 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

3.11 COMPACTION

A. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.12 MAINTENANCE

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, re-shape, and compact to required density prior to further construction.

3.13 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off the Owner's property.

END OF SECTION

SECTION 31 31 19 VEGETATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil treatment for control of vegetation under gravel bed at Equipment Yard and as indicated on Drawings.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data and application instructions prior to application for Project Engineer's approval.

1.03 QUALITY ASSURANCE

A. In addition to the requirements of these Specifications, comply with manufacturer's instructions and recommendations for the Work, including preparation of substrate and application.

B. Comply with Mississippi Regulations Governing Herbicide Control in following the labels of the herbicide.

1.04 PROJECT CONDITIONS

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with other handling and application instructions of the soil toxicant manufacturer.

C. Remove all non-pressure treated wood contacting soil. Remove grade stakes prior to applying horizontal barrier and all form boards, stakes and concrete over pour prior to applying vertical soil treatment.

1.04 GUARANTEE

A. Furnish 3 copies of manufacturer's standard written warranty.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

A. Use an emulsible concentrate herbicide for dilution with water specially formulated to prevent growth of vegetation. Provide a working solution of one of the following chemical elements:

1. Horizontal barrier: Equal to ACCORD™ Concentrate Herbicide as manufactured by Dow AgroSciences, Indianapolis, IN. Tel. (800) 263-1196.

B. Other solutions may be used as recommended by Applicator and if acceptable to local and state governing authorities.

PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator must examine the areas and conditions under which soil treatment for vegetation control is to be applied and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.

3.02 APPLICATION

A. Remove foreign matter, which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs. Herbicide may be applied before placement of compacted fill under slabs, if recommended by herbicide manufacturer.

B. Application Rates: Under slab-on-grade and graveled areas treat the soil before concrete slabs are poured and gravel is applied using either power sprayer or tank-type garden sprayer. Apply soil treatment solution, USING COLOR DYE MARKING AGENT to insure the area is treated, as follows:

1. Herbicide applied for the prevention of vegetation shall comply with the manufacturer's label and shall not be applied at concentrations or volumes less than specified on the label.
2. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

C. Allow a minimum of 12 hours for drying after application, before beginning concrete placement or other construction activities.

3.03 PROTECTION

A. Prior to each application, the applicator shall notify the Contractor of the intended application and instruct the responsible person to notify construction workers and other site individuals to leave the treated area and not to return until chemical has been installed into the soil.

B. Post signs in the areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

END OF SECTION

SECTION 31 32 20 FILTER CLOTH AND BED EDGING

PART 1 - GENERAL

1.01 SCOPE

A. Description: Filter cloth and bed edging where indicated on Drawings.

B. Submittals: Prior to the delivery of any filter cloth or bed edging to the job site, submit for approval product data from the manufacturers of the filter cloth and bed edging describing the materials proposed for use on the project. Deliver no materials to the job site until submittals have been approved in writing. Submit samples if and as requested by the Project Engineer.

C. Protections: Protect all underground and exposed appurtenances during and after construction as required to obtain the necessary approval and acceptance of the system upon the completion of the project.

D. Storage and Handling:

1. Store all materials delivered to the site at suitable storage facilities to adequately protect all materials from damage or deterioration in any way. Handle materials with care to prevent breakage, contamination or other damage. Materials delivered in unopened containers may be stored in same. Any damaged or deteriorated materials will be rejected.
2. Special caution should be exercised when outdoor storage of materials is utilized due to the destructive effects of prolonged sunlight and moisture on filter cloth.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Filter Cloth:

1. Supac 5-P nonwoven fabric as manufactured by Philips Fibers Corporation, Greenville, South Carolina.
2. Typar non-woven fabric as manufactured by DuPont Company, Wilmington, Delaware.
3. Mirafi fabrics as manufactured by Mirafi, Inc., Charlotte, North Carolina.
   a. Drainage: 140N non-woven.

B. Bed Edging: Steel - 3/16 inch by 4 inch in size, color - green, with steel stakes, as manufactured by Ryerson, Gardener's Supply Company, Sure-loc Edging, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Filter Cloth:

1. Clear and grade subgrade areas to be covered as per Section 31 23 12 – Excavation, Fill and Grading.
2. Coordinate with Section 31 31 19 – Vegetation Control.
3. Areas must be smooth and free of irregularities, shrubs, rocks or sharp objects.
4. Unroll the cloth directly on the subgrade overlapping, where required, 18 inches to 3 feet.
5. Place and spread a 4 inch minimum thickness washed gravel bedding course onto the cloth.

