MDOT Use Only
Checked _____
Loaded _____
Keyed _____

SM No. CBWO5222250031

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

16
Building Improvements at the Clinton Maintenance Area Headquarters Office Building, HVAC Upgrades, known as State Project No. BWO-5222-25(003) / 502891301210 in Hinds County.

Project Completion: 08/20/2025

(STATE DELEGATED)

NOTICE

BIDDERS MUST COMPLETE AN ONLINE REQUEST FOR PERMISSION TO BID THIS PROJECT.

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

SECTION 900

OF THE CURRENT 2017 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

JACKSON, MISSISSIPPI

DOCUMENT 00 01 07 SEAL PAGE

Plumbing / Mechanical
Engineering Resource Group, Inc.
250 Katherine Drive
Flowood, MS 39232
(601) 362-3552

7/15/2024

Electrical
Schultz & Wynne, P.A.
4523 Office Park Drive
Jackson, MS 39206
(601) 982-3313

07/15/2024

DOCUMENT 00 01 10 TABLE OF CONTENTS

PROJECT: CLINTON MAINTENANCE AREA HEADQUARTERS OFFICE HVAC UPGRADE, CLINTON, HINDS COUNTY, MISSISSIPPI

PROJECT NUMBER: BWO-5222-25(003) 502891

DATE: 07-15-24

DESCRIPTION A: This Work shall consist of minor site work and all construction work necessary in constructing a HVAC Upgrade for Clinton Maintenance Area Headquarters for District five at Clinton, Hinds County, Mississippi, Project No. BWO-5222-25(003) 502891, 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 building including all code compliance. Omission of items or instruction necessary or considered standard good practice for the proper installation and construction of the building 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 TABLE OF CONTENTS

DOCUMENT 00 01 15 LIST OF DRAWING SHEETS

1.01 LIST OF DRAWINGS

A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

WORKING NUMBER	SHEET NUMBER	DESCRIPTION
	1	MDOT COVER SHEET
T01	2	TITLE SHEET
M001	3	HVAC LEGENDS AND ABBREVIATIONS
MD101	4	HVAC DEMOLITION PLAN
M101	5	HVAC RENOVATION PLAN
M102	6	HVAC CONTROLS/PIPING PLAN
M103	7	REFLECTED CEILING PLAN
M104	8	HVAC 3D VIEW
M501	9	HVAC DETAILS
M601	10	HVAC SCHEDULES
M701	11	HVAC CONTROLS SCHEMATIC
E101	12	ELEC. SYMBOLS, LEGENDS, SCHEDULES & DETAILS
E102	13	ELEC. FLOOR PLAN

END OF DOCUMENT

DOCUMENT 00 21 13 INSTRUCTIONS TO BIDDERS

1.01 QUESTIONS

A. Questions Regarding Bidding: Bidders are advised that all questions that arise regarding the contract documents (proposal) or plans on this project shall be directed to the www.gomdot.com current letting webpage. Click on the call number for this project to open an email form to submit your question. Questions must be submitted by 8:00 a.m. on the Thursday prior to the letting. Answers to questions will be posted by 5:00 p.m. on the Thursday prior to the letting. Answers can be viewed by clicking on Q&A link under the Proposal Addenda column.

B. It shall be the Bidders responsibility to familiarize themselves with the questions and answers that have been submitted on this project. Bidders are advised that by signing the contract documents for this project, they agree that the on-line Questions and Answers submitted on this project shall be added to and made part of the official contract.

1.02 BIDDER'S QUALIFICATIONS

A. Prequalification of Bidders: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.01 – Prequalification of Bidders.

1.03 NON-RESIDENT BIDDER

A. Consideration of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.01 – Consideration of Proposal.

1.04 CONDITIONS OF WORK

A. Each Bidder must fully inform themselves of all conditions relating to the construction of the Project and employment of labor thereon. Failure to do so will not relieve a successful Bidder of obligations to furnish all material and labor necessary to carry out the provisions of the Contract. Insofar as possible, the Bidder must employ methods, or means, which will not cause interruption of, or interference with, the work of any other Bidder or Contractor.

1.05 EXAMINATION OF PROPOSAL AND SITE

A. Examination of proposal and Site: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.05 – Examination of Plans, Specifications, Special Provisions, Notice to Bidders and Site Work.

B. There will be no Pre-Bid Meeting, but failure to visit the site prior to submitting a bid will in no way relieve the successful Bidder from furnishing materials or performing work required to complete Work in accordance with Drawings and Project Manual (Proposal).

1.06 LAWS AND REGULATIONS

A. Laws and Regulations: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 107.01 – Laws to be Observed.

1.07 BID DOCUMENT

A. The amount for Bid Document (Proposal) is indicated in the advertisement for Bids. Selected plan rooms will be issued one set of documents without charge.

1.08 METHOD OF BIDDING

A. Lump sum, single bids received on a general contract will include general, mechanical and electrical construction (including Pay Items) and work shown on Drawings or specified in the Project Manual (Proposal).

1.09 PROPOSAL FORMS

A. Preparation of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.06 – Preparation of Proposal.

1.10 SUBSTITUTIONS

A. No substitutions, qualifications or redefining of the Specification requirements are allowed to be marked on the Proposal Form, unless specifically required by the Bid Documents. Refer to Section 01 25 00 entitled Substitution Procedures which covers procedures after the award of Contract.

1.11 ADDENDA

A. Addenda to the Drawings or Project Manual issued before or during the time of bidding shall be included in the proposal and become a part of the Contract.

B. If the Proposal, Section 905, does not contain acknowledgement of receipt and addition to the Proposal and Contract Documents of all addenda issued prior to opening of bids will be considered irregular and may be rejected.

1.12 BIDDER IDENTIFICATION

A. Signature: The Proposal Form shall be signed, by any individual authorized to enter into a binding agreement for the Business making the bid proposal.

B. Name of Business: The name appearing on the Proposal Form should be complete spelling of bidder's name and address – exact as recorded at the Secretary of State https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?#clear=1 which should be the same as you applied for at the Mississippi Board of Contractors http://www.msboc.us/

C. Legal Address: The address appearing on the Proposal Form should be the same address exact as recorded at the Secretary of State https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?#clear=1 which should be the same as you applied for at the Mississippi Board of Contractors http://www.msboc.us/

D. Certificate of Responsibility Number(s): The Certificate of Responsibility Number(s) appearing on the Proposal Form should be the same number appearing in the current Mississippi State Board of Contractors Roster.

1.13 BID SECURITY

A. Proposal Guaranty: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.08 – Proposal Guaranty with the exception that the first and second paragraphs in Subsection 102.08 on page 20 should be deleted and substitute:

1. No proposal will be considered unless accompanied by certified check, cashier's check or bid bond, made payable to the State of Mississippi, in an amount of not less than five percent (5%) of the total amount of the proposal offered. The guaranty shall be evidence of good faith that, if awarded the contract, the bidder will execute the contract and give performance and payment contract bond(s) as stipulated in Subsection 103.05.1, 103.05.2, and as required by law.
2. If a bid bond is offered as guaranty, the bond must be made by a Surety acceptable to the Executive Director and signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent and the Bidder. Such bid bond shall also conform to the requirements and conditions stipulated in Subsection 103.05.2, applicable.

1.14 POWER OF ATTORNEY

A. Power of Attorney: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.05 – Requirement of Contract Bond.

1.15 SUBMITTAL

A. Delivery of Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Article 102.09 – Delivery of Proposal.

1.16 MODIFICATION TO BID

A. A Bidder may NOT MODIFY the bid prior to the scheduled closing time indicated in the Advertisement for Bids.

1.17 OPENING OF BIDS

A. Public Opening of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.12 – Public Opening of Proposal.

1.18 IRREGULARITIES

A. Irregular Proposals: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 102.07 – Irregular Proposal. Proposals will be considered irregular and may be rejected for any of the following reasons:

1. If the proposal is on a form other than that furnished by the Department, or if the form is altered or any part thereof is detached except that is allowed.
2. If there are unauthorized additions, conditions or alternate bids, or irregularities of any kind that may tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning.
3. If the bidder adds any provisions reserving the right to accept or reject an award, or to enter into a Contract pursuant to an award.

4. If the proposal, Section 905, does not contain acknowledgement of receipt and addition to the proposal and contract documents of all addenda.
5. Failure to execute required affidavits, certificates, etc., and furnish proposal guaranty.
6. The Commission reserves the right, for any reason, to reject any or all proposals, to waive technicalities or irregularities, or to advertise for new proposals, and the decision of the Commission to reject any bid or proposal shall not be cause for any liability or damage against the Commission, the Department, or any of its officers or employees.

1.19 PROTEST

A. Any protest must be delivered in writing to the Owner prior to the Award Date.

1.20 ERRORS

A. Any claim of error and request for release from bid must be delivered in writing to the Owner within twenty-four (24) hours after the bid opening. The Bidder shall provide sufficient documentation with the written request clearly proving an error was made.

1.21 AWARD OF CONTRACT

A. Award of Contract: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.02 – Award of Contract.

B. Consideration of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.01 – Consideration of Proposal. .

1.22 FAILURE TO ENTER INTO A CONTRACT

A. Failure to Execute Contract: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.08 – Failure to Execute Contract.

1.23 SECURITY FOR FAITHFUL PERFORMANCE

A. Requirements of Contract Bonds: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 103 – Award and Execution of Contract, Subsection 103.05 – Requirement of Contract Bond.

1.24 BIDDER'S CHECKLIST

A. Proposal Form:

1. Base Bid:
   ( ) Fill-in the amount of the base bid in numbers..
2. Alternates:
   ( ) Fill-in each alternates amount in numbers.

3. Certification Form (State Non-Collusion Certificate)
   ( ) Certification (regarding Non-Collusion, Debarment and Suspension, etc). Form has been executed.
4. Acceptance:
   ( ) Proposal is signed by authorized person.

( ) Name of Business. - complete spelling of bidder's name and address – exact as recorded at the Secretary of State https://corp.sos.ms.gov/corp/portal/c/page/corpBusinessIdSearch/portal.aspx?#clear=1 which should be the same as you applied for at the Mississippi Board of Contractors http://www.msboc.us/
( ) Legal address of the business listed above (at SOS and Contractor's Board).
( ) Correct Certificate of Responsibility Number(s) as it appears in the current Mississippi State Board of Contractors Roster.

5. Certificate of Responsibility Number(s):
( ) Base Bid is under $50,000 and no number is required.
( ) Base Bid is equal to or over $50,000 and number is required.
( ) Joint Venture and *joint venture* number is required.
Or
( ) Joint Venture participants' numbers are required.

B. Bid Security

1. Bid Bond:
( ) Included Bid Bond payable to the STATE OF MISSISSIPPI with Project number identified thereon,
Or
( ) Included Certified Check payable to the STATE OF MISSISSIPPI with Project number identified thereon.
2. Power of Attorney:
( ) Included Power of Attorney.

C. Non-Resident Bidder

1. Preference Law:
( ) Attached a Copy of Non-Resident Bidder's Preference Law.
Or
( ) Attached a Statement.

D. Subcontractors' Name

1. Subcontractor:
( ) List Mechanical, Plumbing, and/or Electrical Subcontractor regardless of cost.
* List name even for under $50,000.
* Fire Protection Sprinkler Contractors do not have to be listed.
* If Mechanical, Plumbing, and/or Electrical Subcontractor is performed by the General Contractor, be sure the General has COR for said discipline.

E. Subcontractors' COR Number

1. Certificate of Responsibility
( ) Certificate of responsibility Number for all listed Sub-Contractors over $50,000.

END OF DOCUMENT

DOCUMENT 00 22 13 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.01 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

1.02 WORK IN PROXIMITY OF HIGH VOLTAGE POWER LINES

A. Contractor's Responsibility for Utility Property and Services: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 107.18 – Contractor's Responsibility for Utility Property and services.

1.03 PLANT PEST QUARANTINES INFORMATION

A. Quarantine Information: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 107 – Legal Relations and Responsibility to Public, Subsection 107.22.7 – Quarantine Information.

1.04 PROMPT PAYMENT

A. General: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 108 – Prosecution and Progress, Subsection 108.01.1 – General.

1.05 ALTERATIONS IN BIDDING PROCESS

A. Preparation of Proposal: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 102 – Bidding Requirements and Conditions, Subsection 907-102.06 – Preparation of Proposal (as amended).

1.06 CONTRACT TIME

A. It is anticipated that the Notice to Award will be issued by not later than November 12, 2024, and the date for Notice to Proceed and Beginning of Contract Time will be simultaneous with Execution of Contract.

B. The calendar date for completion of this Contract shall be August 20, 2025 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

1.07 SUBCONTRACTING

A. 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,** excluding the value of any "Specialty Items" listed below:

1. Building related Items, Materials, or Systems:
   a. Acoustical Ceilings
   b. Paints & Coatings
   c. Electrical Items
2. These items are not to be confused with Division 10 – Specialties of the Specifications.
3. See Notice To Bidders for Specialty Items associated with the Site Improvements for this Project.

END OF DOCUMENT

DOCUMENT 00 72 00 GENERAL CONDITIONS

1.01 DESCRIPTION.

A. The American Institute of Architects AIA DOCUMENT A201-2007, “General Conditions of the Contract for Construction”, 2007, Sixteenth Edition, Articles 1 through 15 inclusive, except as may be added to or modified herein, is hereby made a part of the Contract Documents. For brevity, AIA DOCUMENT A201-2007 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.

END OF DOCUMENT

AIA® Document A201® – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
CLINTON MAHQ OFFICE HVAC UPGRADE
CLINTON, HINDS COUNTY, MISSISSIPPI

BWO-5222-25(003) 502891/301210

THE OWNER:
(Name, legal status and address)

MISSISSIPPI TRANSPORTATION COMMISSION
P O BOX 1850
JACKSON, MISSISSIPPI 39215-1850

THE ARCHITECT:
(Name, legal status 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.

TABLE OF ARTICLES

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers 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. .

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.

§ 1.1.2 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. The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications

§ 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. In the event of a conflict between or among the Contract Documents, Contractor shall perform Work and obligations of the higher quality, larger quantity, greater expense, tighter schedule and more stringent requirements, unless otherwise directed in writing by the Owner.

§ 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. 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.

§ 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.

§ 1.7 EXECUTION OF THE WORK

Sections of Division 01 General Requirements govern the execution of the Work of all Sections in Divisions 02-49 of the Specifications.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 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.

§ 2.1.2 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 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).

§ 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 and any Work or material called for by either shall be provided as if called for by both, 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 and Professional shall be responsible for any resulting loss or damage.

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

§ 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.

§ 3.4.4 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.

§ 3.4.5 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 performed on Legal Holidays, Sundays or after 5:00 P.M. on week days without prior written approval from the Project Engineer.

§ 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 Supplemental Agreement (Change Order). The amount of the Supplemental Agreement (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. The 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.

§ 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 that would otherwise exist as to a party or person described in this Section 3.18. The Contractor agrees to defend, hold harmless and indemnify the Owner against all claims or demands caused by the Contractor's acts or omissions.

§ 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.

§ 4.1.4 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, provide Construction Documents and Construction Administration for this Project. These Consultants are advisors to the Project Engineer and MDOT Architect.

§ 4.1.5 The term "Project Engineer" as used in these Documents refers to the Mississippi Department of Transportation Executive Director's authorized representative. The Project Engineer shall be the Initial Decision Maker referenced in Article 15. The term "MDOT Architect" is the representative for the MDOT Architectural Services Unit and is an advisor to the Project Engineer.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide assistance to the Project Engineer and MDOT Architect for administration of the Contract as described in the Contract Documents and will be the Project Engineer's representative during construction until the date the Project Engineer issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Project Engineer 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 Project Engineer, 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 Project Engineer reasonably informed about the progress and quality of the portion of the Work completed, and report to the Project Engineer (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 Architect and Contractor shall endeavor to communicate with each other through the Project Engineer about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect to the MDOT Architect and Project Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Project Engineer.

§ 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 the Project Engineer will prepare State Estimates for Payment in such amounts.

§ 4.2.6 The Architect shall advise the Project Engineer to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will advise the Project Engineer 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 recommendation 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 Project Engineer, with recommendations from the Architect, will prepare Supplemental Agreements (Change Orders) and Advanced Authority (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 Project Engineer, MDOT Architect, and Architect will conduct inspections to determine the date or dates of Completion; determine Final Acceptance; receive and forward to the Project Engineer, for 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 Project Engineer 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 recommend 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 either in connection with other portions of the Project or other construction or operation on the site. In such event, the Contractor shall coordinate its activities with those of the Owner and of other Contractors so as to facilitate the general progress of all work being performed by all parties. Cooperation will be required in the arrangement for the storage of materials, and in the detailed execution of the

work.

(Paragraph Deleted)

§ 6.1.3 The Owner shall provide for coordination of the activities of the separate contractors 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.

(Paragraph Deleted)

§ 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 Supplemental Agreement (Change Order), Advance Authority (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 Supplemental Agreement (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 Project Engineer.

§ 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 Supplemental Agreement (Change Order), Advance Authority (Construction Change Directive) or order for a minor change in the Work.

§ 7.2 SUPPLEMENTAL AGREEMENT (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.

§ 7.2.2 The maximum cost included in a Supplemental Agreement (Change Order) 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 comply passively without protest to the same requirements when participating in a Supplemental Agreement (Change Order).

§ 7.3 ADVANCE AUTHORITY (CONSTRUCTION CHANGE DIRECTIVES)

§ 7.3.1 Advance Authority (Construction Change Directive) is a written order prepared and signed by the Project Engineer, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Project Engineer may by Advance Authority (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 as Advanced Authority on changes to the Work where agreement has been reached prior to preparation of Supplemental Agreement (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 Project Engineer will prepare a Supplemental Agreement (Change Order). Supplemental Agreements (Change Orders) shall be issued for all or any part of an Advance Authority (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 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 Completion is the date certified by the Project Engineer and approved by the Owner 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 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 Project Engineer may determine, subject to the Owner's approval. The Contractor's sole and exclusive right and remedy for delay by any cause whatsoever is an extention of the Contract Time but no increase in the Contract Sum. 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.

§ 8.3.2 No delay, interference, hindrance or disruption, from whatever source or cause, in the progress of the Contractor's Work shall be a basis for an extension of time unless the delay, interference hindrance or disruption is (1) without the fault and not the responsibility of the Contractor, its subcontractors and suppliers and (2) directly affects the overall completion of the Work as reflected on the critical path of the updated Construction Schedule. The contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and delay in construction activities which do not affect the overall completion of the work does not entitle the Contractor to any extension in the Contract Time.

§ 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.

1. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather must actually cause a delay in the completion of the project. The delay must

be beyond the control and without the fault or negligence of the Contractor.

§ 8.3.5 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's activity durations for inclusion in the progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

1. Adverse Weather Evaluation: The table below defines the monthly anticipated adverse weather in days for the project:

   Adverse Weather Table

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10	9	9	8	9	8	10	9	7	6	8	9

§ 8.3.6 Monthly anticipated adverse weather delay work days based on five (5) day work week.

§ 8.3.7 Upon acknowledgement of the Notice to Proceed (NTP) and continuing throughout the Contract, the Contractor shall record on the daily report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on the overall projects' critical activities for 50 percent or more of the Contractor's scheduled workday. The number of actual adverse weather days shall include days impacted by actually adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 8.3.5 above, the Owner and the Architect will convert any qualifying delays to calendar days giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract.

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, 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, MDOT Architect, or Project Engineer, 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. 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.

§ 9.3.1.1 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.

§ 9.3.1.3 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 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 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.

§ 9.3.2.1 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 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.

§ 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 recommend acceptance or state what portions should be modified to the Project Engineer for such amount as the Architect determines is properly due, or notify the Contractor and Project Engineer in writing of the Architect's reasons for modifications in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The recommendations for Payment will constitute a representation by the Architect to the Project Engineer, 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 Date of 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 recommendations for Payment will further constitute a representation that the Contractor is entitled to payment in the amount recommended. However, the recommendations 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 recommend to withhold 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 recommend 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 make recommendation for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also make recommendations to withhold Payment or, because of subsequently discovered evidence, may make recommendations to nullify the whole or a part of a Payment previously made, 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 recommendations to withhold Payment are removed, recommendations will be made for amounts previously withheld.

(Paragraph Deleted)

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has reviewed the Application for Payment and made recommendations to the Project Engineer, the Project Engineer shall make payment in the manner and within the time provided in the Contract Documents.

§ 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.

§
9.6.8 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
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
§ 9.8.1 Substantial Completion shall not be recognized under this Contract. The Project Engineer shall determine when the building or designated portion is complete to the point it can be used for its intended purpose. This date shall be the Date of Completion. All Warranties and Extended Warranties shall use this date as the starting date of Warranty Period.

§ 9.8.2 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 Date of 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 agreement 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 agreement 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.

§ 9.11 LIQUIDATED DAMAGES

§ 9.11.1 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 D
$0	$100,000	$150
100,000	500,000	360
500,000	1,000,000	540
1,000,000	5,000,000	830
5,000,000	10,000,000	1,200
10,000,000	20,000,000	1,800
20,000,000	----------	3,500

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 anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, or the 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 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.

(Paragraphs Deleted)

§ 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.

§ 11.1.5 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	1,000,000.00	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	$500,000.00	Per Occurrence
Contractor Insurance Option Number 1: Bodily Injury & Property Damage (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 (Combined Single Limit)	$1,000,000.00	Aggregate

.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 Or	Equal to Value of Work
Installation Floater	Equal to Value of Work

§ 11.1.6 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.

§ 11.1.7 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

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 11.1.5.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor 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.

(Paragraph Deleted)

§ 11.3.1.3 If the property insurance requires deductibles, the Contractor 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.

(Paragraphs Deleted)

§ 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 (5) days after occurrence of loss

§ 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 DATE OF 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 DATE OFCOMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of 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 Date of Completion by the period of time between Date of 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 laws of the State of Mississippi 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 Time shall be adjusted for increases in the time caused by suspension, delay or interruption as described in Section 14.3.1. 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.

.1 The Contractor shall anticipate delays in the progress of the Work, due to adverse weather, during the stipulated Contract Time in the amount of days published in recognized official data. If documented evidence (from recognized official data) indicates weather delays in excess of this amount, then the Contractor may be granted an Extension of Time for each Work Day, in excess of the normal days, in which the weather prevented work on the Project Site for fifty (50) percent or more of the Contractor's "Normal Work Day", but only if such prevented work was critical to the timely completion of the project.

.2 Contractor's "Normal Work Day" shall be defined on the basis of a five (5) Day Work Week. Example: If the "normal" (regular) schedule is a five (5) Day Work Week, meaning Monday through Friday, then a rain on Sunday (since not a scheduled Work Day) will not necessarily delay the Work of the Project. However, site conditions, as a result of the rain, could partially or fully prevent scheduled outside work on Monday (and thereafter) thereby making the Contractor eligible to apply for a Weather Delay Extension of Time on the basis of the conditions stated in the paragraph above.

§ 15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the causes of delay which may have concurrent or interrelated affects on the progress of the Work, or for concurrent delays due to the fault of the Contractor

§ 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 Project Engineer will serve as the Initial Decision Maker. 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.

§ 15.5 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).

§ 15.5.1 CONDITIONS PRECEDENT TO ARBITRATION 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.

(Paragraph Deleted)

§ 15.5.2 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.

§ 15.5.3 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.

§ 15.5.4 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.

§ 15.5.5 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.

§
15.5.6 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.

§ 15.5.7 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.

§ 15.5.8 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.

DOCUMENT 00 91 13 ADDENDA

1.01 NOTICE TO BIDDERS

A. Addenda issued on this Project will become part of the Standard Form of the Agreement Between the Owner and the Contractor.

B. Addenda will be indicated on the second sheet of Section 905 (end of the Proposal/Project Manual) as addenda.

END OF DOCUMENT

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, the Clinton MAHQ Office HVAC Upgrade, for District Five at Clinton, Mississippi. The building will be vacated during the construction period.

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. Utilities: Coordinate with local utility companies for installation and pay for all costs incurred thereby.
3. Pay legally required sales, consumer, use, payroll, privilege and other taxes.
4. 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.
5. Give required notices
6. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that bear on performance of Work.
7. 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.
8. Enforce strict discipline and good order among employees. Do not employ on Work, unfit persons or persons not skilled in assigned task.
9. 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.
10. Sub-Contractor 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 Form CAD-720 – REQUEST FOR PERMISSION TO SUBCONTRACT for each subcontractor before they are allowed to perform any Work. Contract Administration Division will provide copies of approved subcontractors to Project Engineer and Architectural Services.

11. 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
4. 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 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 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

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

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.04 COORDINATION WITH OCCUPANTS

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

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

2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Final Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
2. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.05 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

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

1. Notify Project Engineer not less than two days in advance of proposed utility interruptions.
2. Obtain Project Engineer’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Project Engineer not less than two days in advance of proposed disruptive operations.
2. Obtain Project Engineer’s written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

1.06 SPECIFICATION AND DRAWING CONVENTIONS

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

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. 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.
3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 33 00 “Submittal Procedures” for submittal requirements.
2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.02 ACTION SUBMITTALS

A. The MDOT Architect and his Consultants WILL NOT consider requests for substitutions during bidding. ONLY ONE REQUEST per product will be allowed.

B. Substitution Requests: Within 30 days after Notice to proceed, submit four copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use facsimile of form provided in Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
   b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate Contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
   g. Cost information, including a proposal of change, if any, in the Contract Sum.
   h. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

i. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. MDOT Architect's Action: If necessary, MDOT Architect will request additional information or documentation for evaluation within ten days of receipt of a request for substitution. MDOT Architect will notify Contractor through Project Engineer of acceptance or rejection of proposed substitution within 15 days of receipt of request, or ten days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if MDOT Architect does not issue a decision on use of a proposed substitution within time allocated.

1.03 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals. ONLY ONE REQUEST per product will be allowed.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Contractor 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.
   c. Cost data is complete and includes all related costs under his Contract.
   d. Contractor waives all claims for additional costs related to substitution that consequently becomes apparent.
   e. Requested substitution will not adversely affect Contractor's construction schedule.
   f. Requested substitution has received necessary approvals of authorities having jurisdiction.
   g. Requested substitution is compatible with other portions of the Work.
   h. Requested substitution has been coordinated with other portions of the Work.
   i. Requested substitution provides specified warranty.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. ONLY ONE REQUEST per product will be allowed.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
   a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional

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

b. Contractor 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.
c. Cost data is complete and includes all related costs under his Contract.
d. Contractor waives all claims for additional costs related to substitution that consequently becomes apparent.
e. Requested substitution does not require extensive revisions to the Contract Documents.
f. Requested substitution is consistent with the Contract Documents and will produce indicated results.
g. Requested substitution will not adversely affect Contractor's construction schedule.
h. Requested substitution has received necessary approvals of authorities having jurisdiction.
i. Requested substitution is compatible with other portions of the Work.
j. Requested substitution has been coordinated with other portions of the Work.
k. Requested substitution provides specified warranty.

PART 3 - EXECUTION

3.01 SUBSTITUTION FORMS

A. Product Substitution Request Form and Contractor's Statement of Conformance are listed on following pages.

PRODUCT 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

2. Itemized comparison of proposed substitution with product specified.

	ORIGINAL PRODUCT	SUBSTITUTION
Name, brand	_____	_____
Catalog No.	_____	_____
Manufacturer	_____	_____

Significant variations: _____

_____

Reason for Substitution:

_____

_____

3. Proposed change in Contract Sum:

Credit to Owner: $_____

Additional Cost to Owner: $_____

4. Effect of the proposed substitution on the Work:

Contract Time: _____

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

MDOT 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 (Supplemental Agreements) 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 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications (Supplemental Agreements) by the Project Engineer and the Contractor.

1.02 CHANGE ORDER (SUPPLEMENTAL AGREEMENT) 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 requested substitutions in accordance with Section 01 25 00 Substitution Procedures and Section 01 60 00 Product Requirements.

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 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 SUMMARY

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

B. Related Requirements:

Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.02 SCHEDULE OF VALUES

A. Scope: Submit electronic pdf copy of the Schedule of Values to the MDOT Architect, with a copy 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 General Conditions, AIA Document A201™-2007 Amended for requirements). Use Schedule of Values only as basis for contractor's Application for Payment.

B. This copy of the Schedule of Values will be reviewed as Submittal No.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 Unit, 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 one returned to the Contractor.

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 - 49. Identify each line item with number and title as listed in Table of Contents of this Specification.

D. Preparing Schedule of Values:

Itemize separate line item costs for each of the following general cost items: Performance and Payment Bonds, field supervision and layout, temporary facilities and controls, and closeout documents.
Itemize separate line item cost for Work required by each Section of this specification. Breakdown installed cost with overhead and profit.
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.

Group line items to show subtotal of Description A, Description B, Description C, and then Description D 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:

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.
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

1.03 METHOD FOR PAYMENT

A. The method of measurement and payment shall conform to the applicable provisions of Article 9 of the AIA Document A201-2007 General Conditions of the Contract for Construction.

1.04 APPLICATIONS FOR PAYMENT

A. Format:

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:

Present required information in type written form.
Execute certification by signature of authorized officer.
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.
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.
Prepare Application for Final Payment as specified in Section 01 77 00-Closeout Procedures.

C. Submittal Procedures:

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

D. Substantiating Data:

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

1.05 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, with an individually identifying number for each employee, 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.

1.06 BASIS OF PAYMENT

A. This Work will be paid for by Contract Sum. The Work includes renovations to the Sharkey County Maintenance Building Improvements. The Contract Sum shall be full compensation for furnishing all materials, and all other Work and effort of whatever nature in the renovation of the buildings, installation of specified 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:

Description A:

MDOT Project No. BWO-5222-25(003) 502891 lump sum

TOTAL PROJECT CONTRACT SUM **LUMP SUM**

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 SUMMARY

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

1. Project Management.
2. Requests for Information (RFIs).
3. Project meetings.

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.

C. Related Requirements:

1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.02 INFORMATIONAL SUBMITTALS

A. Key Personnel List: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.

1. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers.
2. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project

B. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

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

1.03 DUTIES OF PROJECT COORDINATOR (SUPERINTENDENT)

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

1. 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 questions.
3. Transmissions: 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 01: Coordinate and assist in the preparation of all requirements of Division 01 and specifically as follows:

1. Enforce safety requirements.
2. Schedule of Value: 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: 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.

1.04 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.

1.05 SUBCONTRACTOR'S DUTIES

A. General: 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.

1.06 REQUESTS FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. MDOT Architect will return RFIs submitted to MDOT Architect by other entities controlled by Contractor 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 information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.

5. Name of Architect
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
14. RFI Forms: CSI Form 13.2A. Identify each page of attachments with the RFI number and sequential page number.

C. MDOT Architect's Action: MDOT Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by MDOT Architect 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 inaccurately prepared RFIs.
2. MDOT Architect's action may include a request for additional information, in which case MDOT Architect's time for response will date from time of receipt of additional information.
3. MDOT 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 Section 01 26 00 "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify MDOT Architect in writing within 7 days of receipt of the RFI response.

D. On receipt of MDOT 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.

E. 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 MDOT Architect's response was received.

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.07 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated. Project Meetings shall be held for the following reasons:

1. Establish an understanding of what is expected from everyone involved.
2. Enable an orderly Project review during the progress of the Work.
3. Provide for systematic discussion of problems and effect remedies and clarifications.
4. Coordination of the Work.
5. Review installation procedures and schedules.

B. Scheduling and Administration: 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.

C. Scheduling and Administration: 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 affected parties of result and include report of activities in next scheduled meeting.

D. Scheduling and Administration: 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.

E. Scheduling and Administration: Consultants may attend meetings to ascertain work is expedited consistent with Contract Documents and construction schedules.

F. Preconstruction Conference: The Project Engineer, with the assistance of the MDOT Architect, will preside over and administer this meeting.

1. Schedule: Schedule Pre-Construction Meeting within 10 days after Notice to Proceed.
2. Location: A central site, convenient for all parties, designated by the Project Engineer and the MDOT Architect.
3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Distribute and discuss tentative construction schedule prepared by Contractor.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of record documents.
    l. Use of the premises
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for moisture and mold control.
    r. Procedures for disruptions and shutdowns.
    s. Construction waste management and recycling.
    t. Parking availability.
    u. Office, work, and material storage areas.
    v. Equipment deliveries and priorities.
    w. First aid.
    x. Security.
    y. Progress cleaning.
4. Minutes: Record and distribute meeting minutes.

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

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Project Engineer and MDOT Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.

e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

H. Progress Meetings:

1. 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.
2. Place of Progress Meetings: Contractor’s Field Office except as otherwise agreed.
3. 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.
4. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.

4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

5. Minutes: Record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

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

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Site condition reports.

1.02 SUBMITTALS

A. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

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.

B. Construction Schedule Updating Reports: Submit with Applications for Payment.

C. Site Condition Reports: Submit at time of discovery of differing conditions.

1.03 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Form of Schedules: Prepare in form of horizontal bar chart. The following is a minimum requirement and other type schedules are acceptable with Project Engineer’s approval.

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

B. 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.

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

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the Contract Time.

D. 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.

1.05 REPORTS

A. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - EXECUTION

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

END OF SECTION

SECTION 01 32 33 PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Periodic construction photographs.

1.02 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit (e-mail) image files on a weekly basis.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:
   a. Name of Project.
   b. Date photograph was taken.
   c. Description of vantage point, indicating location, direction (by compass point), and elevation of construction.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. .

C. Periodic Construction Photographs: Take photographs for each day that any substantial construction activity occurs at the job site. The purpose of the photographs is to document the installation of the work and verify that the work is being installed properly.

D. Construction Photographs: The Project Engineer / MDOT Architect may direct the Contractor to take certain photographs during his job site observation or at any time as directed.

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

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

B. 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.

C. Related Requirements:

1. Section 01 25 00 “Substitution Procedures” and Section 01 60 00 “Product Requirements”, for requirements concerning products that will be acceptable on this Project.

1.02 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by MDOT Architect and additional time for handling and reviewing submittals required by those corrections.

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

1.03 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
3. MDOT Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on MDOT Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. MDOT Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Partial submittals are NOT ACCEPTABLE, will be considered non-responsive, and will be returned without review.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification. Paper Submittals are required for sheets larger than 11 by 17 inches.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 3 by 4 inches on label or beside title block to record Contractor's review and approval markings and action taken by MDOT Architect.
3. Include the following information for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name of Contractor.
    d. Name of subcontractor.
    e. Name of supplier.
    f. Name of manufacturer.
    g. Submittal number or other unique identifier, including revision identifier.
        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Location(s) where product is to be installed, as appropriate.
    k. Other necessary identification.
4. Transmittal for Paper Submittals: 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. MDOT Architect will return without review submittals received from sources other than Contractor.
    a. Transmittal Form for Paper Submittals: Use AIA Document G810 or CSI Form 12.1A.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name of Contractor.
        6) Name of firm or entity that prepared submittal.
        7) Names of subcontractor, manufacturer, and supplier.
        8) Category and type of submittal.

9) Specification Section number and title.
10) Specification paragraph number or drawing designation and generic name for each of multiple items.
11) Drawing number and detail references, as appropriate.
12) Transmittal number**,** numbered consecutively.
13) Submittal and transmittal distribution record.
14) Remarks.
15) Signature of transmitter.
16) Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements, and compliance with Contract Documents PRIOR to submitting to the MDOT Architectural Services Unit.

E. Electronic Submittals: Electronic pdf submittals are required for pages smaller than 11 by 17 inches. Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by MDOT Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Project Engineer and MDOT Architect**,** containing the same information as for paper submittals..
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

F. Options: Identify options requiring selection by MDOT Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from MDOT Architect's action stamp.

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 / color charts as directed. The Project Engineer, MDOT Architect and Consultant (as required) shall retain one of each.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from MDOT Architect's action stamp.

K. 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

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals for 81/2 by 11 inches and 11 by 17 inches submittals only) via email as pdf electronic files.
   a. MDOT Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Action Submittals: Submit four copies or one electronic pdf copy of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return three copies or electronic pdf copy of each, unless indicated otherwise.
3. Informational Submittals: Submit three paper copies or one electronic pdf copy of each submittal unless otherwise indicated. MDOT Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign dditional copies may be required for each type of submittal in remaining paragraphs below for projects with a construction manager or a commissioning authority.

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Application of testing agency labels and seals.
   g. Notation of coordination requirements.
   h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data concurrent with Samples.
6. Submit Product Data in electronic pdf file.

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

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions (required) established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 11 by 17 inches, but no larger than 24 by 36 inches.
3. Submit Shop Drawings in the following format:
   a. Submit four paper copies or one electronic pdf copy of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return three copies, unless indicated otherwise

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. MDOT Architect will return one sample with options selected.
    b. If a specified product color is discontinued, Contractor shall notify Project Engineer promptly to determine if it affects other color selections.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit four sets of Samples. Project Engineer and MDOT Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

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. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.

1. Submit product schedule in the following format:
    a. PDF Electronic pdf file
    b. Architect will return one copies.

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

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

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

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

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

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

M. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

N. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

P. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

2.02 DELEGATED-DESIGN SERVICES

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

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

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file (optional) and eight paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to MDOT Architectural Services Unit.

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

C. Notify the Project Engineer in writing at the time of submission, of deviations in submittals from requirements of Contract Documents.

D. 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.

E. Contractor’s responsibility for errors and omissions in submittals is not relieved by MDOT Architect’s / Consultant’s review of submittals.

F. Do not order materials or begin Work requiring submittals until the return of submittals bearing MDOT Architect / Consultant’s stamp and initials indicating review.

3.02 MDOT ARCHITECT'S / CONSULTANTS’ ACTION

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

B. Action Submittals: MDOT Architect / Consultants will review with reasonable promptness, each submittal for design concept of Project and information given in Contract Documents, make marks to indicate corrections or revisions required, and 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 one (or the remainder (if paper submittal) to the Contractor. MDOT Architect / Consultants will stamp each submittal with an action stamp and will mark appropriately to indicate action. Consultants will retain one copy of reviewed submittals.

C. Informational Submittals: MDOT Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. MDOT Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 35 16 ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: 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. Work to be assigned, coordinated and scheduled includes, but is not limited to, the following:

1. Work of each Division and Section of the Specifications as shown on the Drawings and in the Specifications
2. 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. Interpretation of Contract Documents:
    a. Consultation: Consult with MDOT Architect to obtain interpretations.
    b. Assistance: Assist in resolution of questions.
    c. Stop work not in accordance with the requirements of the Contract Documents.
6. Division 01: Coordinate requirements of Division 01 and specifically as follows:
    a. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities. Refer to Section 01 50 00.

b. Cutting and Patching: Supervise and control all cutting and patching. Refer to Section 01 73 00 - Execution.
c. 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 19.
d. 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 Section 01 31 00 – Project Management & Coordination.

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 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.

1.07 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.

1.08 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. Patch and replace any portion of an existing surface to be refinished as a finished surface that is found to be damaged, lifted, discolored or show imperfections that renders surface or substrate unsuitable for application of new finish material.

1. Refinish patched portion to match existing adjacent surface in order to produce a uniform color and texture.

C. 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 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 19 – Construction Waste Management and Disposal.

END OF SECTION

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

2. Requirements for Contractor to provide quality-assurance and -control services required by MDOT Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Project Engineer or MDOT Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Project Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Project Engineer for a decision before proceeding.

1.04 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.05 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Materials will be inspected and sampled in accordance with current Mississippi Department of Transportation SOP pertaining to inspecting and sampling. Distribute copies of reports of inspections and tests to Project Engineer and one copy to the MDOT Architect. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.06 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   d. When testing is complete, remove test specimens, assemblies, and mockups: do not reuse products on Project, unless indicated otherwise in other Sections.

   Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Project Engineer, MDOT Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Project Engineer.
2. Notify Project Engineer and MDOT Architect three days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Project Engineer’s and MDOT Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow ten days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

L. Tolerances:

1. 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.
2. 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.
3. Concrete Floors: Tolerances for concrete floors and pavement are specified in Division 03.
4. Finished Floors: Level to within plus or minus 1/8 inch in 10 feet for hardwood and resilient floor coverings.

M. Protection of Wood:

1. 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.
2. 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.
3. 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.

4. Wood materials or products which become wet from rain, dew, fog, or other source may be considered to have moisture damage and may 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.

N. Grout Fill: 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.

1.07 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports. The manufacturer shall inspect and approve the application or installation work at no additional cost to Contractor or the Owner..

1. 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.
2. The manufacturer’s authorized representative shall be present at the time any phase of this work is started.
3. The manufacturer’s authorized representative shall inspect and approve all surfaces over which, or upon which the manufacturer’s product will be applied or installed.
4. 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.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Project Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Project Engineer, MDOT Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency / special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency / special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Project Engineer, MDOT Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Project Engineer, MDOT Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Project Engineer, MDOT Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00 REFERENCES

PART 1 - GENERAL

1.01 DEFINITIONS

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

B. "Reviewed": When used to convey MDOT Architect's action on Contractor's submittals, applications, and requests, "reviewed" is limited to MDOT Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Project Engineer/MDOT Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": 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. “Experienced”: 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": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Identification and Purpose:

1. 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.
2. 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.

B. Procedures and Responsibilities:

1. 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.
   a. Should specified reference standards conflict with regulatory requirements or the Contract Documents, request Project Engineer’s / MDOT Architect’s clarification before proceeding.
2. 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.
3. 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.

C. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated or when earlier editions are specifically required by Codes.

D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.03 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

AABC	Associated Air Balance Council; www.aabc.com.
AAMA	American Architectural Manufacturers Association; www.aamanet.org.
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org.
ACI	American Concrete Institute (Formerly: ACI International); www.concrete.org
ACPA	American Concrete Pipe Association; www.concrete-pipe.org.
AEIC	Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
AGA	American Gas Association; www.aga.org.
AHAM	Association of Home Appliance Manufacturers; www.aham.org.
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
AI	Asphalt Institute; www.asphaltinstitute.org.
AIA	American Institute of Architects (The); www.aia.org.
AISC	American Institute of Steel Construction; www.aisc.org.
AISI	American Iron and Steel Institute; www.steel.org.
AMCA	Air Movement and Control Association International, Inc.; www.amca.org.
ANSI	American National Standards Institute; www.ansi.org.
AOSA	Association of Official Seed Analysts, Inc.; www.aosaseed.com.
APA	APA - The Engineered Wood Association; www.apawood.org.
APA	Architectural Precast Association; www.archprecast.org.
API	American Petroleum Institute; www.api.org.
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)
ARI	American Refrigeration Institute (See AHRI)
ARMA	Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
ASCE	American Society of Civil Engineers; www.asce.org.
ASCE/SEI	American Society of Civil Engineers / Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
ASME	ASME International (American Society of Mechanical Engineers); www.asme.org.
ASSE	American Society of Sanitary Engineering; www.asse.org.
ASTM	ASTM International (American Society for Testing and Materials International); www.astm.org.
AWI	Architectural Woodwork Institute; www.awinet.org.
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association); www.awpa.com.
AWS	American Welding Society; www.aws.org.
AWWA	American Water Works Association; www.awwa.org.
BHMA	Builders Hardware Manufacturers Association; www.buildershardware.com.
BIA	Brick Industry Association (The); www.gobrick.com.
CFSEI	Cold-Formed Steel Engineers Institute; www.cfsei.org.
CGA	Compressed Gas Association; www.cganet.com.
CISCA	Ceilings & Interior Systems Construction Association; www.cisca.org.
CLFMI	Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
CRI	Carpet and Rug Institute (The); www.carpet-rug.org.

CRRC	Cool Roof Rating Council; www.coolroofs.org
CRSI	Concrete Reinforcing Steel Institute; www.crsi.org.
CSA	CSA International (Formerly: IAS - International Approval Services); www.csa-international.org
CSI	Construction Specifications Institute (The); www.csinet.org.
DASMA	Door and Access Systems Manufacturers Association; www.dasma.com.
DHI	Door and Hardware Institute; www.dhi.org.
ECA	Electronic Components Association; (See ECIA).
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org. ;
FM Approvals	FM Approvals LLC; www.fmglobal.com.
FM Global	FM Global (Formerly: FMG - FM Global); www.fmglobal.com.
GA	Gypsum Association; www.gypsum.org.
GANA	Glass Association of North America; www.glasswebsite.com.
HMMA	Hollow Metal Manufacturers Association (See NAAMM)
HPVA	Hardwood Plywood & Veneer Association; www.hpva.org.
ICBO	International Conference of Building Officials (See ICC)
ICC	International Code Council; www.iccsafe.org.
ICRI	International Concrete Repair Institute, Inc.; www.icri.org.
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America); www.ies.org.
IGMA	Insulating Glass Manufacturers Alliance; www.igmaonline.org.
IGSHPA	International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
ISO	International Organization for Standardization; www.iso.org.
ISSFA	International Solid Surface Fabricators Association (See ISFA)
LPI	Lightning Protection Institute; www.lightning.org.
MBMA	Metal Building Manufacturers Association; www.mbma.com.
MCA	Metal Construction Association; www.metalconstruction.org.
MFMA	Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
MIA	Marble Institute of America; www.marble-institute.com.
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
MPI	Master Painters Institute; www.paintinfo.com.
NAIMA	North American Insulation Manufacturers Association; www.naima.org.
NCMA	National Concrete Masonry Association; www.ncma.org.
NEBB	National Environmental Balancing Bureau; www.nebb.org.
NECA	National Electrical Contractors Association; www.necanet.org.
NEMA	National Electrical Manufacturers Association; www.nema.org.
NETA	InterNational Electrical Testing Association; www.netaworld.org.
NFPA	NFPA (National Fire Protection Association); www.nfpa.org.
NFRC	National Fenestration Rating Council; www.nfrc.org.
NHLA	National Hardwood Lumber Association; www.nhla.com.
NLGA	National Lumber Grades Authority; www.nlga.org.
NSPE	National Society of Professional Engineers; www.nspe.org.
NSSGA	National Stone, Sand & Gravel Association; www.nssga.org.
NTMA	National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
NWFA	National Wood Flooring Association; www.nwfa.org.
PCI	Precast / Prestressed Concrete Institute; www.pci.org.
PDI	Plumbing & Drainage Institute; www.pdionline.org.
RFCI	Resilient Floor Covering Institute; www.rfci.com
SDI	Steel Deck Institute; www.sdi.org.
SDI	Steel Door Institute; www.steeldoor.org.

SEFA	Scientific Equipment and Furniture Association; www.sefalabs.com.
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SJI	Steel Joist Institute; www.steeljoist.org.
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
SPFA	Spray Polyurethane Foam Alliance; www.sprayfoam.org.
SPIB	Southern Pine Inspection Bureau; www.spib.org.
SPRI	Single Ply Roofing Industry; www.spri.org.
SRCC	Solar Rating and Certification Corporation; www.solar-rating.org.
SSINA	Specialty Steel Industry of North America; www.ssina.com.
SSPC	SSPC: The Society for Protective Coatings; www.sspc.org.
SWPA	Submersible Wastewater Pump Association; www.swpa.org.
TCNA	Tile Council of North America, Inc.; www.tileusa.com.
TIA	Telecommunications Industry Association (Formerly: TIA/EIA – Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
TMS	The Masonry Society; www.masonrysociety.org.
TPI	Truss Plate Institute; www.tpinst.org.
TPI	Turfgrass Producers International; www.turfgrasssod.org.
UL	Underwriters Laboratories Inc.; http://www.ul.com.
WCMA	Window Covering Manufacturers Association; www.wcmanet.org.
WDMA	Window & Door Manufacturers Association; www.wdma.com.
WWPA	Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

DIN	Deutsches Institut fur Normung e.V.; www.din.de.
IAPMO	International Association of Plumbing and Mechanical Officials; www.iapmo.org.
ICC	International Code Council; www.iccsafe.org.
ICC-ES	ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

COE	Army Corps of Engineerswww.usace.army.mil. ;
CPSC	Consumer Product Safety Commission; www.cpsc.gov.
DOC	Department of Commerce National Institute of Standards and Technology; www.nist.gov.
DOE	Department of Energy; www.energy.gov.
EPA	Environmental Protection Agency; www.epa.gov.
FG	Federal Government Publications; www.gpo.gov/fdsys.
GSA	General Services Administration; www.gsa.gov.
HUD	Department of Housing and Urban Development; www.hud.gov.
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division; www.eetd.lbl.gov.
OSHA	Occupational Safety & Health Administration; www.osha.gov.
TRB	Transportation Research Board;

National Cooperative Highway Research Program; www.trb.org.

USDA	Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
USDA	Department of Agriculture; Rural Utilities Service; www.usda.gov.
USPS	United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

CFR	Code of Federal Regulations; ; Available from Government Printing Office; www.gpo.gov/fdsys.
DOD	Department of Defense; Military Specifications and Standards Available from Department of Defense Single Stock Point; www.quicksearch.dla.mil.
FED-STD	Federal Standard (See FS)
FS	Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil. Available from Defense Standardization Program; www.dsp.dla.mil Available from General Services Administration; www.gsa.gov. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
MILSPEC	Military Specification and Standards (See DOD)
USAB	United States Access Board; www.access-board.gov.
USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

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 SUMMARY

A. Section includes establishment and use of each temporary facilities 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 for temporary facilities.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.02 USE CHARGES

A. General: Installation and removal of temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Project Engineer, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.03 INFORMATIONAL SUBMITTALS

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

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.04 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.

1.05 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

2.02 TEMPORARY FACILITIES

A. Field Offices: 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.

B. Storage and Fabrication Sheds: 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.

2.03 EQUIPMENT

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

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

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units are prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures".

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

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

C. Powder Actuated Tools: 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.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system or private system indicated as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Date of Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities for the Public:

1. The Contractor shall be responsible for providing portable structure for the exclusive use as temporary toilet facilities for the Public.
2. Suitable, substantial, and watertight temporary structure shall be provided in location on the site as directed by the Project Engineer, or his authorized representative, maintained, and removed from the site at Project completion.

F. Sanitary Facilities for workmen: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

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

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

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

K. Telephone Service: Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Project Engineer schedules Final Completion inspection. Remove before Final Completion. Personnel remaining after Final Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. The drive is to remain open at all times. A flagman will be required to control traffic when construction vehicles are present.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Project Signs: Unauthorized signs are not permitted.

F. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Final Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. 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.

D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

1. 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.

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

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

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

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.05 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged and wet material.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Remove materials that cannot be completely restored to their manufactured moisture level within 72 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

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

B. Burning of Trash: 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.

C. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Date of Completion.

E. Conduct of workers: 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.

F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Completion. Complete or, if necessary, restore permanent construction

that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. At Final Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

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

B. Related Requirements: Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.02 DEFINITIONS

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

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

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

1.03 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. MDOT Architect's Action: If necessary, MDOT Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. MDOT Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or ten days of receipt of additional information or documentation, whichever is later.
   a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
   b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

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

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.06 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," MDOT Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Products specified only by reference standards, select any product meeting standards by any manufacturer.
2. 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.
3. Products 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.
4. 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.
5. 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.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 73 00 EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

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

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

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.02 INFORMATIONAL SUBMITTALS

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

B. Certified Surveys: Submit three copies signed by land surveyor or professional engineer.

1.03 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Project Engineer of locations and details of cutting and await directions from Project Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that

results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in MDOT Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to MDOT Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

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

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

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Project Engineer and MDOT Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

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

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

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

3.04 FIELD ENGINEERING

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

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

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.05 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

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

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

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

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

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

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Project Engineer. Mounting heights shall comply with ADA and OSHA requirements.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

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

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

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

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

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

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

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

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

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

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

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

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

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

3.08 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements"

3.09 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION

SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous] construction waste.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed.

1.04 INFORMATIONAL SUBMITTALS

A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.05 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.06 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
4. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within five days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 1-1/2-inch size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.04 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.05 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Final completion procedures.
2. Warranties.
3. Final cleaning.
4. Repair of the Work.

B. Related Requirements:

1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

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. 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 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: All Warranties and Extended Warranties shall use this Date of Completion as the starting date of Warranty Period.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

1.05 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

2.01 MATERIALS

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

PART 3 - EXECUTION

3.01 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting Engineer and Architect final inspection.
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
   p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting Final Inspection.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. MDOT Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to MDOT Architect.
   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. MDOT Architect will return one copy.

C. Manual Submittal: Submit each manual in final form prior to requesting Final Inspection and at least 15 days before commencing demonstration and training. MDOT Architect will return one copy with comments.

1. Correct or revise each manual to comply with MDOT Architect's comments. Submit two copies of each corrected manual within 15 days of receipt of MDOT Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. 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.

C. 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 and contact information for Contractor.
6. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
7. Cross-reference to related systems in other operation and maintenance manuals.

D. 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.

E. 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.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number(s) on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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 storage media for computerized electronic equipment.
4. 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. System, subsystem, or equipment failure.
8. Chemical release or spill.

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. Use designations for systems and equipment indicated on Contract Documents.
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. Use designations for products indicated on Contract Documents.
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 MANUALS

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 MANUALS

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 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.
   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 video recording, if available.

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. Schedule 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.

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.
   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. 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.

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 01 78 39 "Project Record Documents."

F. Comply with Section 01 77 00 "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 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Project Manual (Proposal)
3. Record Product Data.

B. Related Requirements:

1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:
   a. Submittal:
      1) Submit PDF electronic files of scanned record prints and two set(s) of marked-up record prints.
      2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Project Manual (Proposal): Submit two paper copies and one annotated PDF electronic files of Project Manual (Proposal), including addenda and Contract modifications.

C. Record Product Data: Submit two paper copies and one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain two sets of marked-up paper copies of the Contract Drawings (half-size) and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Record data as soon as possible after obtaining it.

c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order (Supplemental Agreements) numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Final Completion review marked-up record prints with Project Engineer and MDOT Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Project Engineer and MDOT Architect for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Consulting Architect (if applicable).
   e. Name of Contractor.

2.02 RECORD PROJECT MANUAL (PROPOSAL)

A. Preparation: Mark Project Manual (Proposal) to indicate the actual product installation where installation varies from that indicated in the Technical Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders (Supplemental Agreements), record Product Data, and record Drawings where applicable.

B. Format: Submit record Project Manual (Proposal) as scanned PDF electronic file(s) of marked-up paper copy of Project Manual (Proposal).

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders (Supplemental Agreements), record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Project Engineer’s and MDOT Architect’s reference during normal working hours.

C. The information, except Contract Drawings, shall be arranged and labeled by corresponding Specification Section, neatly bound in three ring binders, indexed, and all shop drawings readable without being removed or unstapled.

D. The name and address of each subcontractor and material supplier shall be listed in front of each binder along with the Project Manual (Proposal).

E. 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.

END OF SECTION

SECTION 01 79 00 DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.02 INFORMATIONAL SUBMITTALS

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

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.03 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

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

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

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

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.
2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.

k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

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

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

   1. Owner will furnish Contractor with names and positions of participants.

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

   1. Schedule training with Owner**,** through Project Engineer, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

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

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

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

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

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Project Engineer and MDOT Architect.

C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of demolition Work is indicated on Drawings. Demolition requires selective removal and subsequent offsite disposal. The building will be vacated during the demolition and construction.

B. Types of Demolition Work include, but are not limited to the following items:

1. Removal of Existing HVAC system as indicated on Drawings.
2. Removal of interior Acoustical Ceilings and grid as indicated on Drawings.
3. Removal of Existing lay-in light fixtures as indicated on Drawings.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Predemolition Photographs or Video: Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.05 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.06 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Building furniture will be removed by Owner.

C. Notify Project Engineer and MDOT Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Project Engineer and MDOT Architect. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.07 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

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

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 01 10 00 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.04 SELECTIVE DEMOLITION, GENERAL

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

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them**.**

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.06 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 09 05 15 COLOR DESIGN

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: 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.

B. Related Sections: Section 01 33 00 – Submittal Procedures.

1.02 MANUFACTURER'S TRADE NAMES

A. Manufacturer'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 SAMPLES

A. Color samples shall be submitted for approval prior to applying or installing finishes or items that are included in this Section. See appropriate technical Sections for submittal requirements. 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. 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 / MATERIALS	MANUFACTURER / NUMBER & COLOR NAME	COLOR DESCRIPTION
• Existing - Gypsum Board (Walls)	S/W #7036 Accessible Beige	(light tan)
• Existing - Gypsum Board (Ceilings)	S/W #7010 White Duck	(white)
• 09 65 00 - Rubber Base	Johnsonite #63 Burnt Umber	(bronze)

PART 3 - EXECUTION

3.01 INSTALLATION / APPLICATION, GENERAL

A. Refer to execution requirements specified in other Sections of this Specification for the specific products listed. Colors, finishes, textures or patterns not included in this Color Design will be selected by the Project Engineer / MDOT Architect upon written notification and subsequent submittals by the Contractor.

END OF SECTION

SECTION 09 51 00 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Lay-in acoustical panels (2 ft. by 2 ft. grids) and exposed suspension systems for ceilings.
2. Suspended metal grid system complete with wall trim.

B. Related Sections:

1. Division 23 for Mechanical Requirements.
2. Division 26 for Electrical Requirements.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer’s product specifications, and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods that may be detrimental to finishes and acoustical performances.

B. Samples: For each exposed product and for each color and texture specified.

1.03 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Evaluation reports.

C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Installer: A company with not less than 3 years of documented successful experience in installation of acoustical ceilings similar to requirements for this Project.

1. References required for approval.

1.06 PROJECT CONDITIONS

A. Do not install acoustical ceilings until the following conditions are met:

1. Space is enclosed and weatherproof.

2. Wet work in space completed and nominally dry.
3. Work above ceilings is completed.
4. Ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

B. Maintain a light level of a minimum of 50 fc during entire installation.

1.07 COORDINATION

A. It shall be this contractor's responsibility to coordinate with mechanical and electrical trades with respect to their requirements for additional suspension system components. Additional components required shall be furnished and installed by this contractor.

1.08 MAINTENANCE STOCK

A. At time of completing installation, deliver stock of maintenance material to Owner.

1. Furnish full size units matching units installed, packaged with protective covering for storage, and identified with appropriate labels.
2. Furnish amount equal to 3 percent of acoustical units and exposed suspension installed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.02 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

C. Acoustical Panel Standard: Comply with ASTM E 1264.

D. Metal Suspension System Standard: Comply with ASTM C 635.

E. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.03 ACOUSTICAL PANELS

A. Manufacturers: Provide manufacturer's standard lay-in panels of type recommended by manufacturer for application indicated. Provide sizes shown by reflected ceiling plans or, if not otherwise indicated, 2 ft. by 2 ft. grid-size panels, with white washable finish.

B. Mineral Fiber Acoustical Tile: Provide units that are sag resistant and with Antimicrobial solution (MOLD AND MILDEW GUARD) not less than 5/8-inch thick and of density not less than l0 pounds per cubit foot, medium-coarse non-directional texture, NRC 0.50 to 0.60, CAC 25 to 33, light reflectance over 75 percent. Products offered by manufacturers to comply with requirements include the following:

1. No. 1728 Fine Fissured Square Edge; Armstrong World Industries, Inc.
2. Van-157 Vantage 10 Trim Edge; CertainTeed Corp.
3. No. 2210 Radar ClimaPlus Square Edge; U.S. Gypsum Co.

C. Substitution requests WILL NOT be considered PRIOR to Contract Award. Substitutions that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00- Substitution Procedures and Section 01 60 00- Product Requirements.

2.04 METAL SUSPENSION SYSTEM

A. Comply with ASTM C 635, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, and partition system (if any). Structural Class of the system shall be intermediate-duty.

B. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table l, Direct Hung.

1. Hanger Wires: Galvanized carbon steel, ASTM A 64l, soft temper pre-stretched, yield-stress load of at least 3 times design load, but not less than l2 gage (0.l06 inch).
2. Type of System: Either direct or indirect-hung suspension system, at Contractor's option.
3. System Manufacturer: Same as acoustical unit manufacturer or one of the following:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corp.
   c. Chicago Metallic Corp.
   d. USG Interiors, Inc.

C. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish unless otherwise indicated.

D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, or types and profiles indicated, with exposed cross runners coped to lay flush with main runners. Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system, including moldings, trim, and accessories. Use manufacturer's standard baked enamel finish, color white, unless otherwise selected by MDOT Architect.

2.05 MISCELLANEOUS MATERIALS

A. Edge Trim Molding: Metal or extruded PVC plastic, of types and profiles indicated, white finish unless otherwise indicated.

B. Hold-Down Clips: Where required for wind uplift resistance or fire-resistance rating, provide standard spring steel clips, except provide accessible type at locations indicated on drawings.

PART 3 - EXECUTION

3.01 COORDINATION

A. Mechanical and electrical work above suspended ceiling shall be strictly coordinated with the work in this Section.

3.02 EXAMINATION

A. Installer must examine conditions under which acoustical ceiling work is to be performed and must notify Contractor in writing of unsatisfactory conditions.

1. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.03 PREPARATION

A. Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

1. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling.
2. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.04 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to the Work.
2. Hangers: Support only from building structural members.
   a. Locate hangers near each end and spaced 4 feet along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of l/8 inch in l2 feet.
   b. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
3. Edge Molding: install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
   a. Screw-attach moldings to substrate at intervals not over l6 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of l/8 inch in l2 feet. Miter corners accurately and connect securely.
4. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members.
   a. Scribe and cut panels to fit accurately at borders and at penetrations.
   b. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire- resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

3.05 ADJUSTING AND CLEANING

A. Adjust sags or twists which develop in the ceiling system and replace parts that are damaged or faulty.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

1. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13 RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Resilient wall base, and accessories.