B. Bed Edging: Install per manufacturers recommendations.

3.02 CLEAN-UP

A. Refer to Section 01 74 00 – Cleaning and Waste Management

END OF SECTION

SECTION 32 92 00 TURF AND GRASSES

PART 1 - GENERAL

1.01 SCOPE

A. Topsoil, sodding and related products at all exterior ground areas within the limits of the Contract, except surfaces occupied by buildings, structures and pavement, and areas indicated as undisturbed or otherwise planted as shown on Drawings. The Work shall include furnishing and/or spreading topsoil, finish grading, preparing bed, and providing plant establishment.

1.02 REQUIREMENTS

A. Meet the requirements and recommendations of the applicable portion of the following standards:

1. Mississippi Fertilizer Law: Rules and Regulations - Mississippi Department of Agriculture and Commerce.
2. Mississippi Pure Seed Law and Regulations: Mississippi Department of Agriculture and Commerce.
3. Other governing Federal, State and Local Laws, Rules, Regulations and Ordinances applicable to this project and the Work described herein and on Contract Drawings.

1.03 PLANTING OPERATIONS

A. Shall be performed by a licensed Landscape Contractor with a valid Landscape Gardeners license from the Bureau of Plant Industry, Mississippi Department of Agriculture and Commerce.

1.04 FIELD INVESTIGATIONS

A. Contractor shall visit the job site and familiarize himself with the nature and location of the work, existing conditions and conditions that will exist under which he will be obligated to operate in the performance of the work.

1.05 RELATED WORK

A. Grading of the site requirements are specified in Section 31 23 12.

1.06 SUBMITTALS

A. Submit product data and technical specifications, installation instruction and general recommendations for each product specified.

1.07 DELIVERY AND STORAGE

A. Damaged materials will not be accepted.

B. Deliver packaged materials to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.

C. Store materials delivered to site prior to actual usage in a place so as not to interfere with other trades or construction operations and protect from damage by weather or other elements as needed.

PART 2 - PRODUCTS

2.01 WATER: Obtained as specified in Division 1, General Requirements, under Temporary Services. Water shall not contain elements toxic or harmful to plant life.

2.02 FERTILIZERS AND LIME

A. Commercial fertilizers:

1. Complete formula manufactured standard products complying with local, state, and Federal regulations and laws.
2. Uniform in composition, dry and free flowing, and
3. Contain not less than the percentage by weight of ingredients set out in the following table:

GRADE	NITROGEN	PHOSPHORUS P-2-0-5	POTASH K-2
13-13-13	13	13	13

An allowance of 4 percent variation or tolerance of the above proportions will be permitted based on relative commercial value.

4. Application rates: 13-13-13 at rate of 7 pounds per 1,000 square feet initially.

B. Ground Agricultural Limestone: Apply to grassing areas at the rate of one ton to the acre, or forty-six (46) pounds per 1,000 square feet.

2.03 VEGETATIVE MATERIALS

A. Substitutions: In plant species shall be made only with the written approval of the Project Engineer.

B. Solid Sod:

1. Type: Centipede Grass
2. Characteristics:
   a. Firm, tough texture, having a compact growth of grass with good root development.
   b. Reasonably free from obnoxious weeds or other grasses and shall not contain any matter deleterious to its growth.
3. Provide in blocks at least 8 inches by 8 inches by 2 inches, reasonably free from ragged edges, and with at least 1 1/2 inch of soil adhering firmly to the roots.
4. Mow within 24 hours preceding cutting, and transplant within 24 hours from time of cutting, unless stacked in a manner satisfactory to the Project Architect.
5. Keep sod in stacks moist and protected from exposure to the air, sun and freezing.
6. In NO event shall more than three (3) days elapse between the cutting and planting of the sod.
7. Dormant planted sod need not show signs of new growth, however, warranty shall extend through May 1 following planting (which may be after Project Acceptance) to determine new growth.

2.04 TOPSOIL (natural)

A. General:

1. Both stockpiled onsite, and offsite topsoil shall be approved by Project Engineer.
2. If off-site topsoil is necessary, a representative sample may (at the option of the Project Engineer) be tested in accordance with paragraph 3.02.
3. Owner and Project Engineer reserve the right to approve or reject topsoil site if the material does not meet the requirements of paragraph 'B', below.