B. Related Sections:

1. Section 09 05 15 - Color Design (for color selection).

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data (Not MSDS) and written instructions for recommended installation and maintenance practices for each type of product and accessories indicated.

B. Samples: Full-size units by 6” long of each color of resilient wall base required.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Wherever possible, provide resilient wall base, adhesives, cleaners, polishes and accessories produced by a single manufacturer.

B. Secure the service of an experienced, professional floor service company to provide necessary equipment and manpower to complete the Work.

C. Fire- Test-Response Characteristics:

1. As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
2. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.05 PROJECT CONDITIONS

A. Continuously heat areas to receive resilient wall base to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required.

1. Maintain 70 degrees F. temperature continuously during and after installation as recommended by manufacturer but not less than 48 hours.
2. Maintain a minimum lighting level of 50 fc during installation.
3. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Mannington Commercial, P.O. Box 12281, Calhoun, GA 30701, Tel. No. (800) 241-2262.

B. Equivalent products by the following manufacturers are acceptable:

1. Armstrong Commercial Flooring, Lancaster, PA. Tel. No. (800) 292-6308.
2. Azrock Commercial Flooring, Florence, AL. Tel. No. (800) 558-2240.
3. Flexco, Inc. Tuscumbia, AL. Tel. (800) 633-3151.
4. Johnsonite, Chagrin Falls, OH. Tel. No. (800) 899-8916.

C. Substitution requests WILL NOT be considered PRIOR to Contract Award. Substitutions that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00- Substitution Procedures and Section 01 60 00- Product Requirements.

2.02 RESILIENT BASE

A. Rubber Base: Comply with ASTM F-1861, Type TP, Group 1 (solid) Standard Specification for Resilient Wall Base, with matching end stops and preformed or molded corner units as available.

1. Size: Resilient Wall Base shall be 4 inches high, 0.125-inch gage, length 120 feet, standard top-set cove.
2. Color: As selected by MDOT Architect from full range of colors.

2.03 ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine the areas and conditions under which resilient wall base and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work.

1. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION

A. Acclimate wall base and accessories to job site conditions for at least 48 hours prior to installation

B. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

C. Immediately before installation, clean substrates to be covered by resilient wall base.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilaster, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable (continuous between openings and wall to wall), with preformed corner units.

C. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.

D. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient wall base.

B. Cleaning: Remove excess adhesive or other surface blemishes, using neutral type cleaners as recommended by resilient wall base manufacturer.

C. Protection: Protect installed resilient wall base from damage by covering with protection paper.

END OF SECTION

SECTION 09 90 00 PAINTS AND COATINGS

PART 1 - GENERAL

1.01 SUMMARY

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.

1. 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.
2. “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.
3. 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.

B. Related Sections: Section 09 05 15 – Color Design.

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.

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 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.

B. Samples for Initial Selection: For each type of topcoat product indicated. 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 or provide "Custom" color if not match.

C. Samples for Verification: For each type of paint system and each color and gloss/sheen of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Comply with Articles 3.7 and 3.8 indicating each type of primer, intermediate coat and topcoat required for each substrate by product name and number.
2. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

E. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer / supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product / color / finish was used, product data pages, Material Safety Data sheets (MSDS), care and cleaning instructions, including touch-up procedures.

F. Substitutions for Convenience: Architect will consider formal written requests from Contractor for substitution of products in place of those specified if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect. 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.

1.04 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.05 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 not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.06 PROJECT CONDITIONS

A. Apply paints only when temperature of product, surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paint late in the day when dew and condensation are likely to form; or snow, rain, fog or mist is expected; 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.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Benjamin Moore & Company, Montvale, NJ. Tel. (800) 344-0400.
2. Farrell-Calhoun Paint, Memphis, TN. Tel. (901) 526-2211.
3. PPG Paints, Inc., Pittsburgh, PA. Tel (412) 434-3131.
4. Rust-Oleum, Vernon Hills, IL. 60061. Tel. (800) 323-3584.
5. Sherwin-Williams Company, Cleveland, OH 44115. Tel. (800) 321-8194.

B. Substitution requests WILL NOT be considered PRIOR to Contract Award. Substitutions that fully meet or exceed the specified requirements may be considered under provisions of Section 01 25 00- Substitution Procedures and Section 01 60 00- Product Requirements.

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. Colors 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 acceptable. 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.

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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. 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.

1. 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.
2. Remove, if necessary, for the complete painting of the items and adjacent surfaces.
3. Following completion of painting of each space or area, re-install the removed items by workmen skilled in the trades involved.
4. Clean surfaces to be painted before applying paint or surface treatments.
5. Remove oil and grease prior to mechanical cleaning.
6. Remove mildew by washing with a mixture of 1 part liquid chlorine bleach to 3 parts water. Before use, be sure to read and follow instructions and warnings on label. Rinse thoroughly.
7. Schedule the cleaning and painting so that contaminates from the cleaning process with not fall onto wet, newly painted surfaces.
8. Warning-If you scrape, sand, or remove old paint; you may release lead dust or fumes. Lead is toxic and can cause serious illness. Wear a properly fitted NIOSH-approved respirator and prevent skin contact to control lead exposure.

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 applications 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 Paint: 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 Mechanical, Plumbing and Electrical 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 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements.
4. Contractor shall remove non-complying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials.
5. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.06 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 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.

3.07 EXTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
   b. Intermediate Coat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
   c. Topcoat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
   b. Intermediate Coat: Super Spec HP P29 D.T.M Acrylic Semi-gloss
   c. Topcoat: Super Spec HP P29 D.T.M Acrylic Semi-Gloss

B. Provide the following Farrell-Calhoun paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
   b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
   c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
   b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
   c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)

C. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
   c. Topcoat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)

2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: S-W Pro Industrial Waterbased Alkyd Urethane, B53-1150 series (1.7 mils dry)
   c. Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane, B53-1150 series (1.7 mils dry)

3.08 INTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior Semi-gloss Enamel
2. Gypsum Drywall(Egg Shell)
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
   b. Intermediate Coat: #N538 Ultra Spec 500 Interior Eggshell Enamel
   c. Topcoat: #N538 Ultra Spec 500 Interior Eggshell Enamel
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer
   b. Intermediate Coat: #V341 Waterborne Epoxy
   c. Topcoat: #V341 Waterborne Epoxy
4. Concrete Masonry Units (Enamel)
   a. Prime Coat: #206 Super Spec Hi-Build Block Filler
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
5. Ferrous and Zinc Coated Metal
   a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
6. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
   b. Intermediate Coat: #N110 SK 5000 Dry Fall Flat
   c. Topcoat: #N110 SK 5000 Dry Fall Flat
7. Painted Woodwork
   a. Prime Coat: #N534 Ultra Spec 500 Interior Latex Primer Sealer
   b. Intermediate Coat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
   c. Topcoat: #N539 Ultra Spec 500 Interior Semi-Gloss Enamel
8. Concrete Garage Floor (Refer to Section 03 35 25 - Concrete Floor Hardener and Polish
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: TuffCrete Solvent Acrylic Stain Clear
   b. Topcoat: TuffCrete Solvent Acrylic Stain Clear.

B. Provide the following Farrell-Calhoun paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
   a. Prime Coat: F/C #380 Perfik-Seal Interior Latex Primer/Sealer (1.8mils DFT)
   b. Intermediate Coat: F/C #680 Line Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
   c. Topcoat: F/C #680 Line Interior Semi-Gloss Latex Enamel (1.9 mils DFT)

2. Gypsum Drywall(Egg Shell)
   a. Prime Coat: F/C #380 Perfik-Seal Interior Latex Primer/Sealer (1.8mils DFT)
   b. Intermediate Coat: F/C #370 Line Interior Premium Eggshell Latex Enamel (107 mils DFT)
   c. Topcoat: F/C #370 Line Interior Premium Eggshell Latex Enamel (107 mils DFT)
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: F/C #699 Waterborne 100% Acrylic Enamel Undercoater (1.6 mils DFT)
   b. Intermediate Coat: F/C #1260 Line Waterborne Pre-Cat Acrylic Epoxy (2.0 mils DFT)
   c. Topcoat: F/C #1260 Line Waterborne Pre-Cat Acrylic Epoxy (2.0 mils DFT)
4. Concrete Masonry Units (Enamel)
   a. Prime Coat: F/C #470A Interior/Exterior Acrylic Latex Masonry Block Filler (10 mils DFT)
   b. Intermediate Coat: F/C #680 Line Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
   c. Topcoat: F/C #680 Line Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
5. Ferrous and Zinc Coated Metal
   a. Prime Coat: F/C #5-56 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
   b. Intermediate Coat: F/C #600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
   c. Topcoat: F/C #600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
6. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: F/C #5-56 100% Acrylic All Purpose Metal Primer (1.8 mils DFT). Spot prime if needed.
   b. Intermediate Coat: F/C #999 Tuff-Boy Water-Base Dry Fog Flat (3.2 mils DFT)
   c. Topcoat: F/C #999 Tuff-Boy Water-Base Dry Fog Flat (3.2 mils DFT)
7. Painted Woodwork
   a. Prime Coat: F/C #699 Waterborne 100% Acrylic Enamel Undercoater (1.6 mils DFT)
   b. Intermediate Coat: F/C #600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
   c. Topcoat: F/C #600 Line 100% Acrylic Interior Semi-Gloss Latex Enamel (1.9 mils DFT)
8. Concrete Garage Floor (Refer to Section 03 35 25 - Concrete Floor Hardener and Polish.)
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: Anvil 2350 Wet Look Sealer
   b. Topcoat: F/C Anvil 2350 Wet Look Sealer + Anvil 9102 & 9105 Talon Grip Slip Resistant Additive

C. Provide the following PPG Paints, Inc. paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
   a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
   b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)
   c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Semi-Gloss, 9-500 (1.4 mils dry)

2. Gypsum Drywall(Egg Shell)
   a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
   b. Intermediate Coat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300Xl (1.4 mils dry)
   c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300Xl (1.4 mils dry)
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: PPG Pure Performance Zero VOC Interior Latex Primer, 9-900 (1.4 mils dry)
   b. Intermediate Coat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
   c. Topcoat: PPG Pitt Glaze Waterborne Acrylic Epoxy, 16-551 Series (2.0-3.0 mils dry)
4. Concrete Masonry Units (Enamel)
   a. Prime Coat: PPG Speedhide Interior Exterior Latex Block Filler, 6-15Xl Series (7.4 mils dry)
   b. Intermediate Coat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
   c. Topcoat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
5. Ferrous and Zinc Coated Metal
   a. Prime Coat: PPG Pitt-Tech DTM Acrylic Primer Finish, 90-712 (2.0 to 3.0 mils dry)
   b. Intermediate Coat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
   c. Topcoat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
6. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: PPG Pitt-Tech DTM Acrylic Primer Finish, 90-712 (2.0 to 3.0 mils dry)-Spot prime if needed.
   b. Intermediate Coat: PPG Super Tech WB Waterborne Acrylic Dry Fall, 6-725Xl
   c. Topcoat: PPG Super Tech WB Waterborne Acrylic Dry Fall, 6-725Xl
7. Painted Woodwork
   a. Prime Coat: PPG Seal Grip Interior Acrylic Primer Finish, 17-951 (1.2 mils dry)
   b. Intermediate Coat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
   c. Topcoat: PPG Interior Exterior Semi-Gloss Acrylic Metal Finish, 7-374 (1.5 to 2.0 mils dry)
8. Concrete Garage Floor (Refer to Section 03 35 25 - Concrete Floor Hardener and Polish)
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: PPG Perma-Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200.
   b. Topcoat: PPG Perma-Crete Plex Seal WB Waterborne Clear Acrylic Concrete Sealer, 4-6200; Anti Slip Additive to the topcoat. Note-New concrete must be etched prior to application.

D. Provide the following Rust-Oleum paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
   a. Prime Coat: Rust-Oleum Zinsser Dry Wall Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi-Gloss, (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi-Gloss, (1.5-2.0 mils dry)
2. Gypsum Drywall(Egg Shell)
   a. Prime Coat: Rust-Oleum Zinsser Dry Wall Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Acrylic Satin, (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Acrylic Satin, (1.5-2.0 mils dry
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: Rust-Oleum Zinsser Dry Wall Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
   c. Topcoat: Rust-Oleum 5300 Series WB Epoxy (2.5-3.0 mils dry)
4. Concrete Masonry Units (Enamel)
   a. Prime Coat: Rust-Oleum Zinsser Water Tite Flexible Primer & Finish (5.0-6.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
5. Ferrous and Zinc Coated Metal
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Semi Gloss Acrylic (1.5-2.0 mils dry)
6. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)-Spot prime if needed.
   b. Intermediate Coat: Rust-Oleum 5100 Series Waterborne Acrylic Dry Fall Flat
   c. Topcoat: Rust-Oleum 5100 Series Waterborne Acrylic Dry Fall Flat
7. Painted Woodwork
   a. Prime Coat: Rust-Oleum Zinsser Bulls Eye 123 Acrylic Primer (1.0-1.5 mils dry)
   b. Intermediate Coat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi Gloss, (1.5-2.0 mils dry)
   c. Topcoat: Rust-Oleum Zinsser Perma White Interior Acrylic Semi Gloss, (1.5-2.0 mils dry
8. Concrete Garage Floor (Refer to Section 03 35 25 - Concrete Floor Hardener and Polish.)
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: Rust-Oleum® Natural Look Concrete Sealer – Clear
   b. Topcoat: Rust-Oleum® Natural Look Concrete Sealer – Clear; Slip Resistant Additive to the topcoat.

E. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:

1. Gypsum Drywall (Semi-Gloss)
   a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 mils dry)
   b. Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (1.6 mils dry)
   c. Topcoat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series (1.6 mils dry)
2. Gypsum Drywall(Egg Shell)
   a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 mils dry)
   b. Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (1.6 mils dry)
   c. Topcoat: S-W ProMar 200 Zero VOC Interior Latex EgShel, B20-2600 (1.6 mils dry)
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 mils dry)
   b. Intermediate Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-360 Series (2.0-5.0 mils dry)
   c. Topcoat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-360 Series (2.0-5.0 mils dry)
4. Concrete Masonry Units (Enamel)
   a. Prime Coat: S-W PrepRite Block Filler, B25W25 (8.0 mils dry)
   b. Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (1.6 mils dry)
   c. Topcoat: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (1.6 mils dry)
5. Ferrous and Zinc Coated Metal
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.0-3.0 mils dry)
   c. Topcoat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.0-3.0 mils dry)
6. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)-Spot prime if needed.
   b. Intermediate Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42 Series
   c. Topcoat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42 Series
7. Painted Woodwork
   a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600 (1.0 mils dry)
   b. Intermediate Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.4-3.0 mils dry)
   c. Topcoat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (2.4-3.0 mils dry)
8. Concrete Garage Floor (Refer to Section 03 35 25 - Concrete Floor Hardener and Polish.)

9. Concrete Floor Sealer (Clear)
   a. Prime Coat: H&C Clarishield Water Based Clear Sealer Wet Look.
   b. Topcoat: H&C Clarishield Water Based Clear Sealer Wet Look.H&C SharkGrip Slip Resistant Additive to the topcoat. Note-New concrete must be etched prior to application.

END OF SECTION

SECTION 23 00 10 MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 DIVISION OF WORK

A. This section delineates the division of work between Divisions.

B. Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation. This section is provided to assist the Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

C. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 HVAC (Indicated as 23 in table), Division 26, and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE/RESPONSIBILITY MATRIX							
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
FIRE & LIFE SAFETY SYSTEMS							
	Fire alarm and smoke control systems	26	26	26	26	
	Duct mounted & in-direct mounted smoke detectors	26	23	26	26/ 23	[2]
	Other smoke detectors	26	26	26	26	
MECHANICAL EQUIPMENT							
	Packaged mechanical equipment	23	23	26	23	
	Fans	23	23	26	23	
	Motor starters	23	23	26	23	[3]
	Other powered equipment	23	23	26	23	
	Disconnects	26/23	26/23	26	26	[4]
PLUMBING SYSTEMS							
	Condensate drains including traps	22	22	-	-	
	Natural gas connections, pressure reducing station, gages	23	23	-	-	[5]
	Relocation of existing backflow preventer	23	23	-	-	

INTERFACE/RESPONSIBILITY MATRIX						
System		Division under which the following is specified				Remarks
		Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	
HVAC SHEET METAL						
	Duct air leakage testing	23	23	-	-	[6]
	Duct mounted sensors	23	23	23	23	
	Filter gauges	23	23	-	-	
	Control dampers	23	23	23	23	[7]
	Control damper actuators	23	23	23	23	[7],[8]
MISCELLANEOUS						
	Trenching, backfilling, boring, soil compaction, saw-cutting, patching and paving for underground piping	23	23	-	-	
	Louvers	23	23	-	-	
	Concrete equipment pads	23	23	-	-	[9]
	Equipment, ductwork, and piping steel supports and frames	23	23	-	-	
	Painting of exposed piping, HVAC equipment, etc.	23	23	-	-	
	Fire-stopping around pipe and duct penetrations in floors, ceilings, and walls	23	23	-	-	
	Framing of walls and ceilings to accept air outlets, fire dampers, etc.	23	32	-	-	[10]
	Ceiling and wall access doors	23	23	-	-	[11]
	Replace all existing ceiling tiles and ceiling grid	09	09	-	-	
	Repair, prepare, and paint all interior walls	09	09	-	-	
	Install new rubber base to match existing throughout building	09	09	-	-	

NUMBERED REMARKS:

[1] Wiring includes raceway, fittings, wire, boxes and related items, all voltages

[2] Wiring of interlock of duct smoke detectors to shut off supply fans upon detection of smoke is specified under Division 23 HVAC. All other smoke control/fire alarm related control wiring is specified under Division 26 Electrical.

[3] Motor starters are specified under Division 23 HVAC. Incoming power (from source) and outgoing power (to motor) is specified under Division 26 Electrical.

[4] Disconnects are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise, all disconnects are specified under Division 26 Electrical.

[5] Pressure reducing valves to deliver gas at the pressure required by mechanical equipment, including final connections and shut-off cock, is specified under Division 23 HVAC. All other gas control and regulating devices provided under the Section providing the gas-fired equipment. Venting of gas regulating devices and other equipment gas-train devices where required is specified under Division 23 HVAC.

[6] Duct air leakage testing is specified under Division 23 HVAC. Division 23 HVAC contractor shall notify Testing, Adjusting, and Balancing (TAB) Agency once all ductwork has passed the pretests and maximum duct air leakage rates confirmed. TAB Agency shall witness the final duct air leakage tests and initial the Duct Air Leakage Test Log (included in Section 233113 – Metal Ducts) certifying the test passed.

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power Wiring [1]	Control & Interlock Wiring [1]	

[7] Duct access doors required for access to control devices where required specified under Division 23 HVAC.
[8] Actuators for motorized dampers supplied with fans or hood, where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted but not wired. Actuator power and control wiring is specified under Sivison 23 HVAC.
[9] Shop drawings showing dimensions of concrete equipment pad. specified under Division 23 HVAC.
[10] Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 09.
[11] Dimensioning of access doors to mechanical equipment and coordination with Prime Professional and Division 09 specified under Division 23.

D. HVAC/Electrical Design Coordination

1. The power ratings of motors and other HVAC equipment and the electrical characteristics of electrical systems serving them, as specified herein and indicated on the Drawings, have been established as minimums which will allow that equipment to satisfactorily function while producing the required capacities. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices. Under no circumstances shall equipment with power ratings less than those indicated on the Drawings or specified herein be provided.
2. Reasonable efforts have been made to coordinate the electrical requirements of the HVAC equipment with the electrical systems serving that equipment. Differences among manufacturers of HVAC equipment make it impossible to produce a single electrical design which will satisfy the varying electrical requirements of those manufacturers. Consequently, the Contractor shall coordinate the electrical requirements of the HVAC equipment actually furnished on this Project and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the HVAC equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the HVAC equipment actually furnished shall be provided at no additional cost to the Owner.

E. Related Work Specified Elsewhere

1. Painting (except as specifically indicated): See Division 09 Finishes
2. Electric power, interlock and control wiring, except as specified herein.
3. Installation of starters, contactors, thermal overload switches, and remote push buttons, except as specified herein.
4. Fire alarm initiating devices, control modules, and monitoring modules.

1.03 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendation of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies

1. In accordance with the requirement of Division 1 General Requirements.
2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.
3. Where contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.
4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Comply with the Safety Orders issued by OSHA and any other safety, State health or environmental regulations and any districts having jurisdictional authority. Where an omission or conflict appears between OSHA requirements and the Drawings and Specifications, OSHA requirements shall take precedence.
6. Applicable codes as listed below, in addition to others specified in individual sections.

    a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) – Standard 90.1-2016 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.
    b. International Building Code (IBC) – 2018.
    c. International Mechanical Code (IMC) – 2018.
    d. International Plumbing Code (IPC) - 2018.
    e. NFPA 1 – 2018, Fire Code
    f. NFPA 70 - 2017, National Electric Code
    g. NFPA 90A - 2018, Installation of Air Conditioning and Ventilating Systems

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 HVAC, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards.

F. All Gas Fired Devices: Comply with standards and bear label of AGA.

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.

H. All Electrical Devices and Wiring

1. Conform to standards of NEC
2. All devices UL or ETL listed and identified

I. Guidelines and Standards: The latest edition of guidelines and standards published by the following govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

AABC	Associated Air Balance Council
ADC	Air Diffuser Balance Council
AGA	American Gas Association
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
ETL	Interlek Semko (Formerly Electrical Testing Laboratories)
GISO	General Industry Safety Orders
HI	Hydraulic Institute
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
UL	Underwriter's Laboratories, Inc.

1.04 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed herein and with all applicable national, state and local codes.

B. All equipment and accessories shall be new, and the product of a manufacturer regularly engaged in its manufacture.

C. All items of a given type shall be the products of same manufacturer.

D. Workmanship, material and equipment shall be in accordance with Specifications and Drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements.

1.05 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformance with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified. See also Division 01 – General Requirements.

C. Submit no later than 35-days after signing of Contract, or as otherwise indicated by Prime Professional. Submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Prime Professional will advise of any conflicts in reviewing submittals that the proposed schedule presents.

1. Complete schedule of submittals for equipment and layout shop drawings. Allow 15-working days for review unless Prime Professional agrees to accelerated schedule.
2. List of all proposed substitutions: See requirements herein.
3. Designate in schedule dates for submission and dates that reviewed shop drawings, product data and samples will be needed.
4. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

D. Submit drawings, product data, samples and certificates of compliance required hereinafter specified.

1. See also Division 01 General Requirements.
2. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.
3. Submittals for each specification section shall be submitted in a single package. However, it is not required (nor desired) for all products to be submitted concurrently. Rather, submittals may be staggered based on schedule and required equipment release dates.
4. Allow 15-working days for review unless the Prime Professional agrees to accelerated schedule.
5. For substitutions, list any features or characteristics that are not strictly in compliance with specifications. If none are listed with the submittal, Contractor is guaranteeing that substituted product is functionally equivalent to the specified product in accordance with requirements herein.
6. Submittal reviews by the Prime Professional are intended to assist the Contractor in complying with the design intent and requirements of the drawings and specifications. Reviews do not relieve the Contractor from compliance with these requirements and comments or lack thereof does not constitute approval of changes in these requirements.

E. Submission and Resubmission Procedure.

1. Each submittal cover sheet shall contain the Contractor's review statement. The statement shall be worded as follows:

   a. It is hereby certified that the information included in this submittal and approved/proposed to be incorporated into this project (include official project name on Contract Drawings), is in compliance with the Contract Drawings and specifications, the electrical requirements have been coordinated with the Electrical Sub-Contractor, can be installed in the allocated spaces with adequate service space, and is approved for use and is submitted for Prime Professional's review.

   Authorized Reviewer: _____ Date: _____

2. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as "SUBMITTAL 23 xx xx-01".
3. Each resubmittal shall have the original unique serial number plus revision number such as "SUBMITTAL 23 xx xx-01 REVISION 1".

4. Submit in format specified below. Submissions made in wrong format will be returned without action.

    a. Product Submittals: One copy in word-searchable electronic format per requirements herein. Submit each specification section in a separate file named with unique name and number described above.
    b. Shop Drawings:

        1) One copy in electronic format .dwg, .dwf, or .pdf
        2) Two and only two copies on paper; any additional copies will not be returned without review

    c. Samples: As indicated in each specification section.

5. Prime Professional will return a memo or mark-up of submittal with comments and corrections noted where required.
6. Make corrections

    a. Revise initial submittal to resolve review comments and corrections.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number.

7. Resubmit revised submittals until “No Exceptions” or “Furnish as Corrected” is provided by the Professional.
8. Once submittals are accepted and stamped with “No Exceptions” or “Furnish as Corrected”, provide:

    a. Complete submittal of all accepted products in a single electronic file for each specification section.
    b. Photocopies for coordination with other trades, if and as required by the Contractor or Prime Professional. Photocopies will serve as submittal for record and coordination.

9. The stipulation included with the Professionals remarks with “Furnish as Corrected” indicate provisional acceptance.

F. Product Data Submittals

1. Contents.

    a. Manufacturer’s name and model number.
    b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to:

        1) Schedule when more than one of each item is covered by submittal.
        2) Physical data, as applicable.

            a) Dimensions.
            b) Weights.
            c) Finishes and colors.
            d) Dimensional shop drawings.

3) Performance data, as applicable.

a) Rated capacities.
b) Performance curve.
c) Operating temperature and pressure.
d) Efficiency.

4) Flow and wiring diagrams as applicable.
5) Description of system operation.

c. All other pertinent information requested in individual sections.

2. Format.

a. See Division 01 – General Requirements.
b. Identify clearly if submittal is substitution: See requirements herein.
c. Reference specification Division, Section, Title, Paragraph and Page number or drawing number as applicable
d. Use same nomenclature, legend, symbols, and abbreviations on submittal material as used in contract documents.

1.06 COMPLETION REQUIREMENTS

A. Procedure.

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted”.
2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Prime Professional.
3. After review, furnish quantity of sets indicated below to Owner.
4. Format:

a. See herein for required format of Completion Documents.
b. Paper Copies: Assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder.
c. Where electronic copies are called for herein, comply with the following:

1) Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable.
2) For submittals, provide separate file for each type of equipment.
3) For Test & Balance report, provide separate files for each air handling system.
4) Record drawings shall be in original format.

B. Operating and Maintenance (O&M) Manual.

1. See O&M Manual requirement herein

C. Record Drawings.

1. Keep up-to-date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines.

a. Fully illustrate all revisions made by all crafts in course of work.

b. Include all field changes, adjustments, variances, substitutions, and deletions, including all Change Orders.
c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains.
d. Exact size, invert elevations and location of underground and under floor piping and ducts.

1) Progress drawing set shall be available for inspection by Prime Professional weekly.
2) Update engineering design drawings and shop drawings to reflect revisions and additional data listed above at completion of Project.

e. Original engineering design drawings will be provided to Contactor in electronic format compatible with AutoCAD version 2010 or later.
f. Both shop and engineering design drawings shall be in format compatible with AutoCAD version 2010 or later.
g. Drawings required to be updated if revisions were made.

1) Floor plans.
2) Shop drawings required herein.
3) Sections.
4) Riser diagrams.

D. Test and Balance Reports.

1. See Section 230593 – Testing, Adjusting, and Balancing for HVAC.

E. Training Materials.

1. See Training Materials requirements herein.

F. Miscellaneous Certificates.

1. Pressure and Leakage Test documentation/certificates.
2. Training/Instruction completion certificates.
3. Fire Marshal and Fire Department approvals of system, as required.
4. Final inspection certificate signed by governing authorities.
5. Warranty period, including start and end period.
6. Field test report, including as applicable.
7. Start-up documents with date and name of technician.
8. Piping pressure tests.
9. Flex coupled pump alignment verification.
10. Duct leakage and pressure tests.
11. Drain pan drainage tests.
12. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures.
13. Machinery vibration test reports.
14. Certificates of sterilization/chlorination of plumbing systems.
15. Others as specified herein and in other Division 23 – Mechanical sections.

G. Format of Completion Documents.

1. Provide the type and quantity of media listed in table below.
2. Optical media shall be readable on a personal computer.

Document	Paper (Binder or bound)	USB Flash Drive
O&M Manuals	3	1
Record Drawings	2 Full sizes 2 Half sizes	1
Control sequences	1	1
Test and Balance Report	1	1
Miscellaneous Certificates	1	1
Warranty documents	1	1
Training materials	1 per trainee	1

1.07 SUBSTITUTIONS AND PRODUCT OPTIONS

A. For specific substitution requirements, See Division 00, and Division 01.

B. Where equipment and materials are shown on the drawings and/or specified hereinafter by a manufacturer's name and/or model number, it is the intent of these specifications to set minimum definite standards for equipment and materials to be used on the project. It is not the intent of these specifications to preclude the use of materials and equipment of similar design and quality to manufacturer's name specified. If the Contractor desires to substitute materials and equipment, he shall obtain written approval through the materials submittals process of all such substitutions before such substitutions are made. Unauthorized substitutions of materials and equipment may be ordered removed from the project without further grounds. The Prime Professional will not approve any substitutions for specified materials and equipment unless such substitutions are requested by the Contractor.

C. The products of particular manufacturers have been used as the basis of design in preparation of these documents. It shall be the responsibility of this Contractor to determine if the submitted materials and equipment will fit into the space allotted with all required clearances as the materials and equipment utilized as the basis of design. Furthermore, the Contractor shall verify and maintain adequate access to equipment, valves, filters, lubrication outlets, etc. Any changes to the building or system design necessary shall be arranged for in writing before the materials and equipment is ordered. All costs involved in making such changes shall be borne by the Contractor. If such changes are deemed inadvisable by the Prime Professional, the Contractor shall install items specified even though materials and equipment had been previously approved. Prime Professional's approval of materials and equipment other than the basis of design is for performance only.

D. Contractor shall consider the following parameters (at a minimum) when considering materials and equipment substitutions:

1. Capacities: The capacities included in the Contract Documents are absolute minimum and the substitution shall have equal or greater capacities.
2. Physical size limitations: Substitutes shall fit in the allotted space and shall have the manufacturer's minimum clearances.
3. Installation and operating weights.
4. Structural properties.
5. Noise levels.
6. Vibration.
7. Interchangeability.
8. Accessibility for maintenance, operation, and replacement.
9. Compatibility with other materials and assemblies.
10. Equal quality and style.

1.08 DESCRIPTION OF BID DOCUMENTS

A. The Contractor shall be responsible for becoming thoroughly acquainted with all Contract Document contents that affect his work under this contract. Work required under this section includes, but is not limited to, all material, equipment transportation, services and labor required to complete the entire mechanical system as required by the Contract Documents.

B. The Specifications and the associated Drawings are complimentary, and any portion of the work described in one shall be provided as if described in both.