B. Quality:

1. Friable loam, typical of cultivated topsoils locally, containing at least 2% of decayed organic matter (humus).
2. Taken from a well drained, arable site and reasonably free of subsoil, stones, earth, clods, sticks, roots or other objectionable extraneous matter or debris.

a. Topsoil shall not be taken from a site containing Nutgrass (Purple or Yellow Nutsedge, or related species.)

3. Shall not contain toxic materials.
4. Do not deliver in a frozen or muddy condition.

PART 3 - EXECUTION

3.01 GENERAL

A. Conduct planting operations in weather conditions which provide favorable temperature, moisture and soil conditions.

3.02 SOILS ANALYSIS

A. When offsite topsoil is required, provide soils analyses prepared from samples taken from the excavation site. Collect and have analyzed by the local County Extension Service. Provide 2 samples per 1,000 cubic yards. Analysis is for the purpose of determining the pH of the soil or determining nutrient deficiencies.

3.03 SOIL PREPARATION

A. Includes tillage of soil, application of topsoil, application of fertilizer, and lime as required.

B. Spread topsoil to a depth of 2 inches (to the grades specified) throughout areas to be grassed. Note - an additional 2 inches of topsoil is not required in areas of earthwork operations which received topsoil as per the requirements of Section 02300.

C. Ground preparation shall consist of:

1. Plowing and pulverizing of the area to be planted to a depth of not less than 4 inches.
2. Following plowing, thoroughly disk and harrow the area until well pulverized to the full depth and present a smooth, uniform, loose, well-broken, and fine grained soil with large clods, earth balls, boulders, stumps, large roots, or other particles which will interfere with the work removed.

3. When topsoil is to be applied to the area under preparation, the depth of the preparation may be reduced to 2 inches or when permitted by the Project Engineer, the necessary disking and harrowing may be performed after the topsoil has been placed.
4. Final result - ground pulverized and cultivated to provide a suitable bed for planting operations, with grades true to the lines as established.

D. Do not commence planting operations if the ground is in such condition that it can not hold persons or equipment without damaging the finish grade.

3.04 PLANTING OPERATIONS

A. Sodding:

1. Place on the approved prepared surface with edges in close contact, and starting at the lowest point and working upward.
2. Close cracks between blocks of sod small pieces of fresh sod. Fill cracks too small for sod with a light dressing of approved soil.
3. Compact and water sod area to the satisfaction of the Project Engineer. Compact with light rollers, hand tamps or other approved equipment.
4. Excavate so that the soil elevation of the sod meets flush with the seeded soil elevations where seeded areas join sodded areas.
5. Peg with wooden pegs driven through the sod into firm earth at intervals deemed suitable to hold the sod in place, in areas where the sod may slide (due to the height and slope of the surface or nature of the soil).

3.05 PLANTING OPERATIONS - GENERAL

A. Compaction: Following completion of planting operations, compact areas planted, to the satisfaction of the Project Engineer with rollers, cultipackers, or other approved equipment used for this purpose.

3.06 PLANT ESTABLISHMENT

A. Sodding: Consists of preserving, protecting, replacing, watering, and maintenance necessary to keep the sod in satisfactory condition until acceptance.

3.07 PROJECT COMPLETION

A. Clean-Up: Refer to Section 01 74 00.

B. Maintenance:

1. Begins immediately after sod is planted and continues until planting has passed final inspection and acceptance.
2. Includes watering, weeding, cultivating, mowing, removal of dead materials, resetting sod to proper grades and other necessary operations.
3. Mowing shall begin twenty-one days after planting and continue every fourteen days until Final acceptance. Perform mowing with rotary or reel mowers- no bushhogs or flail mowers allowed.
4. Provide protection to lawn areas. Repair damage resulting from construction operations promptly.

C. Maintenance By Owner:

1. Owner will provide adequate maintenance during the guarantee period, however, Contractor shall fully explain the watering, and mowing needs of the work to the Owner in writing, submitted with the closeout documents.
2. Contractor is responsible for planting until the guarantee period is up, unless the Owner is grossly negligent in his maintenance of the work.
3. Maintenance by Owner shall not begin until final acceptance.