C. Specifications.

1. Specifications, in general, describe quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as “The Contractor shall,” “shall be,” “furnish,” “provide,” “a,” “an,” “the,” and “all” have often been omitted from specifications for brevity.

D. Drawings.

1. Drawings are diagrammatic in nature and, unless explicitly dimensioned, indicate approximate locations of apparatus, equipment, ductwork, and piping. Changes in the location, and offsets, of same which are not shown on the Drawings but are necessary in order to accommodate building conditions and coordination with the work of other trades, shall be made during the preparation of coordination drawings and prior to initial installation, without additional cost to the Owner. Contractor shall install all system components in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear and maintain required servicing clearances without further instructions or additional cost to the Owner.
2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.
3. Before proceeding with work, check and verify all dimensions in field.
4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
6. It is intended that all mechanical, plumbing and fire protection devices, piping, etc. be located symmetrically with all architectural elements. Refer to Architectural, Structural, Plumbing, Fire Protection, Mechanical and Electrical Specifications and Drawings in completing the required coordination.
7. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under this Contract. He shall exercise due and particular caution to determine that all parts of his work are made readily accessible.
8. The Contractor shall study all drawings and specifications to determine any conflict with all applicable ordinances and statutes. Any discrepancies shall be reported to the Owner and any changes shall be shown on the as-built drawings with the additional work performed at no cost to the Owner.
9. The submittal of his bid shall indicate the Contractor has examined the site, drawings and specifications and has included all required allowances in his bid. No allowance shall be made for any error or omission resulting from the Contractor’s failure to visit job site and to review drawings and specifications. The Contractor’s bid shall include costs for all required drawings and changes as outlined above at no cost to the Owner.
10. Provide access to equipment and apparatus requiring operation, service or maintenance throughout the life of the system.

E. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

F. If any part of Specifications or Drawings appears unclear or contradictory, apply to Prime Professional for an interpretation and decision prior to bid and as early as possible.

1. Do not proceed with work without the decision of the Prime Professional.

1.09 DEFINITIONS

A. In addition to those defined in Division 01 – General Requirements, the following additional definitions shall apply. Definitions of term used in Division 23 HVAC may differ from those given in general and supplementary conditions.

B. “Provide”: to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. “Supply”: to purchase, procure, acquire, and deliver complete with related accessories.

D. “Work”: includes labor, materials, apparatus, controls, equipment services and all related accessories necessary for the proper and complete installation of complete systems.

E. “Piping”: includes pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and all related accessories.

F. “Wiring”: includes raceway, fittings, wire, boxes, and all related accessories.

G. “Concealed”: not in view, installed in masonry or other construction, within furred spaces, double partitions, hung ceiling, trenches, crawl spaces, or enclosures.

H. “Exposed”: in view, not installed underground or “concealed” as defined above. Exposed piping, conduit, or ductwork is that which can be seen when the building is complete without opening or removing access doors or panels or accessible ceiling components.

I. “Control or Actuated Devices”: includes automatic sensing and switching devices such as thermostats, pressure, float, flow, electro-pneumatic switches, and electrodes controlling operation of equipment.

J. “Indicated,” “shown” or “noted”: as indicated, shown, or noted on drawings or specifications.

K. “Reviewed,” “approved,” or “directed”, as reviewed, approved, or directed by or to Owner.

L. “Motor Controllers”: starter, variable speed drives and other devices controlling the operation of motors.

1.010 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section.

1. In case of conflict, the most stringent takes precedence.
2. For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.

3. Exact routing of piping, ductwork, etc. shall be governed by structural conditions and other obstructions. Not all offsets in ductwork or piping are shown on the Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, Prime Professional reserves right, at no additional cost to the Owner, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Owner's requirements in this regard prior to rough-in.
4. Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the appropriate location shown on Mechanical Drawings.
5. Mounting heights of brackets, outlets, etc., as required.
6. Report to Prime Professional, in writing, conditions which will prevent proper provision of this work.
7. Beginning work of any Section without reporting unsuitable conditions to Prime Professional constitutes acceptance of conditions by Contractor.
8. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination.

1. Work out all "tight" conditions involving Work specified under this Division and work in other Divisions in advance of installation, if necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner.
2. Conflicts: Difference or disputes concerning coordination, interference, or extent of Work between sections shall be decided as follows:

    a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

        1) Drain piping required by code to be sloped.
        2) Supply air and exhaust air ductwork connected to fans.
        3) Electrical conduit 4 inches and larger.
        4) Hydronic piping connected to pumps.
        5) Domestic water piping.
        6) Fire sprinkler piping.
        7) Electrical conduit smaller than 4 inches.
        8) Transfer ducts and other ductwork not connected to fans.
        9) Control system piping and wiring.

    b. Continued disputes shall be decided by Contractor and Contractor's decision, if consistent with Contract Document requirements, shall be final.

3. Supervision: Personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.
4. Provide templates, information, and instructions to other Divisions to properly locate hides and openings to be cut or provided.
5. The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-in.

1. Rough-in locations shown on Mechanical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources.

a. From Shop Drawings for equipment provided under this contract.
b. From Prime Professional for Owner Furnished-Contractor installed equipment.
c. From existing equipment where such equipment is relocated under this Contract.

2. Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Prime Professional and provide as directed by the Prime Professional at no additional cost to the Owner.
3. Make final connections.

1.011 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping, equipment, or ductwork.

1. Prohibited, except as noted in:

a. Electric rooms and closets over equipment, as restricted by NEC.
b. Telephone rooms and closets.
c. Elevator machine rooms.
d. Elevator shafts.
e. Electrical switchboard room.
f. Communications room.

2. Prohibited, except as noted, over or within 5 feet of:

a. Transformers.
b. Substations.
c. Switchboards.
d. Motor control centers.
e. Standby power plant.
f. Bus ducts.
g. Electrical panels.
h. Variable frequency drives.
i. Starters.

B. Drip pans under piping.

1. Where piping is located over any electrical equipment listed above; reroute piping, if possible, rather than use drip pan.
2. 28 gage galvanized steel.
3. 18 gage copper.
4. Reinforced and supported.
5. Watertight.
6. With 1-1/4-inch drain outlet piped to floor drain or service sink.

C. Electrical Working Space: Dimensions of the working space shall be a minimum depth of 42" horizontally, the width of the equipment or 30", whichever is greater, and the height of the equipment or 78", whichever is greater. Minimum depth shall be increased to 60" for equipment rated over 600 V.

1.012 PRODUCT DELIVERY, HANDLING AND STORAGE

A. See Division 01 – General Requirements (Product Requirements).

B. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Provide protective coverings during construction.

C. Handle and ship in accordance with manufacturer's recommendations.

D. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed with no exceptions taken Shop Drawings.

E. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no additional cost to Owner.

F. Where necessary, ship in crated sections of size to permit passing through available space.

1.013 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. See Division 01 – General Requirements.

B. Overview: Provide a project manager/engineer for the duration of the Project to coordinate the Division 23 HVAC work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

C. Review of shop drawings prepared by other subcontractors

1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 23 HVAC work.
2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 23 HVAC contract documents. Document and discrepancy or deviation as follows:

    a. Prepare memo summarizing the discrepancy.
    b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.

3. Prepare and maintain a shop drawing review log indicating the following information.

    a. Shop drawing number and brief description of the system/material.
    b. Date of review.
    c. Indication if follow-up coordination is required.

D. Request for Information (RFI)

1. See Division 1 Request for Information

1.014 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of the Owner and/or Prime Professional.

B. Advise Owner that work is ready for review at the following times.

1. Prior to backfilling buried work.

2. Prior to concealment of work in walls and above ceilings.
3. When all requirements of Contract have been completed.
4. When testing will be performed.

C. Do not backfill or conceal work without Prime Professional's consent.

D. Maintain on site, one set of Specifications and Drawings for use by Owner and/or Prime Professional.

1. Include all change orders.

E. Contractor is responsible for construction methods, sequences, and safety precautions.

F. Do not order equipment until electrical connections have been thoroughly verified and coordinated.

1.015 SCHEDULE OF WORK

A. In accordance with Division 01 – General Requirements and as follows:

1. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.
2. In scheduling, anticipate means of installing equipment through available openings in structure.

B. Confirm in writing to Prime Professional, within 35-days of signing of contract, anticipated number of days required to perform test, balance, acceptance testing and commissioning of mechanical systems. Schedule test balance and acceptance testing of mechanical systems as follows:

1. Submit for review at this time, names and qualifications of test and balancing agencies to be used.
2. Test, Adjusting and Balancing and commissioning must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
3. Allow 21-days after test and balance for system commissioning and life safety testing (where applicable).

1.016 CUTTING AND PATCHING

A. See Division 01 – General Requirements.

1.017 UTILITY CONNECTIONS

A. Utilities include but are not limited to, water, sanitary sewer, storm sewer, natural gas, fire protection water, chilled water, heating water, steam, Energy Management and Control System, etc.

B. Connect to utility company mains as required. Include all meters and other ancillary components required by serving utility company.

C. Connect to on-site piping mains.

D. Contractor shall be responsible for payment of all service charges.

E. Contractor shall be responsible for provisions for temporary utilities.

F. (Others as required).

1.018 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts and as follows.

B. All warranties specified herein shall be non-prorated.

C. Warranty all materials, equipment, apparatus, and workmanship to be free of defective materials and faulty workmanship for a period of one year from and after date of acceptance of completed contract.

D. Provide new materials, equipment, apparatus, and labor to replace that determined by Prime Professional to be defective or faulty.

E. This guarantee also applies to services including instructions, adjusting, testing, noise, balancing, etc.

F. Refrigerant compressors to have an additional four-year parts warranty.

G. Nothing herein intends or implies that guarantee shall apply to work which has been abused or neglected by the Owner or the Owner's successor in interest. The Contractor shall clearly identify such work and Owner requirements inside warranty documentation and at Owner training, with forms and checklist.

H. No manufacturer or contractor warranty exclusions shall be acceptable that contradict the Professional's specified warranty, including labor, materials, installation(s).

1.019 PERMITS

A. Obtain all permits, certificates of inspections, patent rights and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations or orders of any officer and/or body. Provide all notices necessary in connection therewith and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdiction authorities and observation by the Prime Professional.

1.020 CONTINUITY OF EXISTING SERVICE AND SYSTEMS

A. Schedule work so existing systems will not be interrupted. Obtain approval from the Owner and Prime Professional at least 14 days prior to any utility interruption or connection.

B. Perform work at such time and in such a manner as to cause minimum inconvenience to the Owner and as approved by the Prime Professional. No allowance will be made for lack of knowledge of existing conditions.

C. Existing utility service and systems:

1. Protect existing active utilities.
2. Relocate as indicated on Construction Drawings.
3. Existing inactive utilities shall be capped or plugged (below grade).

D. Connections to existing work:

1. Install new work and connect to existing work with minimum interference to existing facilities.
2. Connect new work to existing work in neat and acceptable manner. Restore existing disturbed work to original condition.

E. Removal and relocation of existing work.

1. Disconnect, remove, or relocate piping, ductwork, conduit, and other work noted or required by alterations, modifications, or changes in existing construction.
2. Plug or cap affected active lines behind or below finished walls and/or floors.
3. Dispose of removed piping and material.

F. Special Traffic Requirements:

1. Maintain emergency and service entrances so they are usable for pedestrian, truck and emergency vehicles at all times.
2. Where trenches are cut, provide adequate bridging for above-mentioned traffic.

1.021 PROCEDURE OF WORK

A. The Contractor is hereby cautioned that although he will be permitted to conduct his work during regular working hours (see exceptions below), his work shall be performed in such a manner so as not to interfere with the conduct of regular business unless approval for such interference has been obtained from the Owner and Prime Professional. No reimbursement shall be made to the Contractor for losses sustained due to delays and interruptions of his work to accommodate the operation and business of the Owner.

B. Regular working hours exceptions: Extended utilities shutdowns and/or major equipment changeouts.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Listed “Acceptable Manufacturers” are those considered capable of manufacturing products or equipment conforming to detailed Specifications and Schedules, and as such, are invited to compete provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed Specifications and Schedule requirements. Listing herein as “Acceptable Manufacturers” does not imply “Accepted”, “Approved”, “Prior Approval” or any other connotation. All product offerings must be submitted for approval after Contract Award.

B. Alternate manufacturers as identified in each section will be considered under conditions specified herein.

C. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.

D. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

E. Where no specific make of material or equipment is mentioned, any first-class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

F. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

G. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Prime Professional of conflicts in writing.

H. Material and Equipment-General Requirements

1. New.
2. Approved for use by State Fire Marshal and local building inspection department when applicable.
3. Testing agency labeled or with other identification wherever standards have been established.
4. Prime Professional reserves right to reject items not in accordance with Specification either before or after installation.
5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design.
6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense.
7. Installed fully operating and without objectionable noise or vibration.
8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

I. Electrical Requirements

1. Electrical Work performed under Division 23 – Mechanical shall conform to requirements of Division 26 Electrical.
2. Provide weatherproof devices and installation for out-of-doors work.

2.02 PAINTING

A. Finish painting (other than factory applied) of mechanical equipment and associated piping and ductwork shall be as specified in Division 09 “Painting” Section(s). Provide touch up painting of prefinished mechanical products.

1. All equipment, ductwork, piping conduit and associated supports, attachments, hardware, and connectors exposed to the weather shall be properly coated, painted, or otherwise protected from corrosion caused by the elements (sun, wind, rain, snow, ice, etc.). All interior ductwork and piping exposed in finished spaces shall be cleaned, primed, and painted.

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish ready for finish coats.

1. Piping, Ductwork and Equipment: Clean exterior of piping, ductwork and equipment removing rust, plaster, and dirt by wire brushing. Remove grease, oil, and similar materials by wiping with clean rags and suitable solvents.
2. Motors, Pumps and Other Items with Factory Finish: Remove grease and oil and leave surfaces clean and polished.

C. Cleaning operations may be supplemented by more detailed instructions in various other Sections of this Specification.

D. Paint for high temperature piping and equipment shall be high temperature resistant, designed for the temperatures at which the system will operate.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Prime Professional if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.02 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Use printed descriptions, specifications, and recommendations of manufacturers as a guide for installation of Work. Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

C. Equipment.

1. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent.
2. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent.
3. Accurately set and level equipment with supports neatly placed and properly fastened.
4. Properly fasten equipment in place with bolts to prevent movement.
5. Coordinate the installation of equipment with openings in structure.
6. Coordinate and fully dimension steel supports for mechanical equipment, where shown on drawings with installing contractor.
7. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.
8. Concrete.

    a. Concrete work, include forming, steel bar reinforcing, cast-in-place concrete, finishing, and grouting is specified under Division 03 Concrete.
    b. Coordinate and fully dimension concrete housekeeping pads and curbs with installing contractor; dimensions shall be as required for structural requirements.
    c. Coordinate inertia base fill with installing contractor

D. Electrical.

1. See Division 26 Electrical.
2. Install electrical devices with code required clearances and access.
3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment.

E. Sleeves, Chases and Concrete Inserts.

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.
2. Sleeves, chases are prohibited in structural members, except where shown or as directed by Prime Professional in writing.
3. Embed no piping in concrete or masonry.

F. Waterproof Construction.

1. Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of mechanical penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls.
2. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight.
3. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rainwater; this requirement applies to damper operators and bearings, damper motors, controls and instruments. See other Sections in this Division for application of this requirement to motors, drives, ducts, and fans.

G. Restoration of Damage.

1. Repair or replace, as directed by Prime Professional, materials and parts of premises which become damaged.
2. Remove replaced parts from premises at no additional cost to the Owner.

H. Review architectural drawings and coordinate with Prime Professional and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

I. Access Panels and Doors.

1. Coordinate size requirements and exact location with Contractor who will install access doors.
2. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Prime Professional.
3. Provide where shown, or required by Regulatory Agencies, for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work:

    a. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors.
    b. Access doors shall not be used solely for access to balancing dampers; use instead, remote control devices specified under Section 233300 – Air Duct Accessories.

J. Openings.

1. Coordinate and fully dimension all openings in walls, floors, roofs, and structural elements required for mechanical work.
2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code.
3. Fire damper openings: Contractor shall provide damper UL installation requirements to contractor installing partitions to ensure construction complies with listing.
4. Air outlet openings.

    a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition.
    b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials.

3.03 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION

A. See Division 01 – General Requirements.

B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.

C. Store equipment and material under cover, and off the ground or floors exposed to rain.

D. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.

E. Protect coils against damage by installing temporary closure panels over exposed coil faces. Panels shall be minimum 24-gauge sheet metal or 0.375" plywood.

F. Completely cover motors and other moving machinery to protect from dirt and water during construction.

G. Close open ends of fans, air valves, terminal units, energy recovery units, air handling units, and ductwork with temporary closures of sheet plastic taped in place.

H. Plug ends of pipes when work is stopped to prevent debris from entering the pipes.

I. Provide dust and debris protection for ductwork, coils, fans, equipment, motors, and bearings operated during construction up to date of substantial completion.

J. Cover open ends of exhaust and return ducts with temporary filter media while fan systems are operating.

K. Material, equipment, or apparatus damaged because of improper storage or protection will be rejected.

1. Remove from site and provide new, duplicate, material, equipment, or apparatus in replacement of that rejected.
2. Any porous materials, such as duct liner, insulation or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination).

L. Perform Work in manner precluding unnecessary fire hazard.

3.04 ADJUSTMENT

A. Preliminary Operation.

1. Operate any portion of installation for Owner’s convenience if so requested by Prime Professional. Such operation does not constitute acceptance of Work as complete but does constitute beneficial use. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is requested by Owner.

B. Startup Service.

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 – Mechanical.
2. Start and operate all systems.
3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, chillers, fire pumps, etc.

4. Adjusting: See Section 230593 – Testing, Adjusting and Balancing for HVAC.
5. Life Safety Testing.

    a. Assist Division 26 Electrical contractor in testing fire alarm controls, including control of smoke dampers and shut-off of fan systems.
    b. Correct any problems related to equipment supplied under Division 23 – Mechanical.
    c. Complete the control matrix with details such as fan tags, FSD tags, etc. based on control matrix provided with Life Safety Report.
    d. Assist Life Safety System commissioning agent in testing and commissioning Life Safety System.
    e. Provide all tests, air balance and start-up personnel require to start and commission the system and for assisting the design/construct team in demonstrating system compliance with the local fire district and building department.

6. Submit startup checklist and narrative from equipment manufacturer on specialized equipment as boilers, chiller, DOAS, and VRF/VRV systems.

C. Noise.

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances.
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Owner.

3.05 SPECIAL TOOLS

A. Furnish to Owner at completion of work.

1. One set of any special tools required to operate, adjust, dismantle, or repair equipment furnished under any section of this Division.
2. Pressure gage and temperature sensor for piping test plug.

3.06 CLEANING

A. Cleaning.

1. See Division 01 – General Requirements.

B. Thoroughly clean equipment, fans, pumps, motors, piping, and other materials under this Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Prime Professional.

C. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Prime Professional may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

D. Completely cover all plumbing fixtures and all motors and other moving machinery to prevent entry of dirt and water during construction.

E. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction.

F. Clean and polish identification plates.

G. Clean equipment, ductwork, insulation, piping, conduit, and room surfaces of dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

3.07 PAINTING

A. Painting.

1. Piping exposed to outdoors and, where indicated elsewhere.

a. One coat primer.
b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated.
c. Not required for copper, galvanized steel, or insulated piping.

2. Steel hangers and supports exposed to outdoors.

a. One coat primer.
b. Not required for galvanized steel.

3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces.

a. Flat black.

4. Marred surfaces of factory painted equipment.

a. Spot coat to match adjacent coat.

5. Insulation exposed to sunlight:

B. Execution.

1. Protect flooring and equipment with drop cloths.
2. Paint and materials stored in location where directed.
3. Oily rags and waste removed from building every night.
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint is applied.
5. Workmanship.

a. No painting or finishing shall be done with:

1) Dust laden air.
2) Unsuitable weather conditions.
3) Space temperature below 60 deg. F.

b. Pipes painted containing no heat and remain cold until paint is dried.
c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls, or other defects.
d. Finished surfaces shall be uniform in sheen, color, and texture.
e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats.
f. Priming undercoat of slightly different color for inspection purposes.

6. Piping continuously painted in all exposed areas.

C. Paint.

1. High gloss medium or long alkyd paint.
2. Best grade for its purpose.
3. Deliver in original sealed containers.
4. Apply in accordance with manufacturer's instructions.

D. Colors.

1. Colors as directed by Prime Professional unless specified herein.
2. Interior of ductwork as far back as visible from outside: flat black.
3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer.

E. Factory Finish.

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel.
2. Aluminum air outlets that are not to be painted: anodized.
3. Exposed fan coil units: baked enamel.
4. Unit ventilators and unit heaters: baked enamel.
5. Fans, pumps, compressors, tanks and like items.
6. Air handlers, pumps, water heaters and like items, where exposed.

F. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat.

G. Properly prepare Work under this Division to be finish painted under Division 09 – Painting.

H. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment, and materials.

I. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division.

1. Other air outlets.

J. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel.

K. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction.

L. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Prime Professional.

3.08 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements (Quality Control).

B. Tests.

1. Perform as specified in individual sections and as required by authorities having jurisdiction.
2. Duration as noted.

C. Provide required labor, material, equipment, and connections.

D. Furnish written report and certification that tests have been satisfactorily completed.

E. Repair or replace defective work, as directed by Prime Professional in writing, at no additional cost to the Owner.

F. Restore or replace damaged work due to tests as directed by Prime Professional in writing, at no additional cost to the Owner.

G. Restore or replace damaged work of others, due to tests, as directed by Prime Professional in writing, at no additional cost to the Owner.

H. Remedial work shall be performed to the satisfaction of the Prime Professional, at no additional cost to the Owner, including:

1. Work related to all Division 23 – Mechanical tests.
2. Division 23 – Mechanical work related to Section 230593 – Testing, Adjusting and Balancing for Mechanical.

I. Remedial work shall include performing any tests related to remedial work and additional time at no additional cost to the Owner.

3.09 EXISTING EQUIPMENT AND SYSTEMS

A. Owner has first right of refusal of all existing equipment and components indicated to be removed.

B. Material and equipment which has been removed and not accepted by the Owner shall become the property of the Contractor and shall be removed from the site.

C. Material and equipment which has been removed shall not be used in the new work, except as specified herein.

D. Where existing piping, ductwork and equipment is indicated on the Drawings, its size and location shall be verified.

3.010 EQUIPMENT AND INSTALLATION REQUIREMENTS

A. Air systems shall operate without aerodynamic noise generated from the faulty installation of ductwork or any component of the air distribution system.

B. Equipment shall be installed and connected as specified herein or indicated on the Drawings in accordance with the manufacturers' instructions and recommendations for this Project. Furnish and install auxiliary piping, water seals, valves, and electrical connections recommended by the manufacturer for operation.

C. Provide roughing, fittings, accessories, and connecting piping, and make final connections to all equipment. Coordinate carefully with equipment vendor prior to starting rough-in work.

D. In unfinished areas designated for future build-out, install piping, ductwork, conduit, and equipment tight against the structure to maximize future ceiling height.

E. Motor quantities, sizes and equipment wattage ratings specified herein or indicated on the Drawings are the minimum requirements, unless noted otherwise. Motor quantities, sizes, and equipment wattage ratings less than those specified herein or indicated on the Drawings are not acceptable. Larger motor sizes and equipment wattage ratings may only be provided, if necessary, to meet the prescriptive requirements specified herein or indicated on the Drawings. Where multiple motors or motor sizes or equipment wattage ratings larger than specified herein or indicated on the Drawings are furnished, provide and coordinate the corresponding increased number or capacity of feeders and other electrical equipment serving them, at no additional cost to the Owner.

F. Field-installed equipment controls, or sensor wiring shall be installed in conduit. Low voltage control and sensor wiring shall be installed in conduits separate from line voltage control wiring and power wiring.

G. Where water connection sizes at equipment vary from the pipe size indicated on the Drawings, provide appropriate reducers/increasers directly adjacent to the pipe-equipment unions. Unless otherwise specified herein or indicated on the Drawings, the size of the valves and accessories dedicated to the equipment shall not be less than the pipe size to which they are connected.

H. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible and with the manufacturer's minimum required clearances provided. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made without written approval.

1. Group concealed valves, controls and equipment requiring access, so as to be freely accessible through access doors.

3.011 EXCAVATION AND BACKFILLING

A. Provide barricades, signs, lanterns, shoring, sheeting, and pumping as part of Work in this Division as required to ensure safe conditions. Comply with OSHA requirements.

B. Dig trenches straight, true to line and grade with sides and bottoms smoothed of any rock points.

1. Excavate 6 inches below grade of pipe.
2. Fill with sand properly packed.
3. Support pipe for entire length on packed sand.
4. Shape or pack bottom of trenches for pipe, duct fittings, hubs, couplings, etc., using templates to fit outside periphery of lower third of piping and ductwork.
5. Provide piping outside building with 36-inch minimum cover from top of pipe to finished grade.
6. Minimum width 16 inches.

C. Dispose of all surplus excavation material and seepage water as directed by the Prime Professional.

D. Backfill.

1. After piping has been installed, tested, and approved, backfill all excavation, tamp and compact by motor powered or compressed air tampers.
2. Backfill to 6-inches above crown of pipe with unwashed sand, with remainder of trench back-filled and mechanically tamped in 6-inch maximum layers of selected excavated materials, free from organic matter, rocks, etc. Provide 90-percent compaction in accordance with ASTM D 1557-58T; 95-percent compaction for trenches below building slabs.

E. In any asphalt or concrete paved areas, backfill only to subgrade level.

F. When piping is installed, prior to backfilling, advise Prime Professional; do not backfill without acceptances of Prime Professional.

G. Replace to original condition all paving, curbs, gutters, walks, etc., which become disturbed by trenching.

3.012 DIAGRAMS

A. Frame and mount the following information:

Information	Location
HVAC diagrams, start-stop procedures, valve schedules, and valve location floor plans.	Appropriate mechanical rooms.

B. Diagrams shall be computer generated.

C. Diagrams shall be as-built, and shall include interfaces and interlocks with other equipment.

D. Diagram framing system: 0.125" thick acrylic with satin finish aluminum frames.

3.013 MAINTENANCE

A. Equipment operated prior to the date of substantial completion shall be maintained in accordance with manufacturer's recommendations. In addition, provide complete water treatment for hydronic and steam systems operated prior to date of substantial completion.

B. Prepare and submit a lubrication chart listing for each piece of equipment:

1. Points requiring lubrication.
2. Recommendations for a single manufacturer's lubricants with brand name and designation.
3. Frequency of lubrication required.

C. Lubricate each item of apparatus requiring lubrication prior to start-up in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 23 00 20 MECHANICAL CLOSE-OUT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Summary Includes

1. As-Built Drawings.
2. Operation and maintenance documentation directory.
3. Emergency manuals.
4. Operation manuals for systems, subsystems, and equipment.
5. Maintenance manuals for the care and maintenance of systems and equipment.
6. Closeout Documentation Checklists.
7. Warranties

B. Related Sections:

1. Section 230010 – Mechanical General Provisions.
2. Section 230030 – Demonstration and Training for Mechanical Systems.

1.03 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Initial Submittal: Submit draft copy of each manual a minimum of 60 days prior to requesting Substantial Completion inspection. Include a complete operations and maintenance directory. Architect will return draft copy and mark whether general scope and content of manuals are acceptable.

C. Submit manuals according to the following table.

1. “R” means required.

Item	Product Data	O&M Manual	Samples	Shop Drawing
As-Built drawings		R		
Operation and Maintenance Documentation Directory		R		
Emergency Manual		R		
Operation Manual		R		
Systems and Equipment Maintenance Manual		R		
Closeout Documentation Checklists		R		
Warranties		R		

PART 2 - PRODUCTS

2.01 AS-BUILT DRAWINGS

A. Maintain at job site a set of contract record documents kept current by indicating thereon all changes, substitutions, etc., between work as specified and as installed.

B. Show on record documents actual air quantities, water flow rates, valve or damper positions after balancing, etc.; also show, by actual dimension, location of all new and known existing underground work.

C. At the completion of the project, furnish the Owner three sets of drawings and three complete, clean sets of specifications showing installed location, size, etc., of all work and material as taken from record documents. All as-built (on record) drawings shall be labeled “As-Built Drawings,” dated and certified accurate by Contractor with his signature, on front page of all Drawing sets and Specifications.

2.02 OPERATION AND MAINTENANCE MANUALS

A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.

B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the HVAC and building automation systems. Documentation shall include an operations and maintenance documentation directory, emergency information, operating manual, maintenance manual, test reports, and construction documents.

C. Initial Submittal: The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 1 month before systems start-up, and shall be updated, revised and completed at completion of construction.

D. Final Submittal: Provide two (2) complete manuals.

1. Correct or modify each manual to comply with Architect’s comments. Submit Final manuals shall be submitted 15 working days prior to demonstration and training of Owner’s personnel. Manuals are to be used in training sessions by Owner’s personnel.

E. Compile and coordinate the documentation for equipment and systems installed. 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. Documentation shall be typewritten and shall contain, at a minimum, the following information.

1. Introduction:

a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
b. List of Documents.
c. List of systems.
d. List of equipment.
e. Table of Contents.

2. Operations and Maintenance Documentation Directory:

    a. Explanation of the identification system used, including lists of systems, equipment, and component identifiers and names. Use the same system, subsystem and equipment designation as used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, “Preparation of Operating and Maintenance Documentation for Building Systems.”

3. Manual 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:

    a. Title page.
    b. Warranty Page
    c. Table of contents.
    d. Manual contents.

4. Manual Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

    a. Project name, contractors' and subcontractors' names, addresses, telephone numbers, email addresses and facsimile numbers. Indicate the portion of the work for which each subcontractor was responsible.
    b. Subject matter included in manual.
    c. Name and address of Project.
    d. Name and address of Owner.
    e. Date of submittal.
    f. Name, address, telephone number, fax number and email address of Contractor.
    g. Name and address of Architect and other Architects.
    h. Cross-reference to related systems in other operation and maintenance manuals.

5. Warranty Page

    a. Provide table as shown at end of this section. Table to be on separate page in O&M. two (2) copies of table to be laminated and turned over to owner. All products and other warranties to be listed in table.

6. Manual 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.

    a. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table for all volumes in each volume of the set.

7. 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.

    a. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 x 11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

1) 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.
2) Identify each binder on front and spine, with printed title “OPERATION AND MAINTNANCE MANUAL,” Project title or name, project number and subject matter contents. Indicate volume number for multiple-volume sets and six-digit Section number on bottom of spine.

b. 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 system on each divider, cross-referenced to Specification Section number and title of Project Manual.
c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
d. Supplementary Text: Prepared on 8-1/2 x 11-inch, “20-lb” white bond paper.
e. Drawings: Attached reinforced, punched binder tabs on drawings and bind with text.

1) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
2) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual or reduced drawings. DO NOT USE BINDER POCKETS. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.

f. Provide color photographs instead of drawings where necessary to demonstrate unusual or complex installations.

8. Emergency Information:

a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:

1) Fire.
2) Security breach.
3) Water outage.
4) Power failure.
5) Refrigerant release.
6) Heating failure.
7) Cooling failure.

2.03 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. System, subsystem or equipment failure.
8. Chemical release or spill.
9. Sub-freezing weather conditions.

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.

2.04 OPERATION MANUAL

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. Valve tag lists.
10. Precautions against improper use.
11. 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 for pumps, fans and heat exchangers.
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 of 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.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product information, maintenance procedures, repair materials, warranty information and bond information 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. Cross-reference Specification Section number and title in Project Manual.

C. Manufacturer's Maintenance Documentation: Manufacturer's 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. Manufacturer's demonstration and training videotape or DVD, if available.
7. Required maintenance documentation to uphold warranties.

E. Maintenance and Service Schedule: Include service and lubrication requirements, list of required lubricants for equipment and separate schedules for preventative 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 manufacturer's 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 manufacturer's 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 executed warranties and bonds and lists of circumstances and conditions that would affect validity of warranties and bonds.

1. Include procedures to follow and required notifications for warranty claims.
2. Include all model, serial numbers and information required on table at end of section. Table is available in Excel upon request from Professional.

NOTE: Where manuals contain manufacturer's standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data includes 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.

2.06 CLOSEOUT DOCUMENTATION

A. Seven days prior to requesting a final inspection, the Contractor shall submit all O&M and closeout documentation to the Architect, to be submitted to the Owner at the end of the project.

B. The checklist herein shall be utilized for compiling documentation and shall be included behind front cover of O&M manuals.

C. Contractor shall initial and date each line item once completed and shall email a copy of the completed checklist to the Architect prior to final inspection request.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

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

B. Assemble a complete set of the following manuals indicating procedures for each.

1. Emergency manual.
2. Product maintenance manual.
3. Operations and maintenance manual.

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

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

D. Drawings: Prepare drawings supplementing manufacturer's printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequences and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation. Do not use original Project Record Drawings.

1. Do not use original Project Record Drawings as part of operation and maintenance manuals.

3.02 CLOSEOUT DOCUMENTATION CHECKLIST

A. Closeout Documentation Checklists included:

1. Division 23 – HVAC.

CLOSEOUT DOCUMENTATION CHECKLIST DIVISION 23 – HVAC		
Project Name:		
Initials of person completing task	Date task completed	Description of Contractor's Submittal
		Final TAB Report (3 each required).
		Signed Letter Record of Owners Personnel O & M Training.
		DVD Record of Owners Personnel O & M Training (3 each).
		Operation & Maintenance Manuals.
		As-Built Drawings with Contractor's Stamp.
		Warranty Information.
		Manufacturer's representative(s) shall provide certification(s) that HVAC equipment has been installed in accordance with manufacturer's recommendations. Typical for Packaged Units.
		Provide list of all spare air filter sets. List number, size, type and location/equipment match-up.
		Certification by Contractor that all bearings requiring periodic lubrication, as recommended by equipment manufacturer, have been initially lubricated and have been tagged. Provide a list of all equipment lubricated.

		Duct Pressure Test Log.
		On a reduced floor plan drawing, the CONTRACTOR shall indicate the location of all variable frequency drives, starters, and switches. These devices shall be properly marked to indicate equipment they serve as designated on the Contract Documents.
		Keys to access doors. (Provide written receipts with Owner's acceptance).
		Keys to control panels and sensor/controller covers (provide written receipts with Owner's acceptance).

PROJECT NAME								
Equipment Tag	Manufacturer	Model Number	Serial Number	Manufacturer Warranty Description	Start Date	End Date	Contact Information	Remarks
							Name / Phone Number	
RTU-1	NAME OF MANUFACTUER	ABC1234	ABC1234	1-year Parts Only	1/1/2020	1/1/2021	John Doe (Company) (xxx) xxx-xxxx	
				5-year Compressor Parts Only	1/1/2020	1/1/2021	John Doe (Company) (xxx) xxx-xxxx	
VAV Terminal Units	NAME OF MANUFACTUER	ABC1234	ABC1234	1-year Parts Only	1/1/2020	1/1/2021	John Doe (Company) (xxx) xxx-xxxx	
EF-1	NAME OF MANUFACTUER	ABC1234	ABC1234	1-year Parts Only	1/1/2020	1/1/2021	John Doe (Company) (xxx) xxx-xxxx	
EWH-1	NAME OF MANUFACTUER	ABC1234	ABC1234	5-year Heating Element	1/1/2020	1/1/2025	John Doe (Company) (xxx) xxx-xxxx	
				10-year Tank	1/1/2020	1/1/2030	John Doe (Company) (xxx) xxx-xxxx	
ODU-1	NAME OF MANUFACTUER	ABC1234	ABC1234	10-year Parts Only	1/1/2020	1/1/2030	John Doe (Company) (xxx) xxx-xxxx	
IDU-1.01	NAME OF MANUFACTUER	ABC1234	ABC1234	10-year Parts Only	1/1/2020	1/1/2021	John Doe (Company) (xxx) xxx-xxxx	
VRF Equipment	NAME OF MANUFACTUER	N/A	N/A	10-year Parts Only	1/1/2020	1/1/2030	John Doe (Company) (xxx) xxx-xxxx	includes central controller and thermostats
				2-year Labor	1/1/2020	1/1/2022	John Doe (Company) (xxx) xxx-xxxx	includes refrigerant and programming
HVAC Controls Actuators	NAME OF MANUFACTUER	N/A	N/A	5-year Parts Only	1/1/2020	1/1/2025	John Doe (Company) (xxx) xxx-xxxx	

<CONTRACTOR NAME HERE> warranties and guarantees all materials, equipment and workmanship provided by our company relating to the HVAC system and Plumbing for the above referenced project.

If any parts or materials supplied by our company prove defective, we will repair or replace such items as necessary without expense to the Owner, including costs of services, materials, transportation, parts and labor.

This warranty period begins on <INSERT SUBSTANTIAL SUBMITTAL DATE> and shall run for one year from that date.

Any questions relating to warranty should be directed to our home office at <INSERT PHONE NUMBER>.

END OF SECTION

SECTION 23 00 30 DEMONSTRATION AND TRAINING FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Administrative and Procedural requirements for preparing operation and maintenance manuals, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections:

1. Section 230010 – Mechanical General Provisions.
2. Section 230020 – Mechanical Close-Out Requirements.

1.03 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Initial Submittal: Submit draft copy of each manual a minimum of 60 days prior to requesting Substantial Completion inspection. Include a complete operations and maintenance directory. Architect will return draft copy and mark whether general scope and content of manuals are acceptable.

C. Submit manuals according to the following table.

1. “R” means required.

Item	Product Data	O&M Manual	Samples	Documentation
Instruction program				R
Qualification data				R
Attendance record				R
Evaluations				R
DVD				R

D. Instruction Program: Submit to the Architect copies of instructional program outline for demonstration and training, including a schedule of proposed dates, times, length of instruction and instructors’ names for each training module. Include learning objective and outline for each training. Submit to Professional a minimum of seven (7) working days prior to program date coordinated with Owner and Architect.

1. At completion of training, submit two (2) complete training manuals for Owner’s use.

E. Qualification Data: Include lists of completed projects with project names and addresses, names, and addresses of Architects and Owner and other information specified.

F. Attendance Record: For each training module, submit list of participants and length of instruction time.

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

H. Demonstration and Training DVD's: Submit two copies of each DVD within seven (7) days of recording.

1. Format: Provide high quality color DVDs.
2. Identification: On each DVD, provide an applied label with the following information:

a. Name of project.
b. Name and address of photographer.
c. Name of Engineer.
d. Name of Contractor.
e. Date DVD was recorded.
f. Description of vantage point, indicating location, direction (by compass point) and elevation or construction story.

I. Transcript: Prepared on 8-1/2 x 11" (A4) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with the same label information as the corresponding DVD. Include name of Project and date of DVD on each page.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

B. Photographer Qualifications: An individual of established reputation who has been regularly engaged as a professional video photographer for not less than five years.

C. Pre-instruction Conference: Contact Architect and review methods and procedures related to demonstration and training including, but not limited to the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

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

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

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

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

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

1. Heat generation including boiler, pumps, and heating water distribution piping.
2. Gas-fired heating equipment.
3. Refrigeration systems including chillers, pumps, ice storage tanks and chilled water piping.
4. HVAC systems including air-handling equipment, unit heaters, power ventilators, heat exchangers, piping specialties, etc.
5. Energy Management and Control System.
6. All control end-devices and sensors.
7. Variable Frequency Drives.

B. Training Modules (Basis of System Design, Operational Requirements and Criteria): Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following (this will be provided through the Architect):

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria.
3. Operating standards.
4. Regulatory requirements.
5. Equipment function.
6. Operating characteristics.
7. Limiting conditions.
8. Performance curves.

C. Training Modules (Documentation): Review the following items in detail:

1. Emergency manuals.
2. Operations manuals.
3. Maintenance manuals.
4. Project record documents.
5. Submittal manual.
6. Identification systems.
7. Warranties and bonds.
8. Maintenance service agreements and similar continuing commitments.
9. Owner requirements to uphold extended warranties.

D. Emergencies: Include the following as applicable:

1. Instructions on meaning of warnings, trouble indications and error messages.
2. Instructions on stopping.
3. Shutdown instructions for each type of emergency.
4. Operating instructions for conditions outside of normal operating limits.

5. Sequences for electric or electronic systems.
6. Special operating instructions and procedures.

E. Operations: 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. Control Sequences.
6. Safety procedures.
7. Instructions on stopping.
8. Normal shutdown instructions.
9. Operating procedures for emergencies.
10. Operating procedures for system, subsystem, or equipment failure.
11. Seasonal and weekend operating instructions.
12. Required sequences for electric or electronic systems.
13. Special operating instructions and procedures.

F. Adjustments: Include the following:

1. Alignments.
2. Checking adjustments.
3. Noise and vibration adjustments.
4. Economy and efficiency adjustments.

G. Troubleshooting: Include the following:

1. Diagnostic instructions.
2. Test and inspection procedures.
3. Procedures for Owner's efforts ahead of a warranty call.

H. Maintenance: Include 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. Procedures for routine cleaning.
5. Procedures for preventative maintenance.
6. Procedures for routine maintenance.
7. Instructions on use of special tools.
8. List of all maintenance required to uphold warranties.

I. Repairs: Include the following:

1. Diagnosis instructions.
2. Repair instructions.
3. Disassembly: component removal, repair and replacement and reassembly instructions.
4. Instructions for identifying parts and components.
5. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

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

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: The Architect will serve as facilitator to assist the Contractor in preparation of instruction program and training modules, to coordinate instructors and to coordinate between Contractor and Owner for number of participants, instruction times and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate and maintain systems, subsystems, and equipment not part of a system.

1. Contractor will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

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

1. Schedule training with Owner, through Architect, with at least fifteen (15) days advance notice.

2. Submit training agenda/information to Professional for review and approval at lest seven (7) days prior to meeting.

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

E. Demonstration and Training DVD: Record each training module separately. Include classroom instructions and demonstrations, board diagrams and other visual aids, but not student practice.

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

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

3.03 DEMONSTRATION AND TRAINING DVDs

A. Demonstration and Training DVDs: Record instruction of Owner's personnel in the operation and maintenance of equipment and systems. Edit DVDs to remove non-instructional conversation. Photographer shall select vantage points to best show equipment, systems and procedures demonstrated. Include instructions and details on maintenance, and operational procedures which are required to uphold quality equipment/system performance, and warranties. Provide information about Owner responsibilities for precheck items ahead of contacting warranty groups and include warranty contact procedures.

END OF SECTION

SECTION 23 05 00 BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Temporary operation of mechanical equipment.
2. Wall and ceiling access panels.
3. Fire, smoke, and sound stopping.
4. Pipe Sleeves.
5. Escutcheons.
6. Cutting and patching.

B. Related Sections:

1. Section 230010 – Mechanical General Provisions.

1.03 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawings
Wall and ceiling access panels	R			R
Fire, smoke and sound stopping	R			R
Pipe sleeves and sleeve seals	R			R
Escutcheons	R			

1.04 QUALITY ASSURANCE

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

1.05 TEMPORARY ENVIRONMENTAL CONDITIONING

A. If the Contractor requires temporary heating, cooling, and dehumidification capability prior to the permanent building HVAC system being ready for operation, it shall be the Contractor's responsibly to provide and maintain in working condition the HVAC equipment and system components necessary to meet the recommended indoor environmental conditions. All cost associated with these temporary HVAC systems shall be the Contractor's responsibility and included in their bid.

B. Additionally, if the contractor requires temporary heating, cooling, and dehumidification capability prior to the Architect approving the use of the building mechanical systems, the Contractor shall be responsible for providing and maintaining temporary HVAC systems. All cost associated with these temporary HVAC systems shall be the Contractor's responsibility and included in their bid.

1. See minimum building condition requirements herein for operation of building mechanical equipment and systems.
2. Temporary HVAC systems and controls shall be capable of providing the recommended indoor environmental conditions.

1.06 OPERATION OF BUILDING MECHANICAL EQUIPMENT AND SYSTEMS

A. Temporary operation of the building mechanical equipment and systems shall be provided for this project beginning a minimum of 60 days (or as approved by Architect) prior to the scheduled substantial completion date and maintained until the Owner's final acceptance of the project, or any phase thereof. The beginning of this temporary HVAC period is intended to align with general industry standard construction practice of providing a minimum suitable indoor environment for the installation and curing of millwork, adhesives, finishes, wall covering(s), tile ceiling/floors, etc. This interior space conditioning includes all areas of the project where the space will be similarly conditioned with heating, cooling, and/or dehumidification capability after the project or any portion/phase thereof is completed.

B. Temporary Operation of Building Mechanical Equipment and Systems Procedure:

1. The Contractor shall notify the Architect in writing fourteen (14) days in advance to request temporary operation of the building permanent HVAC systems.
2. The Architect will schedule a site-visit to observe the site conditions to ensure all the items described below have been met prior to temporary operation.
3. The Contractor shall submit in writing an operation and maintenance plan for temporary use of the building HVAC systems. At a minimum the O&M plan shall address:

    a. Equipment, system, and air filter maintenance.
    b. Temporary filter efficiency and installation locations.
    c. Daily, weekly, monthly, etc. cleaning procedures to ensure indoor cleanliness.
    d. Describe in detail how the system will be controlled, and indoor conditions monitored. Procedures for shutting down equipment or isolation of areas where dust, dirt, or particulate producing activities occur.

4. At a minimum the following building components and activities shall be completed prior to operation of the building HVAC systems:

    a. Dust or particulate generating construction activities completed.
    b. All dirt, dust, and debris have been removed from the building areas being served.
    c. Duct and cooling water piping insulation is fully completed and all seams, openings, etc. have been sealed.
    d. All HVAC system equipment utilized for temporary heating and cooling shall have been started up per specifications. All manufacturer's authorized representative startup and warranty information (including checklists) shall be completed and submitted to the Architect.

e. All temporary air filters in place of types and installed in locations specified in 234000 “Air Cleaning Devices.” All return air and exhaust air distribution devices and openings shall be covered and protected with filter material specified in 234000 “Air Cleaning Devices.” All temporary filters shall be continually monitored and replaced periodically when required.

5. Upon completion of the Architect’s site visit, review of site conditions and temporary operation plan, the Architect reserves the right to refuse temporary startup and operation if site conditions and plan do not meet specifications. No additional time will be given to the Contractor due to unapproved startup and temporary operation conditions.
6. Additionally, the Architect reserves the right to order the building HVAC systems shut down if the building condition or indoor environmental conditions are not maintained and found to be unacceptable.

C. The building indoor environmental conditions shall be continuously maintained within the following limits:

1. Maximum indoor temperature: 85 ˚F dry bulb.
2. Minimum indoor temperature: 60 ˚F dry bulb.
3. Maximum indoor relative humidity: 60% RH.

D. Temperature and humidity data loggers provided by the Contractor shall be installed throughout the facility to record indoor environmental conditions. Data logger quantity and locations shall be approved by Architect. Data from data loggers shall be submitted to the Architect every two weeks for review. Data shall be submitted on an hourly basis in .csv format or other, format agreed upon by Architect.

E. Contractor shall have either specified or temporary controls in place and fully operational to maintain the specified indoor environmental conditions above. Contractor shall provide all required temporary building services for temporary operation at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work includes but are not limited to the following listed in this specification.

B. Wall and ceiling access doors.

1. Acudor.
2. Williams Brothers.
3. J.R. Smith.
4. Or equal.

C. Mechanical sleeve seals.

1. Calpico, Inc.
2. Metraflex Co.
3. Thunderline/Link-Seal.
4. Or equal.

2.02 WALL AND CEILING ACCESS DOORS

A. Access panels shall be provided for all concealed valves, controls, dampers, and other mechanical equipment and devices where occasional access for adjustment or repairs will be necessary. Panels shall have cam and cylinder lock with two keys. All locks shall be keyed alike. Label panels as in accordance with Section 230553 – Mechanical Identification.

B. Size of panels to be large enough to permit servicing or replacement of devices, controls, valves, etc.; minimum size to be 18"x18". Submit schedule with submittal package indicating location and size.

C. General.

1. Fabricate units of all welded steel construction.
2. The frame and panel assembly for fire rated access panels shall be manufactured under the Factory Inspection Service of Underwriters Laboratories, Inc., and shall bear a label reading: "Frame and Fire Door Assembly, Rating 1-1/2 Hr. (B), Temperature Rise 30 Minutes, 250ºF, Maximum".
3. Access panels used in toilets, kitchens, and other areas expected to experience high relative humidity are to be constructed of stainless steel.

D. Flush Panel Access Panels: Model WB-GP.

1. Frame and door shall be of one-piece unit body construction and 14-gauge steel. Body shall be 18-gauge steel with a return edge around door opening.
2. Flange shall be 1-3/4” wide.
3. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
4. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
5. Finishes shall be factory applied with a rust inhibiting phosphated undercoat; finish to be chemically bonded oven baked white enamel.
6. For installation in masonry openings, units shall be furnished with flexible metal anchor straps welded to the body.

E. Flush Access Panel for Drywall or Plaster: Model WB-DW and WB-PL.

1. Body and flange shall be 16-gauge steel. Door shall be 14-gauge steel.
2. Hinges shall be concealed, piano type, opening to 175 degrees. Number of hinges will vary with size of door.
3. Locks shall be flush, key operated cylinder lock. Number of locks will vary with size of door.
4. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
5. Plaster models shall have 2-1/2” of 24 gauge galvanized expanded wing casting surrounding door.
6. Drywall models shall have a 1-1/8” perforated drywall bead on all four sides.

F. Fire Rated “B” Label Access Panel: Model WB-FR.

1. Frame and door shall be of one-piece unit body construction and 14-gauge steel. Door shall be sandwich type filled with 2" thick thermafiber felt insulation and back enclosure of 22-gauge steel. Body shall be 16-gauge steel.
2. Flange shall be 1-3/4” wide.
3. Hinge shall be continuous steel piano type mounted on long side of doors, opening to 180 degrees and equipped with a spring mechanism for automatic closure.
4. Lock assembly shall be self-latching with key operated cylinder lock and shall have a mechanism to release the latch bolt from the inside.

5. Finish shall be factory applied oven baked grey enamel with rust inhibiting phosphated undercoat.
6. For installation in masonry openings, units may be furnished with flexible metal anchor straps welded to the body.

2.03 FIRE, SMOKE, AND SOUND STOPPING

A. UL listed penetration sleeve assembly and/or firestop that meets ASTM E-814 E119, and E84, as "3M" systems or equal for the intended applications.

B. All fire, smoke and sound stopping to be done by a licensed and certified Contractor as approved by Architect.

2.04 PIPE SLEEVES AND SLEEVE SEALS

A. Pipe Sleeves.

1. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
2. PVC Pipe Sleeves: Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
3. Galvanized-Steel Sheet Metal Sleeves: Galvanized sheet metal sleeves with lock seam joints and comply with the following minimum thickness:

    a. 24 gauge for 3 inches and smaller.
    b. 22 gauge for 4 inches to 6 inches inclusive.
    c. 20 gauge for sizes over 6 inches.

B. Sleeve Seals: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.
4. Link-Seal or equal.

2.05 ESCUTCHEONS (WALL, FLOOR, AND CEILING PLATES)

A. Description.

1. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener in exposed applications.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
3. Split-Casting Brass Type: With polished, chrome-plated rough-brass finish and with concealed hinge and setscrew in exposed applications.
4. Escutcheon thickness: For wall and ceiling plates, not less than 0.025-inches for up to 3-inch pipe and 0.035-inches for larger pipe.
5. Escutcheon thickness: For floor plates, not less than 0.094-inches.

2.06 DIELECTRIC FITTINGS

A. Provide where copper and ferrous metal are joined.

1. 2 inch and less: Threaded dielectric union.

2. 2-1/2 inch and larger: Flange union with dielectric gasket and bolt sleeves.
3. Temperature Rating: 210 ˚F for water systems.

PART 3 - EXECUTION

3.01 WALL AND CEILING ACCESS PANEL

A. Coordinate size requirements and exact location with Contractor who will install access doors.

B. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Architect.

C. Provide where shown or required for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work. Where ceiling is constructed with removable tiles or sections, access panels are not required.

1. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors.
2. Access doors shall not be used solely for access to balancing dampers; use instead remote control, devices specified under Section 233300 – Air Duct Accessories.

D. Contractor shall provide substantial metal angle frame and support at all ceiling access panels.

3.02 FIRE, SMOKE, AND SOUND STOPPING

A. Fire and smoke stopping shall be provided and installed at all locations where new and existing mechanical work passes through rated assemblies. This includes all ductwork, piping, and controls related conduit.

B. Penetrations in “sound-rated” walls shall be similarly acoustically sealed, both sides of wall with caulk or other approved material. New and existing walls extending to the roof/floor structure above are considered sound walls.

3.03 PIPE SLEEVES AND SLEEVE SEALS

A. Install sleeves for pipes passing through exterior walls, concrete beams, foundations, footings, floors and roof decks.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exceptions:

1) In areas where pipes are exposed, extend sleeves 1/4-inch above finished floor.
2) Extend sleeves installed in floors of mechanical equipment areas or other wet areas (kitchens, toilets, etc.) 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls, beams, foundations, footings, floors, roof decks and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Pipe shall be capable of free movement within the sleeve.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Contractor shall coordinate specific sealing requirements to ensure fire, smoke or sound ratings are maintained through pipe penetration/sleeve assembly.

    a. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

B. Interior wall pipe penetrations.

1. Galvanized-steel sheet metal sleeves.
2. Interior openings shall be caulked tight with fire, smoke or sound stopping material and sealant to prevent the spread of fire, smoke, and sound. Contractor shall coordinate specific requirements to ensure fire, smoke or sound ratings are maintained.

C. Above grade exterior wall, concrete beams, foundations, footings, waterproofed floors and where sleeve is extended above finished floor pipe penetrations: Seal penetrations using silicone sealant specified above.

1. Install galvanized steel or Schedule 40 PVC pipe sleeve.

D. Below grade exterior wall pipe penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install galvanized steel or Schedule 40 PVC pipe sleeve.
2. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

E. Sleeves that extend into return air plenums shall be of non-combustible material, either galvanized steel or Schedule 40 steel pipe sleeves.

F. For drilled penetrations in existing floors provide one-inch angle ring flange set in silicone sealant and bolted to the floor in lieu of pipe sleeves with one-inch extension above floor.

3.04 ESCUTCHEONS

A. Install pipe escutcheons for exposed pipe penetrations of concrete and masonry walls, wall board partitions, suspended ceilings, etc.

B. Inside diameter shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve and penetration.

C. Use plates that fit tight around insulation or pipes when not insulated.

D. Plates shall cover openings around pipes/insulation and cover the entire pipe sleeve projection. Use deep pattern escutcheons where required to completely conceal protruding fittings and sleeves.

3.05 CUTTING AND PATCHING

A. Do not cut into any major structural element without written approval of the Architect.

B. Cut required openings through existing masonry or reinforced concrete with diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Architect. Locate openings that will least affect structural slabs, columns, ribs, or beams. Refer to the Architect for determination of proper design for openings through structural sections and opening layouts for approval prior to cutting or drilling into structure. After Architect's approval, carefully cut openings through construction no larger than absolutely necessary for the required installation.

C. Patching:

1. Shall be of quality and appearance matching the existing construction.
2. Contractor shall restore all services and construction that remains in use, to its condition prior to Work performed as part of this contract.

END OF SECTION

SECTION 23 05 13 MOTORS AND CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors, motor controllers (starters) for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
   1. Motors.
   2. Motor controllers.

1.03 SUBMITTALS

A. See Section 230010 “Mechanical General Provisions.”

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Motors	R	R		R
Belts and Drives		R		
Motor Controllers/Starters	R	R		R

1.04 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Motors.
1. General Electric
2. Gould, Inc.
3. Baldor.
4. Or equal.

C. Motor Controllers/starters.
1. ABB.
2. Cerus.
3. Square D.
4. Or equal.

2.02 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.03 MOTORS

A. General.
1. In accordance with NEMA, IEEE, and ANSI C50 standards.
2. Capacity.
   a. Minimum horsepower indicated.
   b. To operate driven devices under all conditions without overload.
3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty.
4. Speed.
   a. 1750 RPM, unless otherwise indicated.
   b. See schedules on drawings for other speeds.
5. NEMA KVA locked rotor CODE LETTER: "G" or better.
6. Service factor: 1.15.
7. Type unless otherwise scheduled on Drawings.
   a. Voltage: As scheduled on Drawings. Contractor shall verify actual site voltage prior to procurement.
   b. 1/2 horsepower and smaller.
      1) Single-phase, 60 hertz.
      2) With built-in auto-reset thermal overload protection.
   c. 3/4 horsepower and larger.
      1) Three-phase, 60 hertz.
      2) Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting or as scheduled on Drawings.
   d. EC Motors.
      1) Where scheduled on Drawings or equipment Specifications.
      2) Equal to GE ECM version 2.2 or greater.
      3) Programmed with fan curve for “constant airflow”.

8. Bearings, unless otherwise scheduled on Drawings or equipment Specifications.
    a. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for re-greasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.
    b. Ball type, unless otherwise noted.
    c. Sealed, permanently lubricated, unless otherwise noted or not available in motor size.

B. Enclosure.
1. Open drip-proof (ODP).
    a. Provide ODP motors unless otherwise indicated.
2. Totally enclosed (TEFC).
    a. Motors outside the building or otherwise exposed to the weather.
    b. Non-ventilated: under 1/2 horsepower.
    c. Fan-cooled: 1/2 horsepower and larger.
3. See schedules on drawings for other enclosures.

C. Belt-connected motors.
1. Foundation slide base.
2. Shaft as required for aligning pulleys.

D. Motors 1 horsepower and larger shall be NEMA Premium labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.

E. Multi-speed motors.
1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated.
2. Provide 1800/1200 rpm multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

F. Electrically Commutated Motors (EC Motors).
1. Brushless DC type with electronic commutation from 115 volt or 277-volt single phase power to a DC signal.
2. Speed controllable from a minimum of 20% or less to 100% of full speed.
3. Minimum 80% efficiency at all speeds.
4. Provide the following.
    a. Potentiometer dial mounted on the exterior of the motor housing.
    b. 0-10 VDC control signal input and 0-10 VDC speed feedback output with pre-wired contacts. Motor shall shut off when speed signal is below minimum.

2.04 MOTOR CONTROLLERS/STARTERS

A. General.
1. Manual reset, Class 20, thermal type overload protection for each phase, in accordance with NEMA ICS 2-2000 (R2005).
2. NEMA 3R enclosures for exterior application.
3. Equipment furnished with factory-installed starters shall also be equipped with individual motor disconnect and thermal magnetic circuit breakers or fuses as specified herein with lugs sized to receive a feeder as indicated on the Electrical Drawings.

4. 120 V secondary control power transformer with fused primary and secondary circuit in the enclosure.
5. Unused auxiliary contacts (installed on each contactor): 1 normally open, and 1 normally closed.

B. Motor starters shall be provided with provisions for interfacing with the Energy Management and Control System (EMCS) or other control and interlocking requirements.
1. For all magnetic starters, a minimum of one set of field reversible auxiliary contacts shall be provided with the starter.

C. For 3-phase motors, unless otherwise specified herein:
1. Combination magnetic type and thermal magnetic circuit breaker with:
a. Circuit breakers having minimum AIC rating as specified in Division 26.
b. External operating handle capable of being locked in the off or open position.
c. Hand-off-automatic switch, except those manually controlled.
d. Starters for motors 50 hp and larger shall be solid-state, reduced-voltage type.

D. For 1-phase, unless otherwise specified herein:
1. Manual starting switch with thermal overload protection and pilot light.
2. Hand-off-automatic switch.
3. Magnetic across-the-line starters with overload protection and Hand-Off-Automatic switch, except for manually controlled equipment.

E. Provide control transformers for equipment with voltage above 240 volts, or as required for complete, operable systems.

F. Coordinate with DIVISION 26: ELECTRICAL.

G. Refer to individual equipment sections for factory-provided controllers.
1. Installed on equipment by manufacturer.
2. Supplied with equipment by manufacturer for field installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install in accordance with manufacturer’s written installation instructions.

C. Drives for packaged equipment shall be mounted and wired by equipment manufacturer.

D. Mounting and power wiring of field mounted motor controllers is specified under Division 26 Electrical:
1. Where wall space is not available for mounting motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure.

E. Set overload devices to suit motors provided in accordance with NEC.

3.02 INSTALLATION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.03 PRE-OPERATING CHECKS

A. Before operating motors and controllers.
   1. Check for proper and sufficient lubrication.
   2. Check for correct rotation.
   3. Confirm alignment and re-align if required.
   4. Check for proper adjustment of vibration isolation.

3.04 STARTUP, TESTING AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors.
   1. Check for high bearing temperatures.
   2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running.
   3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Owner.

C. Motor Controllers/Starters.
   1. Provide starters, push buttons, thermal overload switches, and contactors for equipment covered in Division 23 unless otherwise specified herein. Installation of starters, push buttons, and thermal overload switches, not factory installed, is specified under Division 23.
   2. Provide 120 V secondary control power transformers for control circuits where equipment is served at 208 V or higher.

D. See Section 230593 “Testing, Adjusting, and Balancing.”

3.05 TRAINING

A. See Section 230010 “Mechanical General Provisions.”

END OF SECTION

SECTION 23 05 29 HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:
1. Division 22 – Plumbing Work.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels.