3.08 GUARANTEE, INSPECTION AND ACCEPTANCE

A. Inspection:

1. Notify Project Engineer and MDOT Architect:
   a. Prior to the days on which sodding operations are performed, and
   b. To request final inspection.
2. Made by Project Engineer at the conclusion of planting to determine completion, exclusive of replacement of plants.

B. Final Acceptance:

1. Made by Owner following final inspection and approval by the Project Engineer.
3. A satisfactory stand of grass is a cover of living grass (limited to the species of sod which is expected to germinate in the current season), in which no gaps occur in sodded areas.
4. If an acceptable stand of grass is not established within 45 calendar days from date of planting, the area shall be resodded or repaired (at no cost to the Owner) until an acceptable stand is established. Deficiencies in the work must be corrected before final acceptance will be made.

C. Guarantee:

1. Period - 60 days, BEGINNING at the time of FINAL acceptance of the project.
2. Grass shall be alive, in a satisfactory condition at the end of the guarantee period, unless the plant material has suffered from direct damage or negligence by the Owner.
3. Grass damaged directly or indirectly as a result of the Work prior to final acceptance of the complete project, shall be replaced.
4. Refer to warranty requirements of sod (paragraph 2.03B).

D. Reports by Landscape Contractor:

1. Beginning at final acceptance and during the guarantee period, make periodic inspections of the work to verify minimal maintenance by Owner.
2. Inspections shall be made once every 30 days. File a written report with the Project Engineer and the MDOT Architect.
3. Failure to do so shall relieve the Owner of his maintenance requirements during the guarantee period.

E. Replacement - Warranty:

1. Grassing required under this contract which is dead or not in satisfactory condition during, or at the end of the guarantee period, as determined by the Project Engineer, shall be removed and replaced, at the Contractor's expense, provided that:
   a. Owner has complied with the instructions for maintenance provided by the Contractor, and
   b. The 30-day reports by the Contractor are on file with the Project Engineer.
2. Notify the Project Engineer and MDOT Architect when planning to replace the grass so that the Project Engineer and MDOT Architect may be present.

END OF SECTION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

PROCURMENT AND CONTRACTING FORMS

DIVISION 50

S E C T I O N 9 0 5 - P R O P O S A L

Date _____

Mississippi Transportation Commission
Jackson, Mississippi

Sirs: The following proposal is made on behalf of _____
_____ of _____
_____
for constructing the following designated project(s) within the time(s) hereinafter specified.

The plans are composed of drawings and blue prints on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

The Specifications are the current Standard Specifications of the Mississippi Department of Transportation approved by the Federal Highway Administration, except where superseded or amended by the plans, Special Provisions and Notice(s) to Bidders attached hereto and made a part thereof.

I (We) certify that I (we) possess a copy of said Standard and Supplemental Specifications.

Evidence of my (our) authority to submit the Proposal is hereby furnished. The proposal is made without collusion on the part of any person, firm or corporation. I (We) certify that I (we) have carefully examined the Plans, the Specifications, including the Special Provisions and Notice(s) to Bidders, herein, and have personally examined the site of the work. On the basis of the Specifications, Special Provisions, Notice(s) to Bidders, and Plans, I (we) propose to furnish all necessary machinery, tools, apparatus and other means of construction and do all the work and furnish all the materials in the manner specified. I (We) understand that the quantities mentioned herein are approximate only and are subject to either increase or decrease, and hereby propose to perform any increased or decreased quantities of work at the unit prices bid, in accordance with the above.

Attached hereto is a certified check, cashier's check or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law).

INSTRUCTION TO BIDDERS: Alternate and Optional Items on Bid Schedule.

1. Two or more items entered opposite a single unit quantity WITHOUT DEFINITE DESIGNATION AS "ALTERNATE ITEMS" are considered as "OPTIONAL ITEMS". Bidders may or may not indicate on bids the Optional Item proposed to be furnished or performed WITHOUT PREJUDICE IN REGARD TO IRREGULARITY OF BIDS.

2. Items classified on the bid schedule as "ALTERNATE ITEMS" and/or "ALTERNATE TYPES OF CONSTRUCTION" must be preselected and indicated on bids. However, "Alternate Types of Construction" may include Optional Items to be treated as set out in Paragraph 1, above.

3. Optional items not preselected and indicated on the bid schedule MUST be designated in accordance with Subsection 102.06 prior to or at the time of execution of the contract.