B. Pipe Supports: ANSI B31.1, Power Piping.

C. Duct Hangers: SMACNA Duct Manuals.

1.04 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports”.

1.05 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
1. “R” means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe hangers and supports	R	R		R
Structural attachments	R			R
Pipe protection and thermal hanger shields	R	R		R
Equipment supports	R			R
Expansion shields	R			
Welding certificates	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Hangers, Inserts and Supports.
1. Unistrut.
2. Superstrut.
3. B-Line Systems.
4. Or equal.

C. Pipe Protection and Thermal Hanger Shields.
1. Pipe Shields, Inc.
2. Elcen Metal Products Company
3. Superstrut.
4. Or equal.

D. Expansion Shields.
1. Hilti Fastening Systems.
2. ITT Phillips Drill Co.: Red Head.
3. Omark Industries, Inc.
4. Or equal.

E. Pipe Stand Supports.
1. B-Line Systems, Inc.
2. Grinnell Corp.
3. PHD Manufacturing, Inc.
4. Or equal.

F. Powder-Actuated Fastener Systems.
1. Hilti Fastening Systems.
2. ITW Ramset/Red Head.
3. MasterSet Fastening Systems, Inc.
4. Or equal.

G. Insulation Protectors.
1. B-Line Systems, Inc.
2. ITT Grinnell Corporation.
3. PHD Manufacturing, Inc.
4. Or equal.

H. Pipe Supports at Grade.
1. MiFab.
2. B-Line Systems, Inc.
3. Miro.
4. Or equal

I. Miscellaneous Devices.
1. Kopty.
2. Wejit.
3. Or equal.

2.02 PIPE HANGERS AND SUPPORTS

A. Model numbers are Superstrut, unless otherwise indicated.

B. Provide electro-chromate, galvanized or factory painted finish; no plain, "black" hangers allowed.

C. Dielectric Isolators: All uninsulated copper tubing systems; Superstrut isolators or equal, Cush-A-Strip or Cush-A-Clamp on all pipe clamps; for individual hangers, use felt lined hangers.

D. Individual Pipe Hangers.
1. Cold pipe all sizes: Clevis hanger, No. C710.
2. Hot pipe sizes up to 4 in: Clevis hanger, No. C710.
3. Hot pipe sizes above 6 in: Adjustable steel yoke and cast iron, roll No. C729.

E. Multiple or Trapeze Hangers.
1. Factory channel.
a. 12-gauge thick steel.
b. Single or double section.
c. Electro-chromate finish.
d. Strutnuts: Series A-100 or CM-100.
e. Straps: Series 702.
f. No. A-1200 or A-1202.
2. Hot pipe sizes 6 in and larger: cast iron roll and stand; C728 or CR728.

F. Wall Supports.
1. Pipe sizes up to 3 in: Steel bracket No. C738.
2. Pipe sizes 4 in and larger: Welded steel bracket C-735.
3. Hot pipe sizes 6 inches and larger.
a. Welded steel bracket No. C739.
b. Adjustable steel yoke and cast iron, roller No.C729.

G. Vertical Support.
1. Riser clamp Series C-720.

H. Floor Support.
1. Hot pipe sizes up to 4 inch; cold pipe, all sizes.
   a. Adjustable cast iron saddle No. R786.
   b. Locknut nipple.
   c. Floor flange.
2. Hot pipe sizes 6 in and larger: Adjustable cast iron roll and stand No. R-730-C.

I. Thermal Hanger Shields (for insulated pipe supports).
1. 180-degree high density insert.
   a. 100 psi waterproofed cellular glass, asbestos-free, K=0.38, encased in a 360-degree galvanized sheet metal shield, ASTM A653.
   b. See Section 230719 Piping Insulation.
   c. Same thickness as adjoining pipe insulation.
2. 180-degree galvanized sheet metal shield (inverted saddle).
   a. Shield length and gauges.

Pipe Size	Shield Length	Minimum Gauge
1/2-1 1/2	4	26
2 - 6	6	20
8 - 10	9	16

3. Insert to extend one inch beyond metal shield ends on insulated piping.
4. Use double layer shield on bearing surface for:
   a. Roller hangers.
   b. Support spacing exceeding 10 feet.

J. Pipe Isolators.
1. Hanger with felt padding.
2. Tolco Fig. 3F or equal felt lined hangers.

K. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density cellular glass. Guide slide pads shall be Teflon. Ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000 or equal. Anchors shall be Pipe Shields, Inc. Model #C4000 or equal. See Section 230719 Piping and Equipment Insulation.

L. Insulated Pipe Strap.
1. 1/2 in to 1 in plumbing piping in wood frame construction.
2. Felt insulated.
3. Kopty or equal.

M. Escutcheons: See Section 230500 – Basic Mechanical Materials and Methods.

N. Flashing and Sleeves.
1. Flashings.
   a. See Division 7 – Thermal and Moisture Protection.
   b. Flash and counter flash watertight all pipe and duct penetrations of roofs and exterior walls.
   c. Flash pipes through roofs with ITWBuildex Dektite or equal.
   d. Flash vents through roofs with.
      1) Minimum 24-gauge soldered roof jack for flat surface roofs.
      2) Minimum 4-pound lead soldered roof jack for roofs other than flat surface roofs.
      3) Vandal caps.
      4) Provide counter-flashing sleeves and storm collars.

5) Caulk counterflashing and storm collar weather tight.
6) Other flashings shall be minimum 24-gauge galvanized sheet metal.

2. Sleeves.
   a. See 230500 – Basic Mechanical Materials and Methods.
   b. For insulated piping, sleeve diameter shall not be less than diameter of insulation.
   c. Terminate sleeves flush with walls, and ceiling.
   d. For exposed vertical pipe, extend sleeves 1 inch above finished floor except where escutcheons are required.
   e. Packing through fire rated partitions one of following.
      1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty.
      2) Dow-Corning LTV Silicone foam.
      3) Or equal.
3. Separate piping through walls, other than concrete walls, from contact with wall construction materials; use non-hardening caulking.
4. Install insulation on piping in walls which require insulation at time of installation.

2.03 DUCT HANGERS AND SUPPORTS

A. See Section 233113 – Metal Ducts.

2.04 STRUCTURAL ATTACHMENTS

A. Model Numbers are Superstrut, unless otherwise indicated.

B. All components shall have galvanized or equal finish.

C. Anchor Bolts: Size as specified for hanger rods.

D. Concrete Inserts.
1. Malleable iron.
2. Place reinforcing steel through insert as recommended by manufacturer for recommended loads.
3. No. 452 or equal.

E. Beam Clamps.
1. All with U-568 safety strap.
2. All with locknuts on.
   a. Set Screw.
   b. Hanger rod.
3. Bottom flange attachment.
   a. Loading 150-pound and less: U-563.
   b. Loading 150-pound to 300-pound: U-562.
   c. Loading more than 300-pound: U-560.
4. Top flange attachment.
   a. Permitted only when bottom flange attachment cannot be used.
   b. Loading 400-pound and less: M-777.
   c. Loading more than 400-pound: M-778.

F. Welded Beam Attachments: No. C-780 or equal.

G. Side Beam Attachments: No. 542 or equal.

H. Hanger Rods.
1. ASTM A575 Hot rolled steel, galvanized.
2. ANSI B1.1 Unified Inch Screw Treads.
3. Threaded both ends, threaded one end, or continuous threaded.

I. Hanger Rod Fixtures.
1. Turnbuckles: No. F-112 or equal.
2. Linked Eye Rod.
   a. Rod swivel.
   b. No. E-131 or equal.
3. Clevis: No. F-111 or equal.

J. Powder or Gas Actuated Anchors.
1. Not allowed on initial building construction; allowed only for revisions made after initial construction and with approval of Owner.
2. Hardened steel stud with threaded shank; size of shank to match hanger rod size.
3. Use only with non-shock loads.
4. Maximum load safety factors:
   a. Maximum anchor load: 100 pounds.
   b. Static loads – 5.
   c. Vibratory loads - 8-10.
5. For concrete and steel, not to be used for light weight concrete, brick or concrete block.
6. 10% testing rate required, testing by contractor.
7. Omark Drivit or equal.

K. Expansion Shields.
1. Carbon-steel anchors, zinc coated.
2. Stainless steel for corrosive atmospheres.
3. For normal concrete use.
   a. Self-drilling anchor.
   b. Sleeve anchor.
   c. Stud anchor.
4. For thin concrete use: wedge anchor.
5. For brick or concrete block use: sleeve anchor.
6. Maximum load safety factors.
   a. Static loads – 4.
   b. Vibratory loads - 8 – 10.
   c. Shock loads - 8 – 10.
7. Size to suit hanger rods.
8. ITT Phillips Red Head or equal.

L. Steel Deck Inserts.
1. Factory stud with.
   a. Clip.
   b. Spring.
   c. Coupling.
2. ITT Phillips Red-Head or equal.

M. Miscellaneous Metal.
1. Steel plate, shapes, and bars: ASTM A36.
2. Steel pipe columns: ASTM A53, Schedule 40, black.
3. Bolts and nuts: regular hexagon-head type, ASTM A307, Grade A.
4. Lag bolts: square head type, Fed. Spec. FF-B-561.
5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92.

2.05 PIPE SUPPORTS AT GRADE

A. All piping HVAC, plumbing, gas, etc. located above the roof (and supported by the roof) shall be supported utilizing the following roof supports.

B. Widebody rubber support base.

C. Materials:
1. Base: 100% recycled rubber, UV resistant.
2. Channel: 14-gauge galvanized steel (1-5/8-inch-wide x 1-5/8-inch high).
3. Rods: Two 1/2-inch electro zinc plated all threaded rod risers.

D. Maximum load: 800 lbs. for each 9.6-inch-long support.

E. Include strut clamp on condensate drain piping.

F. Include roller provisions on gas piping.

G. Sized appropriately for the quantity of piping being supported.

H. Gas Piping Supports: Mifab CR10/CRE10, Miro Model #4-RAH or approved equal.

I. Condensate Pipe Supports: Erico/Caddy Pyramid 50/TCC cushion clamp, or similar by Mifab, or approved equal.

2.06 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars, black and galvanized.

D. Concrete: Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28-day compressive strength of 3000 psi.

E. Grout: ASTM C1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 PIPE HANGERS, SUPPORTS AND GUIDES

A. General.
1. Assure adequate support for pipe and contents.

2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
4. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and style as installed for adjacent similar piping.
5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards.
6. Support all piping within 2 feet of each change of direction on both sides of fitting.
7. Thermal hanger shields shall be provided at hangers and supports where piping is insulated.
8. Prevent vibration or swaying.
9. Provide for expansion and contraction.
10. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted.
11. Comply with applicable requirements at ANSI B31.1 and B31.2 for piping.
12. Support piping independently so that equipment is not stressed by piping weight or expansion.
13. Hangers and supports shall have minimum safety factor of five (5), based on ultimate tensile or compressive strength, as applicable, of material used, base calculations on equipment's heaviest operating weight and pipes full of water.
14. Install additional supports or braces if, during normal operation, piping should sway, crawl or vibrate. Piping shall be immobile.
15. Install thrust blocks as required to prevent sway.

B. Horizontal piping, except as noted.
1. Adjustable clevis type and rod; all services at or below 250 degrees F.
2. Rollers or slide bases: not required.
3. Trapeze hangers; guide individual pipes on trapezes with 1/4-inch U-bolt or Superstrut 702 pipe clamp.
   a. Install thermal hanger shield at each support point.
4. Galvanized sheet metal shields between hangers and PVC piping.
5. Threaded steel rods.
   a. 2-inch vertical adjustment with 2 nuts each end for positioning and locking.
   b. Size to 12-inch inside pipe size (IPS).

Pipe, IPS	Rod
to 2 inch	3/8 inch
2-1/2 inch and 3 inch	1/2 inch
4 inch	5/8 inch
6 inch and 8 inch	3/4 inch
10 inch and 12 inch	7/8 inch
14 inch and 18 inch	1 inch
20 inch and 30 inch	1-1/4 inch

   c. Size above 12-inch IPS and multiple pipe standards: safety factor of 5 on ultimate strength on area.
   d. For double rod hangers: 1 size smaller than above.

C. Vertical piping.
1. Base support.
   a. Base elbow or welded equivalent.
   b. Bearing plate on structural support.

2. Guides.
   a. At every third floor but not to exceed.
      1) 25 feet for piping to 2-inch.
      2) 36 feet for piping 2-1/2 inch to 12-inch.
      3) 50 feet for piping 14 inch and larger.
   b. Or as otherwise designed by the Vibration Isolation vendor.
3. Top support.
   a. Special hanger or saddle in horizontal connection.
   b. Provisions for expansion.
4. Intermediate supports: steel pipe clamp at floor.
   a. Bolted and welded to pipe.
   b. Extension ends bearing on structural steel or bearing plates.
5. For multiple pipes: coordinate guides, bearing plates and accessory steel.

D. Horizontal insulated piping.
1. Install saddles for rollers or slide bases.
2. Install thermal hanger shields for all other types of supports.
3. See Section 230719 Piping and Equipment Insulation for insulation connection to shields.

E. Vertical insulated piping.
1. Install thermal hanger shields at guides.
2. See Section 230719 Piping and Equipment Insulation for insulation connection to shields.

F. Install Pipe Isolators between hangers and piping for all uninsulated copper tubing.

G. Miscellaneous Steel.
1. Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions.

H. Fire-stopping.
1. At pipe penetrations through rated assemblies.
2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.

I. Roof pipe supports shall be installed per manufacturer’s recommendations in coordination with the roofing system and company holding the roof warranty.

3.02 PIPE SUPPORT SPACING

A. Maximum spacing for horizontal piping.

Type of Pipe	Size	MAXIMUM SPACING
Steel	1-1/2 inch and smaller	7 feet
	2 inch and larger	10 feet
Copper	3/4 inch and smaller	5 feet
	1- 1-1/4 inch	6 feet
	1-1/2 - 3 inch	8 feet
	4 inch and larger	10 feet
Plastic	3/4 inch and smaller	3 feet
	1" - 1-1/2"	6 feet
	1-1-1/4 inches	6 feet

	1-1/2″-3″	8 feet
	4 inch and larger	10 feet

B. Spacing Notes: Additional supports at:
1. Changes in direction.
2. Branch piping and runouts over 5 feet.
3. Concentrated loads due to valves, strainers, and other similar items.
4. At valves 4 inch and larger in horizontal piping, support piping on each side of valve.

C. Parallel piping on trapezes.
1. Maximum spacing to be that of pipe requiring closest spacing.

3.03 ATTACHMENT TO STRUCTURE

A. Concrete.
1. Use inserts for suspending hangers from reinforced concrete slabs, walls, and sides of reinforced concrete beams wherever practicable.
2. Set inserts in position in advance of concrete work.
3. Provide reinforcement rod in concrete for inserts carrying.
   a. Pipe over 4-inch.
   b. Ducts over 60 inches wide.
4. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
5. Where inserts are omitted, install hangers with expansion shields.
6. Through-deck support.
   a. Drill through concrete slab from below.
   b. Provide rod with recessed square steel plate and nut above slab.
7. Where permitted by Owner and only for revisions made after initial construction, powder actuated anchors or expansion shields may be used in lieu of inserts.
   a. In bottom of thick slabs.
   b. In thin slab construction, only in sides of beams.
8. Pre-Cast Concrete.
   a. Use pre-set inserts.
   b. Where inserts are not available, field drill through beam or joists at locations as directed by Architect.
   c. Through bolt side beam bracket to beam or joist.
9. Poured-In-Place Concrete.
   a. With metal form or underdeck.
   b. Before concrete is poured.
      1) Field drill hole through metal deck.
      2) Provide bearing plate, nut, and locknut on rod; or install factory-made steel deck inserts specified hereinbefore.
   c. After concrete is poured.
      1) Install hangers with expansion shields.

B. Steel Beam Anchors.
1. Beam or channel clamps.
2. Do not cut or weld to structural steel without permission of structural engineer.

C. Steel Deck Anchors.
1. Concrete filled: as specified above.
2. Decking without concrete.
   a. Through rod Support.
      1) Weld to square plate, 1/4 in thick.
      2) Plate to distribute load over minimum of two full cells.
      3) Coordinate with floor layouts to clear cells with wiring.

D. Side Wall Supports.
   1. Concrete walls: As specified for hangers.
   2. Stud Walls.
      a. Toggle bolts.
      b. Stud welded to structural studs.

E. Support Spreaders.
   1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment.
   2. Spreaders may be one of methods listed below, or combination of both as required.
      a. Fabricated from structural channel.
         1) End fittings bolted or welded.
         2) Secure to structural members.
            a) As required by construction.
            b) As reviewed by Structural Engineer.
      b. Formed channels with fittings, Superstrut or equal.
         1) Submit manufacturer's calculations for installation.

3.04 DUCT HANGERS AND SUPPORTS

A. See Section 233113 Metal Ducts.

.

3.05 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and floor pipe supports. Finish shall provide a smooth bearing surface.

3.06 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.07 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.08 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 53 MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Equipment nameplates.
2. Access panel and door markers.
3. Duct markers.

1.03 REFERENCE STANDARDS

A. Pipe marker shall comply with ANSI A13-1.

1.04 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe markers	R		R	
Duct markers	R		R	
Equipment tags	R		R	
Concealed equipment markers	R		R	
Equipment label schedule		R		

1.05 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.06 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.
   1. Brimar Industries, Inc.
   2. Seton Identification Products.
   3. Marking Services, Inc.

2.02 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Labels:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
   9. Label Content: Include equipment's Drawing designation or unique equipment number, serial number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

B. Warranty Label:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
9. Label Content: Include warranty information including start date, end of parts and labor warranty date, contact name and contact number. Coordinate information with professional and end user before making labels.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.03 ACCESS PANEL AND DOOR MARKERS

A. Access panel and access door markers:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: Principal lettering shall be 1/2 inch. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label access panels and access doors identifying “Fire Damper, Fire/Smoke Damper”, etc.

2.04 DUCT LABELS

A. Not required.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces, of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment (including motor starters, VFDs, control panels, etc.)

B. Locate equipment labels where accessible and visible.

C. Install access panel markers with screws on equipment access panels.

3.04 EQUIPMENT LOCATOR STICKERS

A. Install color-coded stickers on the grid, access panel, or insulation at the closest access point to the device.

B. Install color-coded stickers to locate above ceiling equipment and devices as follows:
1. Fire dampers (red).
2. Manual volume dampers (orange).
3. Motorized control dampers (yellow).
4. HVAC equipment (black).
5. Hydronic system valves (green).
6. Control system devices (light blue).
7. Cold water (blue).
8. Hot water (red).

3.05 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.06 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Operational testing and adjusting of air handling equipment.
      b. Balancing of air distribution systems.
      c. Testing and adjustment of air terminal devices.
   2. Witnessing and certification of duct air leakage tests.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.04 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
AABC or NEBB certification	R			
Report forms	R			
List of instrumentation	R			
Final air balancing report		R		

C. Final Test & Balance Report.
   1. At least 15 days prior to Contractor's request for final inspection, submit electronic copy of final reports on approved reporting forms, and certifications for review and approval by Architect. Once approved, provide required quantity of paper and electronic copies per 230010 "Mechanical General Provisions."
   2. Form of final reports.
      a. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded.
      b. Each individual final reporting form must bear:
      c. Identify instruments of all types that were used and last date of calibration of each.
      d. Certifications.

1.05 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. Prior to start of testing, adjusting, and balancing, verify that required Project conditions are met:
   1. System and control system installation is complete and in full operation.
   2. All pre-functional tests have been performed.
   3. Equipment has been started and tested in accordance with manufacturer's installation instructions.
   4. Doors and windows are in place and closed or under normal traffic conditions.
   5. Proper mostly clean air filters are in place.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.06 PROJECT REVIEW

A. Construction Review.
   1. Make on-site visits during progress of construction: Number and timing of visits to be as required to perform the functions specified below.
   2. Purpose of review.
      a. Identify potential problem for performing total system balance.
      b. Identify modifications that will affect air total system balance.
      c. Schedule and coordinate total system balance with other work.
      d. Identify conditions that could create hazardous environment for building occupants.
   3. Typical activities.
      a. Check that necessary balancing and measuring hardware is:
         1) In place.
         2) Located properly and accessibly.
         3) Installed correctly.
      b. Identify and evaluate variations from system design.
      c. Record data from equipment nameplates.

d. Identify and report possible restrictions in systems, such as:
   1) Closed fire dampers.
   2) Long runs of flexible duct.
   3) Poorly designed duct fittings.
   4) Questionable piping connections.
   5) Others as may arise or based on Agency's experience.
e. Verify that construction progress will not delay total and/or phased project system balance.
f. Identify best location for duct Pitot tube traverses.
g. Identify scaffolding and other access needs.

B. Verify and coordinate TAB activities on projects with phased sequences requirements.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply.
   1. Voltmeter: plus, or minus 1 percent scale.
   2. Ammeter: plus, or minus 1 percent scale.
   3. Ohmmeter: plus, or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current.
   4. Ultrasonic time-of-travel strap-on flow sensor: plus, or minus 5 percent of reading.
   5. Other flow sensors: plus, or minus 2 percent of reading.
   6. Water pressure gauge: plus, or minus1/2 percent scale, ASME Grade 2A.
   7. Watt meter, plus, or minus1/2 percent scale: 3 phase split core current transducers.
   8. Temperature: plus, or minus 0.4 degrees Fahrenheit.
   9. Calibrated balance valve manufacturer's test kit and required instrumentation.

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 - EXECUTION

3.01 GENERAL

A. Coordinate with work of other trades.

B. Coordinate TAB with project phasing.

C. Report to Professional any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air distribution systems.

D. Perform testing, adjusting, and balancing in accordance with AABC or NEBB standards.

E. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 230713 “Duct Insulation” and Section 230719 “Piping and Equipment Insulation.”.

F. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

3.02 AIR SYSTEMS BALANCING

A. General.
1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.
2. Filters.
a. Check that proper specified filters are installed, oriented in the proper airflow direction, free of bypass, and clean.
b. Make no adjustment for dirty filters, fans were selected for clean filters at design airflow.
c. Adjust airflows to within 5% of scheduled quantities.

B. Air Outlets.
1. Adjust diffusers’ throw pattern, grilles and registers to pattern indicated on the Drawings. Review manufacturer’s instructions for proper diffuser blade or weir gate positions to provide this throw pattern as it is not always intuitive. It is TAB agency’s responsibility to adjust throw patterns for all adjustable throw diffusers. If diffuser has a fixed throw pattern and is incorrectly installed, HVAC contractor shall correct pattern prior to balance.
a. Ceiling diffusers: As indicated on the Drawings.
1) Star pattern diffuser deflectors shall be adjusted for corner blow pattern unless otherwise indicated on Drawings.
b. Double-deflection grilles: Adjust rear blades horizontal 22 degree upward and splay front blades in 45-degree pattern at each end gradually rotating to almost straight at blades in center of grille.
c. Floor grilles: Not applicable.
2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements.
a. Start with all dampers wide open.
b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face (if any) unless absolutely required.
c. At least one damper shall remain wide open at end of balance.
3. Plenum return air grilles or slots in lights: No balance required.
4. Report.
a. Tag each grille, diffuser and register and mark tag on copy of floor plan.
b. For each grille, diffuser, and register, indicate tag, size, type, and effective area (where applicable).
c. Required velocity/cubic feet per minute.
d. Initially tested velocity/cubic feet per minute.
e. Finally tested cubic feet per minute after adjustments.

C. Packaged Equipment Air Flow Rate Readings.
   1. Total supply air quantities shall be determined at all of the following where applicable:
      a. Pitot traverse in the supply duct downstream, positive pressure side of the fan.
      b. Pitot traverse at coil or filter bank.
      c. Totaling the readings of individual air outlets.
   2. Total return air quantities shall be determined at all of the following where applicable:
      a. Pitot traverse in the return air duct or damper entering air handler.
      b. Totaling the readings of individual air outlets if ducted return system.
   3. Outside air quantities shall be determined by all of the following where applicable:
      a. Subtracting pitot traverses of supply and return ducts.
      b. Pitot traverse of outdoor air intake duct.
      c. Note: Balance by measurement of return air, outside air, and mixed air temperatures shall not be used due to inherent inaccuracy.

D. Package Equipment.
   1. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed.
      a. Adjust sheaves on fans with adjustable sheaves.
      b. Change sheaves on fans with fixed sheaves.
      c. Adjust speed potentiometer for EC motors.
      d. Adjust SCR for direct drive PSC motors.
   2. Test and adjust minimum outdoor air flow.
      a. Supply air fan shall first be operating at design airflow.
      b. For systems with economizers.
         1) Open return air damper fully.
         2) Adjust the outdoor air damper signal through the EMCS until the minimum outdoor airflow rate is achieved.
         3) Convey this minimum signal to EMCS installer and note on air balance report.
      c. For systems without economizers.
         1) Adjust minimum outdoor air or return air damper balancing damper position or linkage to deliver design minimum outdoor airflow rate.
         2) Clearly mark minimum damper position on damper housing.
   3. Test with system operating at minimum outside air flow condition described above and record the following on a schematic of the system.
      a. Tag.
      b. Manufacturer and model of fan and motor.
      c. Sheave data at motor and fan; belt data.
      d. Motor horsepower, rpm, volts, phase, FLA.
      e. Fan airflow rate at all locations measured, as listed above.
      f. Final measured amps.
      g. Static pressure measured at:
         1) Return air plenum.
         2) Mixed air plenum.
         3) Downstream of filter.
         4) Downstream of coil.
         5) Discharge of fans.
      h. Concurrent airflow rate readings from EMCS airflow sensors, where applicable.
      i. Minimum EMCS outdoor air control signal, where applicable.

E. Exhaust Fans.
   1. See herein for air outlet balancing.
   2. Total air quantities for fan shall be determined by both:
      a. Pitot tube traverse of main ducts near the fan inlet, and.
      b. Totaling the readings of individual air outlets (or inlets).

3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed.
    a. Constant speed fans:
        1) Adjust sheaves on fans with adjustable sheaves.
        2) Change sheaves on fans with fixed sheaves.
        3) Adjust speed potentiometer for EC motors.
    b. Variable speed fans:
        1) Adjust maximum fan speed at ECM or VFD.
4. Report.
    a. Tag.
    b. Manufacturer and model of fan and motor.
    c. Sheave data at motor and fan; belt data.
    d. Motor horsepower, rpm, volts, phase, full load amps.
    e. Fan airflow rate at all locations measured, as listed above.
    f. Final measured amps.
    g. Inlet and outlet static pressure.

3.03 DUCT AIR LEAKAGE TESTS

A. TAB Agency shall witness duct air leakage tests once Division 23 HVAC contractor confirms in writing that all ductwork has passed the pretest.

B. TAB Agency shall initial Duct Air Leakage Test Log for each section of duct tested certifying that duct passed the maximum permitted air leakage test as specified in Section 233113 – Metal Ducts.

3.04 ADDITIONAL COST

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Architect, and replace sheaves as required.

3.05 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by the Architect. Schedule spot checks with Architect at least 1 week prior to proposed test date.

C. Architect shall select subsets of any tested and balanced air system to be spot-checked on the day of tests without prior notice to the Contractor.
    1. Spot-checking will not require more than one working day.
    2. If additional spot checks are requested by the Architect causing the time limit above to be exceeded, inform Architect, and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies.
   1. If any of the spot-check measurements differ more than 25 percent from those documented in test and balance reports, the Agency shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.
   2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.
   3. Rebalance work shall be witnessed by the Architect at the option of the Architect.
   4. All rebalance work shall be documented, and documentation shall be resubmitted as specified above.
   5. All rebalance work shall be provided at no additional cost to the Owner.

3.06 TRAINING OWNER PERSONNEL

A. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

B. Discuss any outstanding deficient items in control, ducting, piping, or design that may affect the delivery of air.

C. Identify and discuss any systems or system components that are not meeting their design capacities.

D. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

E. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting, and balancing or the mechanical systems.

END OF SECTION

SECTION 23 07 13 DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following duct services:
   1. Ducts and plenums, thermal insulation.
   2. Ducts and plenums, acoustic insulation.
   3. Ducts and plenums, fire rated insulation.
   4. Duct liner.

B. Related Sections:
   1. Section 230719 Piping and Equipment Insulation.

1.03 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe.

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation.

F. ASTM E84 – Surface Burning Characteristics of Building Materials.

G. ASTM E96 – Water Vapor Transmission of Materials.

H. NFPA 255 – Surface Burning Characteristics of Building Materials.

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.

J. UL 723 – Surface Burning Characteristics of Building Materials.

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.04 DEFINITIONS

A. Duct Dimensions.
   1. Duct sizes indicated on Drawings shall be clear inside dimensions unless duct size is specifically indicated as outside dimensions (OD).

1.05 QUALITY ASSURANCE

A. Source Quality Control.
   1. Service: Use insulation specifically manufactured for service specified.
   2. Labeling: Insulation labeled or stamped with brand name and number.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.06 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. "R" means required.
   2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Duct insulation, wrap and liner	R			
Jackets	R			
Adhesives and coatings	R			
Mechanical fasteners	R			
Installer qualifications	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: fiberglass.
   1. Owens-Corning Fiberglass Corporation.
   2. Johns Manville.
   3. Certainteed Corporation.
   4. Knauf.
   5. Or equal.

C. Adhesives.
   1. Childers Brand; H. B. Fuller Construction Products.
   2. Foster Brand; H. B. Fuller Construction Products.
   3. Mon-Eco Industries, Inc.
   4. Or equal.

D. Mechanical Fasteners.
   1. AGM Industries, Inc.
   2. Miracle Adhesives Corporation.
   3. Grip-Nail.
   4. Or equal.

2.02 GENERAL

A. Energy Codes: The current versions of ASHRAE 90.1 shall govern where requirements for thickness exceeds thickness specified.

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963).
   1. Flamespread: maximum 25.
   2. Fuel contributed, and smoke developed: maximum 50.
   3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable.

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

2.03 MATERIALS

A. Duct Wrap with Vapor Barrier, Type DW-V.
   1. Insulation: ASTM C553 and C612; flexible, noncombustible blanket.
      a. Installed 'K' ('Ksi') value: ASTM C518, 0.27 at 75 degrees Fahrenheit.
      b. Maximum service temperature: ASTM C411, 250 degrees Fahrenheit.
      c. Maximum moisture absorption: 0.20 percent by volume.
   2. Vapor Barrier Jacket - factory installed. (FSK).
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
      b. Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
      c. Secure with pressure sensitive tape.
   3. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based, adhesive.
      a. Flexible fiberglass wrap
         1) Supply Air: 2.2” Nominal Thickness with Installed R-Value 6.0 (0.75 pcf)
         2) Return/Outside/Exhaust Air: 1.5” Nominal Thickness with Installed R-Value 4.2 (0.75 pcf)
      b. Installed conductance: 0.27 BTU-inch/hr./square foot/degree Fahrenheit.
      c. Factory applied jacket.
         1) Foil-scrim-kraft laminate: Aluminum foil facing.
         2) Glass scrim reinforcing.
         3) Kraft paper backing.
      d. Maximum vapor permeance: 0.02 perms,

4. Owens-Corning All Service Faced Duct-Wrap or equal.

B. Duct Board with Vapor Barrier, Type DB-V
   1. Insulation: ASTM C612; rigid, noncombustible board.
      a. 'K' ('Ksi') value: ASTM C518, 0.23 at 75 degrees Fahrenheit.
      b. Maximum service temperature: 350 degrees Fahrenheit.
      c. Maximum moisture absorption: 0.20 percent by volume.
   2. Vapor Barrier Jacket - factory installed (FSK).
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
      b. Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
      c. Secure with pressure sensitive tape.
   3. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based, adhesive.
   4. Installed conductance: 0.23 BTU-inch/hr./square foot/degree Fahrenheit.
   5. Thickness per Duct Insulation Type and Thickness Schedule.
   6. Factory applied jacket.
      a. Foil-scrim-kraft laminate.
         1) Aluminum foil facing.
         2) Glass scrim reinforcing.

C. Rectangular Duct Liner, Type AL.
   1. Material.
      a. Insulation: ASTM C423.
      b. 'K': ASTM C518, 0.23 at 75 degrees Fahrenheit.
      c. Maximum service temperature: 350 degrees Fahrenheit.
      d. Maximum moisture absorption: 0.20 percent by volume.
      e. Thickness per Duct Insulation Type and Thickness Schedule.
      f. 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot.
      g. Installed conductance: 0.25 BTU-inch/hr./square foot/degree Fahrenheit.
   2. Interior air side surface.
      a. Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21.
      b. Suitable for velocity up to 4000 feet per minute.
      c. Meet erosion test method described in UL publication No. 181.
      d. Durable and mechanically cleanable.
      e. EPA registered anti-microbial agent.
      f. Certainteed Toughgard Duct Liner or equal.
      g. Adhesives.
         1) Duct Insulation, Internal: Foster 85-60 or equal.
         2) Weld Pins: Duro-Dyne CP or equal.

D. Round Duct Liner, Type RAL.
   1. Same material as Type AL.
   2. Interior air-side surfaces same as Type AL.
   3. Self-supporting, slide-in installation.
   4. Schuller Permacote Spiracoustic or equal.
   5. Small diameter ducts which cannot be insulated internally using duct lining materials shall be prefabricated. Insulation material shall be fixed between outer duct metal and a perforated metal liner. United McGill k27 series or equal. Fittings shall be insulated to same standard and shall be by same manufacturer.

E. Plenum Liner, Type PL
   1. Material.
      a. Heavy-density mat-faced Plenum Liner: Comply with ASTM C 1071.
      b. 'K': ASTM C518, 0.23 at 75 degrees Fahrenheit.

c. Maximum service temperature: 350 degrees Fahrenheit.
d. Maximum moisture absorption: 0.20 percent by volume.
e. Thickness per Duct Insulation Type and Thickness Schedule.
f. 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot.
g. Installed conductance: 0.25 BTU-inch/hr./square foot/degree Fahrenheit.

2. Interior air side surface.
   a. Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21.
   b. Suitable for velocity up to 4000 feet per minute.
   c. Meet erosion test method described in UL publication No. 181.
   d. Durable and mechanically cleanable.
   e. EPA registered anti-microbial agent.
   f. Knauf Insulation Rigid Plenum Liner or equal.
   g. Adhesives.
      1) Duct Insulation, Internal: Foster 85-60 or equal.
      2) Weld Pins: Duro-Dyne CP or equal.

2.04 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Duct Board, Type FB:
   1. Structural-grade, press-molded, xonolite calcium silicate.
   2. Fireproofing board suitable for operating temperatures up to 1700 deg F.
   3. Comply with ASTM C 656, Type II, Grade 6.
   4. Tested and certified to provide a 1 or 2-hour fire rating (as required by application) by an NRTL acceptable to authorities having jurisdiction.
   5. 3M Fire Barrier Duct Board or equal.

B. Fire-Rated Duct Wrap, Type FW:
   1. High-temperature, flexible, blanket insulation with FSK jacket.
   2. Tested and certified to provide a 1 or 2-hour fire rating (as required by application) by an NRTL acceptable to authorities having jurisdiction.
   3. 3M Fire Barrier Duct Wrap or equal.

PART 3 - EXECUTION

3.01 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule.

Location	Cooling or Heat/Cool Supply	Return/Outdoor Air	Exhaust
Supply/return ductwork concealed in ceiling or return air plenum	2.2 inches DW-V	1-1/2 inches DW-V	1-1/2 inches DW-V
Transfer air ducts concealed in ceiling or return air plenum	1 inch 1.5 pounds per Cubic foot AL or AL	1 inch 1.5 pounds per Cubic foot AL or AL	-
Concealed in unconditioned spaces (attic area)	2.2 inches DW-V & 1 inch AL	1-1/2 inches DW-V & 1 inch AL	1-1/2 inches DW-V & 1 inch AL

Location	Cooling or Heat/Cool Supply	Return/Outdoor Air	Exhaust
Exposed outdoors	See Section 233115	See Section 233115	-
Lined duct on first 6' pf R/A and S/A ductwork from HVAC equipment	2 inches 1.5 pounds per Cubic foot AL	2 inches 1.5 pounds per Cubic foot AL	-
Exposed to view duct	1 inch 1.5 pounds per Cubic foot AL or AL	1 inch 1.5 pounds per Cubic foot AL or AL	-
Flex duct	By manufacturer	By manufacturer	-
Air distribution devices, not factory insulated (backpans of grilles, registers, and diffusers)	2.2 inches DW-V	-	-

3.02 NON-INSULATED DUCTWORK

A. No insulation required for ducts so indicated in Duct Insulation Type and Thickness Schedule, and the following:
   1. Factory-insulated flexible ducts.
   2. Factory-insulated plenums and casings.
   3. Indoor flexible connectors.
   4. Indoor vibration-control devices.
   5. Factory-insulated access panels and doors.

3.03 DUCT INSULATION INSTALLATION

A. General.
   1. Ensure that insulation is continuous through all walls.
   2. Finish insulation neatly at hangers, supports and other protrusions.
   3. Locate insulation joints or cover seams in least visible locations.
   4. Where ducts run in groups too close to be individually insulated and finished.
      a. Completely fill all spaces between ducts with rigid or flexible insulating material.
      b. Insulate and finish exterior surfaces of group as specified for particular service.
   5. Where ducts cannot be insulated after erection, insulate prior to installation.
   6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered.
   7. Preparation:
      a. Do not install covering before ductwork and equipment has been tested and reviewed.
      b. Ensure surface is clean and dry prior to installation.
      c. Ensure insulation is dry before and during application.
   8. Mechanical fasteners:
      a. Use spot weld anchors in all shop fabricated internally lined ducts.
      b. Adhered anchors.
      c. Clip off pin penetrations flush with insulation surface or facing.
      d. Seal pins and washers where pins penetrate vapor barriers.
         1) With 4-inch square pieces of vapor barrier material to match facing.
         2) Adhere with vapor-seal adhesive.

e. Spacing on rectangular ducts.
   1) Typical of horizontal and vertical, unless otherwise specified.
   2) Duct board.
      a) 3 inches in from edges.
      b) Intermediate fasteners: 12 inches on center maximum spacing all directions.
      c) Not less than four pins per surface.
   3) Duct Wrap.

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

   4) Duct wrap spacing applicable to flat surfaces of flat oval ducts.

9. Provide 24-gauge sheet metal Z section frames over edges of duct and plenum lining.
   a. At access openings and doors.
   b. Along edges exposed to air flow.

B. Rectangular Duct Wrap.
   1. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing.
   2. 2 inches lap strip at one end.
   3. Peel insulation for 2-inch lap strip along longitudinal joints.
   4. Seal lap strips with vapor-seal adhesive; Foster's 85-60 or equal.

C. Round Duct Wrap.
   1. Adhere flexible insulation to ductwork with adhesive applied in 6-inch-wide strips on 16-inch centers.
   2. Provide 16-gauge annealed tie wire tied, spiral wound or half hitched at 16-inch centers.
   3. Overlap insulation 2 inches and seal joints and breaks with 2-inch lap of foil adhered over joint.
   4. Apply duct wrap with vapor barrier as specified above for rectangular ducts.

D. Duct Board.
   1. Comply with published recommendations of manufacturer.
   2. Secure on top, sides, and bottom of duct with mechanical fasteners, spacing as scheduled.
   3. Secure with 4-inch strips of adhesive, 8-inch on center.

E. Rectangular Duct and Plenum Lining.
   1. Comply with SMACNA Duct Liner Application Standard, published recommendations of manufacturer, and following:
   2. Apply adhesive over 100 percent of surfaces to be lined.
   3. The coated surface shall face air stream.
   4. Surface adjacent to air flow, including at joints, to be uniformly flat.
   5. Insulation on floors of plenums and large ducts where access is required shall be protected by wire mesh so that lining is not damaged when walked or crawled on.
   6. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides; all joints with vapor barrier mastic and taped.

7. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation.
8. Seal butt joints and exposed edges of liner to prevent erosion.
9. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive.
10. Damaged areas replaced or heavily coated with adhesive.
11. Mechanical fasteners.
    a. Use weld pins.
    b. Install mechanical fasteners.
        1) Weld pins flush with liner surface. Weld pins spaced maximum of 12-inch on center in both directions and within 2 inches of all corners and joints, except where SMACNA Standard requires closer spacing.
        2) Within 2 inches of all edges.
        3) Minimum 4 pins per side.
        4) For field alterations of lined ducts, install adhesive and glued pins with washers. Clip-off pins after washers installed. Field installed pins shall be used for unusual conditions only and shall not exceed 1 percent of total pins.

3.04 PENETRATION THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer's installation and listing requirements.

3.05 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

C. See Section 233113 – Metal Ducts for protection of lined duct during construction.

END OF SECTION

SECTION 23 07 19 PIPING AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Piping insulation.
   2. Pipe insulation jacket.
   3. Equipment insulation.

1.03 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe.

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation.

F. ASTM E84 – Surface Burning Characteristics of Building Materials.

G. ASTM E96 – Water Vapor Transmission of Materials.

H. NFPA 255 – Surface Burning Characteristics of Building Materials.

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible.

J. UL 723 – Surface Burning Characteristics of Building Materials.

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

1.04 QUALITY ASSURANCE

A. Source Quality Control.
   1. Service: Use insulation specifically manufactured for service specified.
   2. Labeling: Insulation labeled or stamped with brand name and number.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
   1. Piping Mockups:
      a. One 10-foot section of NPS 2 straight pipe.
      b. One each of a 90-degree threaded, welded, and flanged elbow.
      c. One each of a threaded, welded, and flanged tee fitting.
      d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
      e. Four support hangers including hanger shield and insert.
      f. One threaded strainer and one flanged strainer with removable portion of insulation.
      g. One threaded reducer and one welded reducer.
      h. One pressure temperature tap.
      i. One mechanical coupling.
   2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
   3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   4. Obtain Architect's approval of mockups before starting insulation application.
   5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed.

1.05 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping insulation	R			
Jackets	R			
Adhesives and coatings	R			
Mechanical fasteners	R			
Installer qualifications	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: Elastomeric Closed Cell.
   1. Armstrong World Industries, Inc.
   2. Rubatex Corporation.
   3. Or equal.

C. Weatherproof Aluminum Jacket.
   1. Childers Products Company.
   2. Insul-Coustic/Birma Corporation.
   3. Or equal.

D. Adhesives.
   1. Armstrong 520 Adhesive.
   2. Or equal.

E. Mechanical Fasteners.
   1. AGM Industries, Inc.
   2. Miracle Adhesives Corporation.
   3. Grip-Nail.
   4. Or equal.

2.02 GENERAL

A. Energy Codes: The current versions of ASHRAE 90.1 shall govern where requirements for thickness exceeds thickness specified.

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963).
   1. Flamespread: maximum 25.
   2. Fuel contributed, and smoke developed: maximum 50.
   3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable.

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation.

D. Provide a continuous vapor seal for any service piping that carries liquid below 60 degrees Fahrenheit.

2.03 PIPE INSULATION

A. Flexible, closed cell elastomeric thermal insulation.
   1. Insulation ASTM C534.
   2. Service rating of 220 degrees Fahrenheit.
   3. Density 6.0 pounds per cubic foot.
   4. Closed cell foam: Vapor permeability ASTM E96 0.2 perm.
   5. Max moisture absorption: 1.0 percent by volume, 10 percent by weight.
   6. Molded pipe insulation.
      a. Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature
      b. Maximum water vapor transmission rating of 0.17 perm-inches,
   7. Sheet insulation.
      a. Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature.
      b. Maximum water vapor transmission rating of 0.17 perm-inches.
   8. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal.

2.04 EQUIPMENT INSULATION

A. Flexible, closed cell elastomeric thermal insulation.
   1. Insulation ASTM C534, Type II sheet material.
   2. Service rating of 220 degrees Fahrenheit.
   3. Density 6.0 pounds per cubic foot.
   4. Closed cell foam: Vapor permeability ASTM E96 0.2 perm.
   5. Max moisture absorption: 1.0 percent by volume, 10 percent by weight.
   6. Sheet insulation.
      a. Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature.
      b. Maximum water vapor transmission rating of 0.17 perm-inches.
   7. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal.

2.05 JACKETS

A. Aluminum Jacket: ASTM B209.
   1. Use for weatherproof jacket.
   2. Thickness: 0.016 inch sheet.
   3. Finish: Embossed.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel.

B. Preformed Pipe Fitting Covers:
   1. Aluminum.
      a. Factory fabricated formed covers.
      b. General Aluminum Supply Corporation GASCO or equal.

2.06 ADHESIVES AND COATINGS

A. Foster product names and figure numbers or equal.
   1. Lagging adhesive: 30-36.
   2. Vapor barrier coating: Tite-fit 30-80, UP Label, comply with MIL-C-19565C, Type II; fire and water resistant.
   3. Vaporseal adhesive: 85-60.

4. Outdoor mastic: 30-90.
5. Asphalt mastic: C.I. Mastic 60-25.
6. For elastomeric insulation: 520 contact, adhesive.

2.07 WIRE, BANDING AND FASTENING DEVICES

A. Wire: minimum 16 gauge copper clad annealed steel wire

B. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:
1. Aluminum: 0.007 inches. Except where exposed to weather, 0.020 inches.
2. Stainless steel: 0.010 inches.

C. Staples: outward clinching type of corrosion resistant steel.

2.08 MECHANICAL FASTENERS

A. Mild steel, copper plated.

B. AGM Industries Power Base insulation pins or equal.

C. Insulation washers:
1. Galvanized steel.
2. 1-1/2 inch diameter.
3. AGM Industries SLW-1 or equal.

2.09 FIRESTOPPING

A. At pipe penetrations through rated assemblies.

B. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.

C. Insulation shall be continuous through penetration.

2.010 ACCESSORIES

A. Insulation Protection Saddles: 12-inch long, 16 gauge steel.

B. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives.

PART 3 - EXECUTION

3.01 PIPE & EQUIPMENT INSULATION SCHEDULE

A. Type P-1.
1. Flexible elastomeric insulation.

B. Type E-1.
1. Flexible elastomeric insulation.

C. Application Schedule.

D. Piping Systems	E. Location	F.	G. Pipe Size	H. Insulation Thickness	I. Freeze Protection
K. Cold Condensate Drain Lines	L. Interior	M.	N. All Sizes	O. 3/4"	P. -
Q. Refrigerant suction	R. All	S.	T. All Sizes	U. 3/4"	V. -

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Coordinate with work of other trades.

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

D. Install insulation where it cannot become wet. If insulation becomes wet, remove, and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges, and accessories.

F. On piping exposed to public view, locate insulation and cover seams in least visible locations.

G. Insulate fittings, joints, and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fittings. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping.

I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations.

J. Finish insulation at supports, protrusions, and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

K. Elastomeric Tubing.
   1. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
   2. Apply additional jacket as specified.

L. For all pipe systems exposed in the mechanical equipment rooms, finish with an all service PVC jacket.

M. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

N. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

O. Perform work at ambient and equipment temperatures as recommended by adhesive manufacturer.

P. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost.

Q. Paint all insulation exposed to ultraviolet light (sunlight).

R. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

S. Joints between insulation and access shall be sealed with vapor barrier mastic.

3.03 PIPE INSULATION APPLICATION

A. General.
   1. Before applying insulation.
      a. Test piping for tightness and obtain approval.
      b. Dry pipe thoroughly.
      c. Clean surfaces to be insulated of dust, grease, and foreign matter.
   2. Butt edges neatly.

3. Fill voids with insulating cement.
4. Longitudinal overlaps.
    a. 2 inches minimum.
    b. For exposed work: toward ceiling or wall.
    c. For weatherproof aluminum jackets: on side to shed water.
5. Circumferential overlaps on weatherproof aluminum jackets: 2 inches minimum.
6. Continuous insulation passing through sleeves or other openings.
7. Oversize insulation to accommodate heat tracing on piping.

B. Valves, fittings, flanges, and accessory insulation.
1. Unless otherwise noted, insulate:
    a. Valves including bonnets.
    b. Flanges.
    c. Fittings.
    d. Strainers.
    e. Expansion joints.
    f. Specialties.
2. Insulation for strainers, expansion joints, fittings and accessories requiring servicing or inspection.
    a. Insulation removable and replaceable without damage.
    b. Enclosed within two-piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts.
3. Insulation of same thickness as adjacent piping insulation.
4. For piping systems insulated with elastomeric thermal insulation.
    a. Apply mitered sections of pipe insulation.
    b. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
    c. Prime and paint exterior installations for UV protection.
5. Flanges.
    a. Apply preformed pipe insulation to outer diameter of pipe flange.
    b. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
    c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with the same insulation material as adjacent piping insulation.
    d. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
6. Finish for outdoor locations only: weatherproof aluminum jacket compatible with weatherproof jacket on adjoining pipe insulation.

C. At pipe hangers.
1. Insulation protection shields specified in Section 230529 – Hangers and Supports.
2. Butt insulation to shields.
3. Cold piping: Wet coat of vapor barrier lap cement on all butt joints.

D. Jackets and facings.
1. Vapor-sealed types: continuous; staples not permitted.
2. Adhere longitudinal laps: Adhere 3 inches wide joint strip, of same material as facing, at center of each butt joint.
3. Adhesives.
    a. Vapor-sealed insulation: vapor-seal adhesive.
    b. Heating service insulation: vapor-seal adhesive.
    c. Weatherproof aluminum jacket: sealing compound.
    d. PVC jacket: welding compound.
    e. Underground asphalt felt jacket: asphalt mastic

E. Wiring, banding, and fastening devices: Secure insulation to piping and equipment in accordance with following minimum requirements.
   1. Piping insulation section 3 foot long.
      a. Concealed vapor-sealed insulation banded at ends and center.
      b. Other concealed insulation banded at ends and center.
   2. Pipe fitting insulation.
      a. Loops of wire to secure mitered segments of insulation.
      b. Wire spiraled on from end to end on blanket insulation
   3. Outdoor piping weatherproof aluminum jackets banded at circumferential joints and center of each section: Lap joint at bottom.
   4. Provide aluminum banding near ends of unicellular piping valve and accessory insulation where unicellular is allowed by Professional.

3.04 EQUIPMENT INSULATION

A. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with bands, welded-on anchors, ties or adhesive. Where access to equipment is required for testing or maintenance the insulation shall be installed so that it is removable and so that the vapor barrier can be remade after access.

B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

C. For cold equipment or equipment containing fluids below ambient temperature.
   1. Insulate entire system.
   2. Provide vapor barrier jackets, factory applied, or field applied.
   3. Finish with glass cloth and vapor barrier adhesive.
   4. Cover with aluminum jacket where specified.

D. For equipment containing fluids above ambient temperature.
   1. Insulate entire system.
   2. Provide standard jackets, with or without vapor barrier, factory applied, or field applied.
   3. Finish with glass cloth and adhesive.
   4. Cover with aluminum jacket where specified.
   5. For hot equipment containing fluids 140 degrees Fahrenheit or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
   6. For hot equipment containing fluids over 140 degrees Fahrenheit, insulate flanges and unions with removable sections and jackets.

E. Finish insulation at supports, protrusions, and interruptions.

F. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.

G. Do not insulate over nameplate or ASME stamps; bevel and seal insulation around such.

H. General.
   1. Apply insulation with edges tightly butted.
      a. Joints staggered and secured in place by steel bands.
      b. Where necessary weld on suitable anchors.
   2. Seal with 520, adhesive.

I. Special considerations.
   1. Chiller heads: removable and replaceable covers to allow tube removal.
   2. Strainers and suction diffusers: removable and replaceable covers to allow strainer removal.
   3. Pumps: removable and replaceable covers to allow impeller replacement.
   4. Provide sufficient clearance around openings for normal operation of equipment.

3.05 PENETRATION THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer's installation and listing requirements.

3.06 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

END OF SECTION

SECTION 23 11 23 FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes materials, equipment, fabrication, special-duty valves, specialties, and installation for the following:
   1. Natural gas piping.

1.03 PROJECT CONDITIONS

A. Site Gas System Pressure: (CONTRACTOR SHALL VERIFY).

B. Building Gas System Pressure: (CONTRACTOR SHALL COORDINATE WITH SUBMITTED GAS-FIRED EQUIPMENT).

1.04 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. "R" means required.
   2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping (below ground and above ground	R			R
Valves, all types	R			R
Meters	R	R		R
Pressure regulators	R			R
Specialties	R	R		R

1.05 QUALITY ASSURANCE

A. FM Standard: Provide components listed in FM's Fire Protection Approval Guide if specified to be FM approved.

B. IAS Standard: Provide components listed in IAS's Directory of AGA and CGA Certified Appliances and Accessories if specified to be IAS listed.

C. UL Standard: Provide component listed in UL's Gas and Oil Equipment Directory if specified to be UL listed.

D. ANSI Standard: Comply with ANSI Z223.1 and NFPA 54 (2009 Edition), "National Fuel Gas Code."

1.06 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Using Agency or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than seven days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Appliance Connector Valves.
      a. Conbraco Industries, Inc.: Apollo Div.
      b. Mueller Co.: Mueller Gas Products Div.
      c. Watts Industries, Inc.: Water Products Div.
      d. Brass Craft Manufacturing Co.
      e. American Valve.
   2. Gas Valves, NPS 2 and smaller.
      a. Nibco, Inc.
      b. Flow Control Equipment, Inc.
      c. Grinnell Corp.
      d. Honeywell, Inc. Co.
      e. Crane Valves.
      f. McDonald: A.Y. McDonald Mfg. Co.
      g. Milwaukee Valve Co., Inc.
      h. Mueller Co.: Mueller Gas Products Div.
      i. Watts Industries, Inc.: Water Products Div.
   3. Plug Valves, NPS 2-1/2 and larger.
      a. Walworth Co.
      b. Olson Technologies, Inc.; Homestead Valve Div.
      c. Milliken Valve Co., Inc.
   4. Service Meters: As approved by the Utility Provider or Owner.
   5. Line Pressure Regulators.
      a. American Meter Co.
      b. Equimeter, Inc.
      c. Fisher Controls International, Inc.
      d. Schlumberger Industries: Gas Div.
   6. Appliance Pressure Regulators.
      a. Eaton Corp.: Controls Div.
      b. Harper Wyman Co.
      c. Maxitrol Co.

2.02 PIPING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B (Grade A for pipe 1-1/2 inch and smaller) Schedule 40; black.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
   2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
   3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
   4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
   5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
   6. Joint Compound and Tape: Suitable for natural gas.
   7. Steel Flanges and Flanged Fittings: ASME B16.5.
   8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Polyethylene Pipe: All polyethylene pipe used in the Project must comply with ASTM D-2513 and be manufactured in the United States.
   1. Pipe and Fitting Material. All pipes shall conform to the requirements of the currently approved ASTM D-25 13 specification “Thermoplastic Gas Pressure Pipe, Tubing and Fittings.” All fittings shall conform to the requirements of ASTM D-2683 specification “Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe” or ASTM D3261 “Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.” All pipes shall be manufactured of virgin material, with the exception of the clean rework material that is generated from the manufacturer’s own production, as long as the pipe and/or fittings meet the required specifications. All pipe formulation must have suitable outdoor weather resistance. The color of all polyethylene pipes shall be either orange or yellow.
   2. Pipe Design. All pipe shall be designed for direct burial as specified in D.O.T. Title 49, Part 192, “Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards,” through current Amendment, for natural gas mains and services operated at 60 psig. or less. The pipe must also be suitable for replacing old steel mains and services. The pipe must be homogeneous and be free of holes, cracks, foreign material, blisters, or other deleterious faults. The minimum design stress must comply with the requirements of ASTMD-2513.
   3. Any defect such as a groove, notch, or gouge, greater than ten percent (10%) of the wall thickness of the pipe, shall not be used.

C. Transition Fittings: Type, material, and end connections to match piping being joined.

2.03 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.
   1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.
   1. Tamperproof Feature: Include design for locking.

G. Automatic Gas Valves: ANSI Z21.21, with electrical operator for actuation by appliance automatic shutoff device.

2.04 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
   1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
   2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
   3. Line Pressure Regulators: ANSI Z21.80.
   4. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by Architect.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.05 METERS

A. Natural gas meter: Provide outside adjacent to mechanical room entrance, a meter for the Owner's use in determining the gas usage for this building. Meter shall be pipe or pedestal mounted, rotary style, enamel coated steel case. Provide combined register totalizer, water escape hole in housing and means for sealing against tampering. Provide with a pulse sensor so the building meter reading system can connect to the gas meter.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Refer to Division 31.

3.02 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

L. Install sleeve seals for piping penetrations of concrete walls and slabs.

M. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 PREPARATION

A. Close equipment shutoff fuel gas to premises or section of piping. Perform leakage test as specified in Article entitled, Field Quality Control, to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, paragraph entitled, Prevention of Accidental Ignition.

3.04 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting.

C. Provide Schedule 40 black steel riser (from underground) at building or equipment, extending minimum 2' horizontal to connect with underground piping.

3.05 PIPING APPLICATIONS

A. Flanges, unions, transitions, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, provided compliance with the IFGC is maintained.

B. Fuel Gas Piping above ground: Use the following:
   1. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
   2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Fuel-Gas Piping below ground: Use the following:
   1. Thermoplastic gas pressure pipe, tubing and fittings, ASTM D2513 with transition riser.

3.06 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or less. Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve.

D. Piping Line Valves, NPS 2 and Smaller: Gas valve.

E. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.07 PIPING INSTALLATION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

I. PE Piping Install regulator assemblies aboveground. Include gas valve or plug valve for each assembly.
   1. Install gas valve or plug valve and strainer upstream from each service pressure regulator.
   2. Install service pressure regulators with vent outlet turned down and with corrosion-resistant-metal insect screen.

J. Service Entrance Piping: Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.
   1. Exterior service meter will be provided by gas utility.

K. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
   1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
   2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
   3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in walls, subject to approval of authorities having jurisdiction.
   4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), ventilating ducts, or elevator shafts.
      a. Exception: Accessible above-ceiling space specified above.

L. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

M. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings and in floor channels, unless indicated to be exposed to view.

N. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

R. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

S. Install pressure gage upstream and downstream from each line pressure regulator.

T. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

U. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

V. Purging Pipes and Fittings: A combustible gas indicator shall be used when purging mains and piping. When purging gas from abandoned lines, the air and the gas must be discharged aboveground and directed away from power lines or structures. When purging air from new lines, installation of a 3/4 service saddle and non-corrodible riser is required four (4) feet from each dead-end on all new installations of pipe in order to purge air from all dead-ends simultaneously. Release gas into new lines at a rate that will prevent formation of a hazardous mixture of gas and air or precede natural gas with a slug of inert gas.

W. Pipe Placement and Backfill.
1. When installing polyethylene pipe, sufficient slack shall be provided to allow for possible contraction. The polyethylene pipe shall not have a bend that is less than 25 times the outside diameter of the pipe. If a bend is required that is less than 25 times the outside diameter of the pipe, then an approved polyethylene elbow fitting is required. A fusion joint shall not be placed at a bend. During extremely high temperature conditions it may be necessary to cool the pipe before the last connection.
2. No polyethylene gas line shall be installed above ground. During maintenance, repair, and tie-in work, temporary polyethylene gas lines may be used above ground.
3. The minimum clearance required between the distribution piping and other underground structures is twelve (12) inches. Trench width and minimum cover shall comply with another Section of specification, Excavation, Trenching and Backfilling for Utilities. Unless otherwise shown on plans, pipe embedment shall be select material and remainder of trench may be backfilled with spoil from trenching operation.

3.08 VALVES AND VALVE BOXES

A. Provide valves and valve boxes plumb. All boxes shall be installed flush with the finished grade. Support box with brick or other approved material. Adequate backfill shall be placed around the valve boxes and valve extension boxes to prevent any damage or settlement to the pipeline that may be transferred to the pipe through the valve box. Protective sleeves shall be installed over fusion joints and extend through the valve boxes on the polyethylene valve installations.

3.09 HANGERS AND SUPPORTS

A. Refer to Section 230529 – Hangers and Supports.

3.010 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

B. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

C. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
   2. Do not use gas pipe as grounding electrode.

3.011 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.
   1. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator and specialty valve.
   2. Refer to 230553 – Mechanical Identification.

B. Label piping per 230553 – Mechanical Identification.

3.012 PAINTING

A. Use materials and procedures in Division 09 – Painting.

B. Paint exterior pipe, fittings, pressure regulators, specialty valves, etc.
   1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting).
   2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting).

C. Paint exposed interior pipe, fittings, pressure regulators, specialty valves, etc.
   1. Pipe and Fittings, Color: Yellow (Confirm color with Architect prior to painting).
   2. Pressure Regulators, Specialty valves, Etc., Color: Red (Confirm color with Architect prior to painting).

3.013 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging" and requirements of authorities having jurisdiction. Isolate pressure reducing valves and equipment controls during testing. Test pressure to be 100 psi for a period of 24 hours with no drop in pressure.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect.

D. Verify capacities and pressure ratings of pressure regulators, valves and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.014 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

1. Natural Gas Piping Test Log						
		4. Description of Piping Section Tested				12 13 14
		17.				21
		24.				28
		31.				35
		38.				42
		45.				49
		52.				56
		59.				63
		66.				70
71. This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.						