4. Optional and Alternate items designated must be used throughout the project.

I (We) further propose to perform all "force account or extra work" that may be required of me (us) on the basis provided in the Specifications and to give such work my (our) personal attention in order to see that it is economically performed.

SECTION 905 -- PROPOSAL (CONTINUED)

I (We) further propose to execute the attached contract agreement (Section 902) as soon as the work is awarded to me (us), and to begin and complete the work within the time limit(s) provided for in the Specifications and Advertisement. I (We) also propose to execute the attached contract bond (Section 903) in an amount not less than one hundred (100) percent of the total of my (our) part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted.

I (We) enclose a certified check, cashier's check or bid bond for **five percent (5%) of total bid** and hereby agree that in case of my (our) failure to execute the contract and furnish bond within Ten (10) days after notice of award, the amount of this check (bid bond) will be forfeited to the State of Mississippi as liquidated damages arising out of my (our) failure to execute the contract as proposed. It is understood that in case I am (we are) not awarded the work, the check will be returned as provided in the Specifications.

Respectfully Submitted,

DATE _____

_____
Contractor

BY _____
Signature

TITLE _____

ADDRESS _____

CITY, STATE, ZIP _____

PHONE _____

FAX _____

E-MAIL _____

(To be filled in if a corporation)

Our corporation is chartered under the Laws of the State of _____ and the names, titles and business addresses of the executives are as follows:

President	Address
Secretary	Address
Treasurer	Address

The following is my (our) itemized proposal.

Construction necessary for HVAC System upgrades at the Jackson Shop Complex and the MDOT Administration Building, known as State Project Nos. BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301, in the County of Hinds, State of Mississippi.

I (We) agree to complete the entire project within the specified contract time.

***** SPECIAL NOTICE TO BIDDERS *****
BIDS WILL NOT BE CONSIDERED UNLESS BOTH UNIT PRICES AND ITEM TOTALS ARE ENTERED.
BIDS WILL NOT BE CONSIDERED UNLESS THE BID CERTIFICATION LOCATED AT THE END OF THE BID SHEETS IS SIGNED

*****BID SCHEDULE*****

Line No.	Item Code	Adj Code	Quantity	Units	Description	Unit Price		Item Amount	
						Dollar	Ct	Dollar	Ct
Building Items									
0010	1520-A001		1	Lump Sum	Installation of HVAC System Upgrades--Jackson Shop Complex	XXXXXXXX	XXX		
0020	1520-A001		1	Lump Sum	Installation of HVAC System Upgrades--MDOT Administration Building	XXXXXXXX	XXX		

*** BID CERTIFICATION ***

TOTAL BID.....$_____

*** SIGNATURE STATEMENT ***

BIDDER ACKNOWLEDGES THAT HE/SHE HAS CHECKED ALL ITEMS IN THIS PROPOSAL FOR ACCURACY AND CERTIFIED THAT THE FIGURES SHOWN THEREIN CONSTITUTE THEIR OFFICIAL BID.

_____

BIDDER'S SIGNATURE

_____

BIDDER'S COMPANY

_____

BIDDER'S FEDERAL TAX ID NUMBER

CONDITIONS FOR COMBINATION BID

If a bidder elects to submit a combined bid for two or more of the contracts listed for this month's letting, the bidder must complete and execute these sheets of the proposal in each of the individual proposals to constitute a combination bid. In addition to this requirement, each individual contract shall be completed, executed and submitted in the usual specified manner.

Failure to execute this Combination Bid Proposal in each of the contracts combined will be just cause for each proposal to be received and evaluated as a separate bid.

* *

COMBINATION BID PROPOSAL

I. This proposal is tendered as one part of a Combination Bid Proposal utilizing option ___* of Subsection 102.11 on the following contracts:

* Option to be shown as either (a), (b), or (c).

	Project No.	County		Project No.	County
1.	____________	____________	6.	____________	____________
2.	____________	____________	7.	____________	____________
3.	____________	____________	8.	____________	____________
4.	____________	____________	9.	____________	____________
5.	____________	____________	10.	____________	____________

A. If option (a) has been selected, then go to II, and sign Combination Bid Proposal.

B. If option (b) has been selected, then complete the following, go to II, and sign Combination Bid Proposal.

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
1. _____	_____ _____	_____ _____	_____ _____	_____ _____	
2. _____	_____ _____	_____ _____	_____ _____	_____ _____	
3. _____	_____ _____	_____ _____	_____ _____	_____ _____	
4. _____	_____ _____	_____ _____	_____ _____	_____ _____	
5. _____	_____ _____	_____ _____	_____ _____	_____ _____	
6. _____	_____ _____	_____ _____	_____ _____	_____ _____	
7. _____	_____ _____	_____ _____	_____ _____	_____ _____	
8. _____	_____ _____	_____ _____	_____ _____	_____ _____	

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
9. _____	_____ _____	_____ _____	_____ _____	_____ _____	
10. _____	_____ _____	_____ _____	_____ _____	_____ _____	

C. If option (c) has been selected, then initial and complete one of the following, go to II. and sign Combination Bid Proposal.

_____ I (We) desire to be awarded work not to exceed a total monetary value of $ _____.

_____ I (We) desire to be awarded work not to exceed _____ number of contracts.

II. It is understood that the Mississippi Transportation Commission not only reserves the right to reject any and all proposals, but also the right to award contracts upon the basis of lowest separate bids or combination bids most advantageous to the State.

It is further understood and agreed that the Combination Bid Proposal is for comparison of bids only and that each contract shall operate in every respect as a separate contract in accordance with its proposal and contract documents.

I (We), the undersigned, agree to complete each contract on or before its specified completion date.

SIGNED _____

_____

_____

TO: EXECUTIVE DIRECTOR, MISSISSIPPI DEPARTMENT OF TRANSPORTATION
JACKSON, MISSISSIPPI

CERTIFICATE

If awarded this contract, I (we) contemplate that portions of the contract will be sublet. I (we) certify that those subcontracts which are equal to or in excess of fifty thousand dollars ($50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

NOTE: Insert name and address of subcontractors. (Subcontracts equal to or in excess of fifty thousand dollars ($50,000.00) ONLY.)

(Individual or Firm)	(Address)
(Individual or Firm)	(Address)
(Individual or Firm)	(Address)
(Individual or Firm)	(Address)

NOTE: Failure to complete the above DOES NOT preclude subsequent subcontracts. Subsequent subcontracts, if any, equal to or in excess of fifty thousand dollars ($50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

Contractor _____

By _____

Title _____

CERTIFICATE MUST BE EXECUTED

REV. 2/99

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION
(Execute in duplicate)

I,_____,
(Name of person signing certification)

individually, and in my capacity as _____ of
(Title)

_____ do hereby certify under
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that

_____, Bidder
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301**,

in **Hinds** County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here "_____" if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on _____ _____
Signature

(5/29/2008S)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION
(Execute in duplicate)

I,_____,
(Name of person signing certification)

individually, and in my capacity as _____ of
(Title)

_____ do hereby certify under
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that

_____, Bidder
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301**,

in **Hinds** County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here "_____" if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on _____ _____
Signature

(5/29/2008S)

S E C T I O N 9 0 2

CONTRACT FOR **BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301**

LOCATED IN THE COUNTY(IES) OF **Hinds**

STATE OF MISSISSIPPI,

COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the _____ day of _____, _____.

_____
Contractor (s)

By _____ MISSISSIPPI TRANSPORTATION COMMISSION

Title _____ By _____
Signed and sealed in the presence of: Executive Director
(names and addresses of witnesses)

_____ _____
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ____ day of _____, _____, Minute Book No. _____, Page No. _____.

Revised 8/06/2003

S E C T I O N 9 0 3

CONTRACT BOND FOR: **BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301**

LOCATED IN THE COUNTY(IES) OF: **Hinds**

STATE OF MISSISSIPPI,

COUNTY OF HINDS

Know all men by these presents: that we, _____

_____ Principal, a _____

residing at _____ in the State of _____

and _____

residing at _____ in the State of _____,

authorized to do business in the State of Mississippi, under the laws thereof, as surety, are held and firmly bound unto the State of Mississippi in the sum of _____

_____

($_____) Dollars, lawful money of the United States of America, to be paid to it for which payment well and truly to be made, we bind ourselves, our heirs, administrators, successors, or assigns jointly and severally by these presents.

Signed and sealed this the _____ day of _____ A.D. _____.

The conditions of this bond are such, that whereas the said _____

_____

principal, has (have) entered into a contract with the Mississippi Transportation Commission, bearing the date of _____ day of _____ A.D. _____ hereto annexed, for the construction of certain projects(s) in the State of Mississippi as mentioned in said contract in accordance with the Contract Documents therefor, on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

Now therefore, if the above bounden _____

_____ in all things shall stand to and abide by and well and truly observe, do keep and perform all and singular the terms, covenants, conditions, guarantees and agreements in said contract, contained on his (their) part to be observed, done, kept and performed and each of them, at the time and in the manner and form and furnish all of the material and equipment specified in said contract in strict accordance with the terms of said contract which said plans, specifications and special provisions are included in and form a part of said contract and shall maintain the said work contemplated until its final completion and acceptance as specified in Subsection 109.11 of the approved specifications, and save harmless said Mississippi Transportation Commission from any loss or damage arising out of or occasioned by the negligence, wrongful or criminal act, overcharge, fraud, or any other loss or damage whatsoever, on the part of said principal (s), his (their) agents, servants, or employees in the performance of said work or in any manner connected therewith, and shall be liable and responsible in a civil action instituted by the State at the instance of the Mississippi Transportation Commission or any officer of the State authorized in such cases, for double any amount in money or property, the State may lose or be overcharged or otherwise defrauded of, by reason of wrongful or criminal act, if any, of the Contractor(s), his (their) agents or

employees, and shall promptly pay the said agents, servants and employees and all persons furnishing labor, material, equipment or supplies therefor, including premiums incurred, for Surety Bonds, Liability Insurance, and Workmen's Compensation Insurance; with the additional obligation that such Contractor shall promptly make payment of all taxes, licenses, assessments, contributions, damages, any liquidated damages which may arise prior to any termination of said principal's contract, any liquidated damages which may arise after termination of the said principal's contract due to default on the part of said principal, penalties and interest thereon, when and as the same may be due this state, or any county, municipality, board, department, commission or political subdivision: in the course of the performance of said work and in accordance with Sections 31-5-51 et seq. Mississippi Code of 1972, and other State statutes applicable thereto, and shall carry out to the letter and to the satisfaction of the Executive Director of the Mississippi Department of Transportation, all, each and every one of the stipulations, obligations, conditions, covenants and agreements and terms of said contract in accordance with the terms thereof and all of the expense and cost and attorney's fee that may be incurred in the enforcement of the performance of said contract, or in the enforcement of the conditions and obligations of this bond, then this obligation shall be null and void, otherwise to be and remain in full force and virtue.

Witness our signatures and seals this the _____ day of _____ A.D. _____.

_____	_____
(Contractors) Principal	Surety
By _____	By _____
	(Signature) Attorney in Fact
	Address _____
	_____
Title _____	_____
(Contractor's Seal)	Mississippi Resident Agent
	_____
	(Signature) Mississippi Resident Agent
	Address _____
	_____
	_____
	(Surety Seal)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____
Contractor

_____
Address

_____
City, State ZIP

as Principal, hereinafter called the Principal, and _____

a corporation duly organized under the laws of the state of _____

as Surety, hereinafter called the Surety, are held and firmly bound unto **State of Mississippi, Jackson, Mississippi**

As Obligee, hereinafter called Obligee, in the sum of **Five Per Cent (5%) of Amount Bid**

Dollars ($ _____)

for the payment of which sum will and truly to be made, the said Principal and said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for **Construction necessary for HVAC System upgrades at the Jackson Shop Complex and the MDOT Administration Building, known as State Project Nos. BWO-9018-25(005) / 501918301 & BWO-9021-25(006) / 501919301, in the County of Hinds, State of Mississippi.**

NOW THEREFORE, the condition of this obligation is such that if the aforesaid Principal shall be awarded the contract, the said Principal will, within the time required, enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this obligation to be void; otherwise the Principal and Surety will pay unto the Obligee the difference in money between the amount of the bid of the said Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former, but in no event shall liability hereunder exceed the penal sum hereof.

Signed and sealed this _____ day of _____ , 2009

_____
(Principal) (Seal)

_____ By: _____
(Witness) (Title)

_____
(Surety) (Seal)

_____ By: _____
(Witness) (Attorney-in-Fact)

_____
MS Resident Agent

_____
Mississippi Insurance ID Number

Bid bond must be signed or countersigned by a qualified Mississippi resident agent and the bidder as per Section 102.08 of the Mississippi Standard Specifications for Road and Bridge Construction, 2004 edition.