END OF SECTION

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes materials, equipment, fabrication, special-duty valves, specialties, and installation for the following:
   1. Split system refrigerant piping

1.03 REFERENCE STANDARDS

A. ANSI/ARI 495 – Refrigerant Liquid Receivers.

B. ANSI/ARI 710 – Liquid Line Dryers.

C. ANSI/ASHRAE 34 – Number Designation of Refrigerants.

D. ANSI/ASTM B32 – Solder Metal.

E. ANSI/ASTM B88 – Seamless Copper Water Tube.

F. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

G. ANSI/AWS A5.8 – Brazing Filler Metal.

H. ANSI/AWS D1.1 – Structural Welding Code.

1.04 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping and fitting materials	R			R
Valves and specialties	R			R
Solder	R2			

1.05 QUALITY ASSURANCE

A. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with:
   1. Weight or quality.
   2. Maker's name or mark.

B. Examine piping layouts and determine requirements for piping offsets, loops, or expansion joints to adequately protect systems.
   1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.
   2. Determine anchor reaction forces and coordinate locations of anchors with Architect.

C. Conform to ANSI/ASME B31.1.

1.06 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A.
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

1.07 REUTILIZE EXISTING REFRIGERANT PIPING

A. Clean piping per industry standards and new equipment manufacturer’s recommendations.

B. Pressure test and remedy all leaks.

C. Newly insulate.

D. Install with new liquid drier.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:
   1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
   2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 ˚F.

2.02 VALVES AND SPECIALTIES

A. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 ˚F.
8. Manual operator.

C. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: See DX Coil (AHU) Schedule.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

D. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 ˚F.

E. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10-micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

6. Maximum Pressure Loss: 2 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 ˚F.

2.03 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Atofina Chemicals, Inc.
   2. DuPont Company; Fluorochemicals Div.
   3. Honeywell, Inc.; Genetron Refrigerants.
   4. Or equal.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered.

3.02 VALVE AND SPECIALTY APPLICATIONS

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

E. Install flexible connectors at condensing units.

3.03 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit, where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations, where exposed to mechanical injury.

N. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 230553 – Mechanical Identification.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 – Basic Mechanical Materials and Methods.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 – Basic Mechanical Materials and Methods.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 – Basic Mechanical Materials and Methods.

3.04 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or soldering, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
   1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
   2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.05 HANGERS AND SUPPORTS

A. See Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
   2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
   1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
   3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
   4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Support multi-floor vertical runs at least at each floor.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Comply with ASME B31.5, Chapter VI.
   2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
   a. Fill system with dry nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
   d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.07 SYSTEM CHARGING

A. Charge system using the following procedures:
   1. Install core in filter dryers after leak test but before evacuation.
   2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
   3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
   4. Charge system with a new filter-dryer core in charging line.

3.08 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Verify that compressor oil level is correct.
   2. Open compressor suction and discharge valves.
   3. Open refrigerant valves except bypass valves that are used for other purposes.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

1. Refrigerant Piping Test Log						
2		4. Description of Piping Section Tested	5 6			12. 13. 14.
1		17.	1			21.
2		24.	2			28.
2		31.	3			35.
3		38.	3			42.
4		45.	4			49.
5		52.	5			56.
5		59.	6			63.
6		66.	6			70.
71. This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.						

END OF SECTION

SECTION 23 31 13 METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Ductwork.
   2. Plenums.
   3. Fasteners, sealants, and gaskets.
   4. Hangers and supports.
   5. Duct air leakage tests.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. ASHRAE - Handbook of Fundamentals; Duct Design.
   2. ASHRAE - Handbook of HVAC Systems and Equipment; Duct Construction.
   3. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
   4. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
   5. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   7. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
   8. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.
   9. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
   10. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
   11. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
   12. NFPA 45 – Laboratory Ventilating Systems and Hood Requirements.
   13. SMACNA – HVAC Duct Construction Standards.
   14. SMACNA – Rectangular Industrial Duct Construction Standards.
   15. SMACNA – Round Industrial Duct Construction Standards.
   16. SMACNA – HVAC Air Duct Leakage Test Manual.

17. UL 181 - Factory-Made Air Ducts and Connectors.
18. Engineering Design Manual for Air Handling Systems, United McGill Corporation (UMC).
19. Assembly and Installation of Spiral Ducts and Fittings, UMC.
20. Engineering Report No. 132 (Spacing of Duct Hangers), UMC.
21. AWSD1.1 American Welding Society Structural Welding Code.

1.04 DEFINITIONS

A. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

B. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

C. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

D. Stiffening: folding, bending, beading, cross breaking or corrugating of sheets to achieve strength through shape, for example pocket lock secures joint and is transverse stiffener, with girth angle and fasteners applied (not connectors), joint or stiffener is reinforced.

E. Duct Classification:
1. Pressure classification: except as indicated on the Drawings:
   a. Low Pressure: Ductwork systems up to 2-inch w.g. positive or negative static pressure with velocities less than or equal to 1500 fpm.
   b. Medium Pressure: Ductwork systems over 2-inch w.g. and up to 6-inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.
   c. High Pressure: Ductwork systems over 6-inch w.g. and up to 10-inch w.g. positive or negative static pressure with velocities greater than 2500 fpm.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements.
1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A.
2. Ductwork and components shall be listed as U.L. 181, 181A and 181B, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.
3. Flues shall conform to the requirements of NFPA-211. Products shall be listed to UL-103 and shall carry the appropriate UL listing mark or label.

B. Mockups:
1. Before installing duct systems, build mockups representing static-pressure classes in excess of 2inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   a. Five transverse joints.
   b. One access door(s).
   c. Two typical branch connections, each with at least one elbow.
   d. Two typical flexible duct or flexible-connector connections for each duct and apparatus.
   e. One 90-degree turn(s) with turning vanes.
   f. One fire damper(s).

g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.
1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

C. Product Data: For each type of the following products:
1. Liners and adhesives.
2. Sealants and gaskets.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Ductwork materials and fittings	R			R
Duct fasteners, sealants, and gaskets	R			
Flexible duct	R			R
Flue	R			R
Duct pressure testing reports		R		

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts:
1. United Sheet Metal Division, United McGill.
2. Semco Manufacturing, Inc.
3. Eastern Sheetmetal.
4. Lindab, Inc.
5. Or equal.

C. Duct Connection Systems:
1. Ductmate Industries, Inc.
2. Fabriduct Transverse Duct Connection system.
3. Ward Industries, Inc.
4. Or equal.

D. Flexible Connections:
1. Ventfabrics.
2. Duro Dyne.
3. Or equal.

E. Flexible Ducts:
1. Thermaflex.
2. Hart & Cooley.
3. Flexmaster.
4. Or equal.

F. Duct Sealants:
1. Foster Products Corporation.
2. Hardcast Corporation.
3. 3M.
4. Or equal.

G. Flexible Duct Clamps:
1. Panduit.
2. Dura-Dyne.
3. Young Regulator Company.
4. Or equal.

H. Hi-efficiency & conical Tap Fittings:
1. Flexmaster.
2. Crown.
3. Die Stamp.
4. Or equal.

2.02 APPLICATIONS

A. Ductwork systems shall be constructed in accordance with the following Materials as a minimum standard. Refer to Drawings for any deviation from this Table.

AIR SYSTEM	MATERIAL	SMACNA DUCT PRESSURE CLASS (1)	SMACNA DUCT SEAL CLASS(3)
			Supply and Return Systems:
Single Zone AHU Supply	Galvanized Steel	2” w.g.	A
Return Air	Galvanized Steel	-1” w.g.	A
			Exhaust Systems:
Exhaust Air Device to Exhaust Distribution	Galvanized Steel	-2” w.g.	A
Exhaust Air Distribution	Galvanized Steel	-2” w.g.	A

B. Table Notes:
1. Positive pressure unless noted otherwise in Table.
2. Air device connections may be made with insulated flexible duct as specified herein.
3. Seal Class A Sealing Requirements: Seal all transverse joints, longitudinal seams, and duct wall penetrations. Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

2.03 MATERIALS

A. General Material Requirements.
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. (Minimum duct thickness shall be 24 gauge). Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
2. All duct sizes shown on the Drawings are clear inside dimensions. Allowance shall be made for internal lining, where specified, to provide the required free area.
3. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched) and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for future connections/phases, otherwise plastic covers are acceptable.

B. Galvanized Steel Sheet Metal:
1. Prime, cold rolled soft galvanized steel sheets.
2. Each sheet shall be stenciled with manufacturer's name and gauge.
3. ASTM A653 and A924.
4. Galvanizing: 1-1/4 ounces per square foot, total both sides.
   a. General: G-90.
   b. Exposed to weather: G-90.
   c. Plenum walls and blank-offs where in contact with cooling coil: G-90.
5. Lock-forming quality.
6. Where ductwork is shown to be painted, same is to provide with "paint grip" factory finish on exposed to view applications in finished spaces such as classrooms, offices, meeting rooms, etc.

C. Miscellaneous Products.
1. Screws and rivets:
   a. Same material as sheet, except as indicated on the Drawings.
   b. On aluminum sheets, provide cadmium plated or stainless steel.
   c. Zinc or cadmium plated, permitted on galvanized sheets.
   d. Minimum screw size: No. 10.
   e. Minimum rivet size: 4 pound.
2. Duct Sealants:
   a. Sealing compound: UL-181 listed, water based:
      1) Foster Safetee Duct Sealant 32-19.
      2) Childers CP-146.
      3) Hardcast Products Group Flex-Grip 550.
      4) Or equal.
   b. Rolled Elastomeric Duct Sealant: Hardcast Products Group Foil Grip 1403-181BFX, or equal, UL 181 listed.
   c. Gaskets:
      1) Continuous, reinforced, inert self-conforming type.
      2) 1/8 inch thick.
      3) Width: to match angle connection.
      4) 3M Weatherban Ribbon Sealant PF5422 or equal.
   d. Two-Part Hard-Setting Joint Tape:
      1) Two-part process includes tape and hard setting sealant.
      2) Mineral impregnated woven fiber tape.
      3) Impregnated with activator/adhesive of polyvinyl acetate type.
      4) UL Listed.
      5) Flame spread: 10.

6) Smoke contributed: 0.
7) Equal to Hardcast RTA-50 sealant and DT-5400 4 inch tape.

3. Spring Fasteners:
   a. Oval head stud and receptacle.
   b. Screwdriver slot.
   c. Self-ejecting.
   d. Dzus or equal.
4. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings.
5. Duct connection system:
   a. Transverse bolted duct joints.
   b. Flanges with permanent, non-hardening sealant.
   c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal.

D. Flexible Connections:
1. Conforming to NFPA 701, UL Standard No. 214 and NFPA 90A.
2. SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings.
3. With metal edges at each end: No. 24 USSG galvanized steel. Double lock joint.
4. Length of fabric connections.
   a. Minimum: 4 inch.
   b. Maximum: 10 inch.
5. Materials:
   a. Coated glass fabric.
   b. Flame spread rating: 25.
   c. Smoke development rating: 50.
   d. 30 ounces per square yard.
   e. Sewed and cemented seams.
   f. Indoors:
      1) Neoprene.
      2) Ventfabrics, Inc. Ventglas or equal.
   g. Outdoors:
      1) Weather-resistant.
      2) Fiberglass with Hypalon.
      3) UV, sunlight, and ozone resistant.
      4) Ventfabrics, Inc. Ventlon or equal.

E. Turning Vanes:
1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on the Drawings.
2. Other ductwork: same material as ductwork.
3. Construction per SMACNA HVAC Duct Construction Standards for:
   a. Double wall vanes.
   b. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.
   c. Vane runners: Type 1 or 2 acceptable.
4. Vane radius:
   a. 2 inch radius: duct width up to 36 inches.
   b. 4-1/2 inch radius: duct with 36 inches or larger.
5. Vane shall be at the correct angle for airflow (leading edge in line with the entering duct section; leaving edge in line with existing duct section). If only 45° angles are available, turning vanes shall only be used in 90° elbows where the entering width equals the exiting width; all other elbows shall be full radius type unless otherwise indicated on the drawings.

F. Conical Taps: Low-pressure round take-off fittings in rectangular duct:
1. Heavy 26-gauge G-90 Galvanized Steel Body
2. (1") 26-gauge G-90 Galvanized Steel Flange
3. Double Sided Adhesive Gasket on Flange
4. Extra Heavy 24-gauge G-90 Galvanized Steel Blade
5. 3/8" Square Axle Secured to Blade with U-bolts (2 U-bolts used for 8" diameter and larger)
6. Nylon bushings on thru and end (all sizes)
7. 2" Stool with Locking Quadrant and Handle (all sizes, wing nuts not acceptable)
8. Sealed on all Seams
9. BO3 (2") Build-out, 3/8" Square Shaft (solid rod), U-bolt, Locking Quadrant, Handle
10. Flexmaster CBD-SOG-BO3 UT 3000G, Crown 3210-DS2 or equal.

2.04 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS (LOW PRESSURE)

A. Duct Classification: Ducts shall be considered low pressure when design velocities are 1500 fpm or less and maximum static pressure is 2-inch W.G., positive or negative.

B. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized sheet metal, according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
2. Materials: free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inches thick or less, with more than 10 square feet of unbraced panel area, unless ducts are lined.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Bullhead tees are not permitted.

2.05 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS (LOW PRESSURE)

A. Duct Classification: Ducts shall be considered low pressure when design velocities are 1500 fpm or less and maximum static pressure is 2-inch W.G., positive or negative.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Factory-fabricated spiral lock seam duct:
1. Snap-lock is not acceptable.
2. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes.
3. Round Duct Flanges: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances. All flanges to be factory mounted.
4. Flat Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

E. Fittings:
1. Same material, gauge thickness and construction as duct in which installed.
2. Full body fittings are acceptable.
3. Elbows:
   a. Seams:
      1) 4 inch and higher pressure, class and all ducts exposed to occupant view: continuously welded seams.
      2) 1 inch to 3 inch pressure: spot welded with bonded (sealed) seams.
   b. Gores:
      1) 2 gores - less than or equal to 30 degrees.
      2) 3 gores - 31 degrees through 45 degrees.
      3) 4 gores – 46 degrees through 60 degrees.
      4) 5 gores - over 61 degrees

4.	5.	6.	7.	8.	9.	10.
11	12.	13.	14.	15.	17.	18.

4.	5.	6.	7.	8.	9.	10.
				16.		19.
	20.	21.	22.	23. 24.	25.	26. 27.

4.	5.	6.	7.	8.	9.	10.
28	29.	30.	31.	32. 33.	34.	35. 36.
	37.	38.	39.	40. 41.	42.	43. 44.

4.	5.	6.	7.	8.	9.	10.

2.06 FLEXIBLE DUCTS

A. General Requirements:
1. Flexible ducts shall be used for supply air ducts only (not acceptable for return, exhaust, relief, outdoor, etc. air ducts).
2. UL 181, Class I Air Duct.
3. Labeled for compliance with IMC.
4. Class 1 Air Duct, NFPA 90A and 90B, BOCA, SBBC, HUD/FHA, MIN Property Std.
5. Maximum flex duct length 5'-0" (five feet), installed with no more than 90 degrees of bend to diffusers and grilles. Where longer duct runs or more bends are necessary, provide rigid round ductwork.

B. Type 1 Acoustical Insulated
1. Minimum working pressure:
   a. 10" w.g. positive
   b. 5" w.g. negative, 16" diameter
   c. 1" w.g. negative, 18" & 20" diameter
2. Rated Velocity
   a. 5,550 fpm
3. Acoustic Performance:
   a. Minimum insertion loss (dB) for 6' of 8" diameter flexible duct for flow velocities less than 2,500 fpm.
   b. Acoustical testing to be performed in accordance with ASTM E477 and ADC Test Code FD 72-RI by ETL

	Sound Power Levels, dB re. 10^{-12} Watts, at Octave Band Center Frequency, Hz

	125	250	500	1000	2000	4000
Insertion Loss	5	16	17	18	16	11

4. Duct Fabric:
   a. Polyethylene fabric. Fabric to be mechanically locked to the duct helix without the use of adhesives
5. Duct Helix
   a. Corrosive resistant galvanized steel. Helix is to be mechanically formed to attach the duct fabric without the use of adhesives.
6. Vapor Barrier
   a. Fire retardant, reinforced aluminum.
   b. (.05) perm A.S.T.M. E96, Procedure A
7. Insulation
   a. Factory insulation jacket, factory wrapped. R8 minimum.
8. Flexmaster Type 1M or equal.

C. Type 6 Acoustical Insulated (in locations as indicated on schedules/plans)
1. Minimum working pressure:
   a. 6” w.g. positive
   b. 5” w.g. negative, 16” diameter
   c. 1” w.g. negative, 18” & 20” diameter
2. Rated Velocity
   a. 5,550 fpm
3. Acoustic Performance:
   a. Minimum insertion loss (dB) for 6’ of 8” diameter flexible duct for flow velocities less than 2,500 fpm.
   b. Acoustical testing to be performed in accordance with ASTM E477 and ADC Test Code FD 72-RI by ETL

	Sound Power Levels, dB re. 10^{-12} Watts, at Octave Band Center Frequency, Hz						
	63	125	250	500	1000	2000	4000
Insertion Loss	5.7	14	13	15	16	18	16

4. Duct Fabric:
   a. Spunbond Nylon fabric. Fabric to be mechanically locked to the duct helix without the use of adhesives
5. Duct Helix
   a. Corrosive resistant galvanized steel. Helix is to be mechanically formed to attach the duct fabric without the use of adhesives.
6. Vapor Barrier
   a. Fire retardant, reinforced aluminum.
   b. (.05) perm A.S.T.M. E96, Procedure A
7. Insulation
   a. Factory insulation jacket, factory wrapped. R8 minimum.
8. Flexmaster Type 6M or equal.

2.07 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

I. Round Duct Supports:
   1. Minimum 2" wide 20 gauge galvanized metal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Ductwork Installation – General:
   1. Install ducts in accordance with manufacturer’s written installation instructions.
   2. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
   3. Construct with gages, joints, bracing, reinforcing, and other details per latest IMC, ASHRAE, SMACNA and NFPA, unless specified otherwise.
      a. Comply with most stringent.
      b. Provide ducts with IMC gages or thicker when traversing rated corridors.
      c. Combustion air ducts: Minimum 24 gage.
   4. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings.
   5. Provide for duct rigidity by either of these methods:
      a. Beading at 12 inches on center, maximum.
      b. Cross-break outward in ducts having positive internal pressure.
      c. Cross-break inward in ducts having negative internal pressure.
         1) Exception: All ducts exposed to rain shall outward cross-break on top of the duct.
   6. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).
   7. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Architect.

8. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges.
    a. Clearance from duct to opening shall not exceed 2 inches.
    b. Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum.
9. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions.
10. Tapers:
    a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper.
    b. Abrupt, bushing type fitting not allowed.
11. Duct Openings:
    a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.
    b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.
    c. At fire dampers allow adequate length of duct to install access door.
12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods.
13. No exposed sharp metal allowed.
    a. All exposed pins, screws and sharp objects shall be covered with hardening silicon.
    b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth.
    c. Remove all sheet metal fish hooks.
14. Install lining in ducts and plenums as specified in Section 230713 – Duct Insulation.
15. Flexible Connections:
    a. Coated glass fabric.
    b. For indoor or outdoor use.
    c. Use diaphragm type at plug fan inlets.
    d. Install at connections to fans and air handling units and as indicated on Drawings.
    e. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression.
    f. Protect from direct solar and rain exposure with sheet metal shroud where outdoors.
16. Volume dampers: Install dampers as specified in Section 233300 – Duct Accessories.
17. All sheet metal ductwork in exposed to view applications, in finish spaces, shall include factory "paint grip" finish, where shown to be painted.

C. Elbows and Splits:
1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings: Centerline radius dimension shall not be less than 1-1/2 duct width.
2. Where space does not permit duct radius specified above, install short radius splitter vanes per SMACNA HVAC Duct Construction Standard.
    a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W).
    b. One vane: Radius to width ratio above 0.3.
    c. Two vanes: Radius to width ratio between 0.1 to 0.3
    d. Three vanes: Radius to width ratio 0.1 and smaller.
3. Use square turns with turning vanes in rectangular ductwork, unless otherwise indicated on the Drawings, at following locations.
    a. Use only where full radius elbow cannot fit.
    b. Use only in ducts with 2000 fpm or less design velocity.
    c. In high and medium pressure ductwork spot weld turning vane to duct.

D. Rectangular Duct Joints:
1. Transverse Joints:
    a. In medium pressure ductwork shall be Fabriduct TDC or Ductmate or equal.
    b. In low pressure ductwork shall be Fabriduct TDC or equal except that ducts under 19 inches longest side may be slip & drive (S&D)
2. Longitudinal seams shall be Pittsburgh. Snap lock not allowed.

E. Plenum walls, blank-offs, and casings:
1. Construct per SMACNA HVAC Duct Construction Standard, Casings and Plenums.
2. Static pressure class:
   a. Upstream of fan: -2 inches.
   b. Downstream of fan: fan static pressure or greater.
3. Seal all joints, edges, and penetrations as per HVAC ducts as specified herein.

F. Round and oval ductwork:
1. Joints between ducts:
   a. Made with beaded sleeve joints as scheduled.
   b. Duct sealer applied to male end.
   c. Mechanically fastened with sheet metal screws or pop rivets.
   d. Over joint and screw or rivet heads, apply coating of duct sealer.
      1) Duct where exposed to occupant view: Sealant shall be within joint only and not visible.
2. Joints, duct and fitting:
   a. Slip projecting collar of fittings into duct: Per SMACNA HVAC Duct Construction Standard.
   b. Apply duct sealer: Seal and tape as specified above.
   c. Mechanically fasten: Fastening schedule: Per SMACNA HVAC Duct Construction Standard.
3. Branch take-offs:
   a. Medium pressure: 45 degrees (fittings).
   b. Low pressure: straight 90 degrees (fittings).
4. Horizontal supports:
   a. One or two-piece clamp band strap.
   b. Minimum: one per section.
   c. Support fittings as required to prevent sagging.
5. Vertical Supports: one of the following:
   a. Clamp bands with extended ends supported by floor.
   b. Clamp bands with knee bracing.
   c. Pedestal at base of vertical.

G. Flexible ductwork:
1. Not allowed for:
   a. Return, exhaust, or outdoor air ducts.
   b. Product conveying systems such as kitchen exhaust and laboratory exhaust.
   c. Dryer exhaust (other than final exposed connection at dryer).
   d. Medium and high pressure, ducts.
2. Continuous, single pieces:
3. Length:
   a. Low pressure:
      1) Maximum 5 feet, except where longer lengths are indicated on drawings. Where longer lengths are shown, the last 3 feet to 5 feet shall be wire flex duct and remaining ductwork shall be aluminum flex duct.
      2) Minimum length: 3 feet.
      3)
4. End connections:
   a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions.
   b. Secure with strap clamps specified above.
5. Installations:
   a. Support adequately to avoid excessive droop.
   b. Minimum inside bending radius not less than one duct diameter.
   c.

d. Install as straight as possible except as shown on drawings for sound attenuation.
e. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation.

H. Grille connections:
1. Provide at entry to diffuser collar either.
a. Straight duct for 1 duct diameters or greater.
b. Full radius elbow.
c. Side inlet plenum.
1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille.
2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger.
3) Internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 230713 – Duct Insulation.
4) At contractor's option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted.
d. Thermaflex FlexFlow Elbow or equal.
2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.
3. Seal connections at grilles per seal class of upstream ductwork.

I. Sound-rated duct packing:
1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings.
2. Provide packing for unavoidable duct penetrations.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps, and duct joints shall be clean and free of visual blemishes and all sealant shall be internal to joint and not visible. Ducts shall have no external markings or tags. All duct beads shall be parallel.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Ducts not exposed to weather: Seal using one of the following:
1. Duct sealer compound.

2. Gasketed TDC or Duct-Mate.
3. Two-Part Hard-Setting Joint Tape.
4. Flexible duct:
   a. Secure with straps or clamps as specified herein.
   b. Supplement with duct tape, both inner and outer liner.
5. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible.
6. Fire and fire/smoke dampers: Sealant shall be listed as approved on manufacturer's UL installation sheet.
7. Continuously welded ducts: Additional sealing not required.

B. Seal punched holes and corner cracks.

C. Seal all factory fabricated ducts, including transverse joints on gored elbows.

D. Seal end caps.

E. After installation and testing reseal joints found to be leaking at no additional cost to the Owner.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor, and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 – Air Duct Accessories.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.07 DUCT AIR LEAKAGE TESTING

A. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test. See the Duct Air Leakage Test Log at the end of this section.
2. Test the following systems:
   a. Supply, Return, Exhaust, and Outdoor Air Ducts: Test 100% of installed duct sections.
   b. Field installed plenums. Test 100% of all field installed plenums.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

B. General:
1. Pretesting shall be conducted prior to conducting test in presence of TAB Agency and Architect. Once all required ductwork has passed the pretest duct pressure test, the TAB Agency and Architect shall be notified to visit the site for witness testing.
2. Use portable high pressure, blower and necessary instruments to indicate amount of leakage.
3. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual and make test before duct sections are concealed.
4. Procedure:
   a. Seal openings in ducts and plenums to be tested.
   b. Connect test apparatus to test section using flexible duct connection or hose.
   c. Close damper on blower suction side, to prevent excessive buildup of pressure.
   d. Start blower and gradually open damper on suction side of blower.
   e. Build up pressure in test section equal to static pressure class.
   f. Noise generated from duct leakage not acceptable. Seal as required.
   g. Determine amount of air leakage by makeup air flow measurements:
      1) Maximum permitted leakage for HVAC ductwork shall be:
      2) $CFM_{max} = \left(\frac{A}{100}\right) C_L P^{0.65}$
      3) Where,

CFM_{max} = The maximum permitted leakage, cubic feet per minute (cfm).
A= Surface area of the tested duct sections, square feet.
C_L= Duct leakage class, cfm/100 square feet at 1 inch water column.
= 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts
= 3 for round/flat oval sheet metal or fibrous glass ducts
P= Test pressure which shall be equal to the design duct pressure class rating, inches water column.

4) Allowable leakage can also be calculated as 1 percent of the design operating air volume for the entire system. If this method is used, the total system leakage must first be determined and then compared with the 1 percent (of system volume flow) allowable leakage. Acceptance is indicated if the actual measured leakage of the entire system is less than the calculated allowable leakage.
5) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

5. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation:
1. Submit certification of test results of compliance to Architect (must be initialed by TAB Agency representative prior to submitting to Architect).
2. Include Duct Air Leakage Test Log indicating compliance.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and test logs.

3.08 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:
1. Exposed ends of unlined installed ducts at the end of each day.
2. Exposed ends of lined ducts or plenums whether in storage or installed.

D. Duct cleaning:
1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust.
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning.
3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room.

3.09 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.010 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position.

3.011 TESTING AND ADJUSTING

A. After starting the duct systems: Check for noise and leakage. Repair as required at no additional cost to the Owner.

B. See Section 230593 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:
   1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers.
   2. Install missing dampers.

3. Duct Air Leakage Test Log					
4		6. Description of Duct Section Tested	7	8	12. 13. 14.
1		17.	1		20.
2		23.	2		26.
2		29.	3		32.
3		35.	3		38.
3		41.	4		44.
4		47.	4		50.
5		53.	5		56.
5		59.	6		62.
6		65.	6		68.
6		71.	7		74.
7		77.	7		80.
8		83.	8		86.
8		89.	9		92.
93. This form stall be completed and submitted with the project closeout documents. Contractor shall copy this form if more sheets are required. Piping pressure test log shall be kept at project site and shall be made available to the Architect upon request.					

END OF SECTION

SECTION 23 31 15 OUTDOOR DUCT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Outdoor Duct Systems
   2. Ducts Exposed to Weather

1.03 REFERENCE STANDARDS

A. International Mechanical Code, current edition

B. American Standards: ASTM C 518 2004

C. Standard Test Methods for Water Vapor Transmission of Materials: ASTM E 84–08a

D. Standard Test Method for Surface Burning Characteristics of Building Materials: UL 723

E. Test for Surface Burning Characteristics of Building Materials: NFPA 90A

F. Standard for the Installation of Air Conditioning and Ventilating Systems: NFPA 90B

G. Standard for the Installation of Warm Air Heating and Air–Conditioning Systems: UL/ULC 181

H. SMACNA HVAC Phenolic Duct Construction Standards

1.04 QUALITY ASSURANCE

A. Regulatory Requirements.
   1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A.

1.05 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.
   1. “R” means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

C. Product Data: For each type of the following products:
1. Sealants and gaskets.

D. Submit electronic layout and shop fabrications drawings for approval.
1. Isometric view of duct assembly with duct sections indicated on drawing to match part number tagging on delivered duct sections.
2. Fabrication and assembly instructions.
3. Details for connecting to other components (i.e. curbs, rooftop units, mechanical room walls, etc.)
4. Duct layout indicating sizes and pressure classes.
5. Elevations of top and bottom of ducts.
6. Dimensions of main duct runs from building grid lines.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels

Item	Product Data	O&M Manual	Samples	Shop Drawing
Outdoor Ducts and Plenums	R			R
Sealants and gaskets	R			
Duct pressure testing reports		R		

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Outdoor Ducts:
1. Ducts and Cleats.
2. Thermaduct.
3. Polyguard
4. Or approved equal.

2.02 MATERIALS

A. Ducts and Cleats Pro-R: Pre-assembled: Exterior ductwork is to be a pre-insulated (R-8.1), pre-fabricated, duct system. Duct to be 2 layers, 1-1/2" panel. The panels used in the fabrication of the ductwork system shall be closed cell phenolic foam with autohesively bonded aluminum foil. Outdoor TDC flange covers. Color to be selected by Professional from full range color chart.

B. Thermoduct:
1. Exterior ductwork is to be a pre-insulated, pre-fabricated, duct system. Duct to be 2 layers, 1-3/16" panel.
2. The panels used in the fabrication of the ductwork system shall be closed cell phenolic foam.

3. Duct system shall consist of 1000 micron titanium infused vinyl cladding.
4. Duct system shall use no tapes or adhesives to assemble pieces. Joints to be connected with a gasketed 4 bolt flanging system and covered with manufacturers joint covers.
5. Color to be selected by Professional from full range color chart.

C. Polyguard
   1. Outdoor Duct
      a. Galvanized steel G-90, 304 stainless steel, or aluminum.
      b. Make ducts subject to rain watertight.
      c. Construct as follows to assure water run-off.
         1) Arrange standing seams to not act as dams.
         2) Longitudinal seams at bottom of duct.
         3) Construct all ducts subject to rain watertight and to insure water runoff by one or more of following techniques.
            a) Slope entire top of duct down toward side.
            b) Vertical struts within duct to bow top panels of duct into convex shape.
      d. TDC or Duct-Mate joints: Utilize interior joint gasket material plus a bead of butyl rubber sealant at the joint and continuous metal clip or cleat over the top of all four joints (top bottom and sides).
      e. Continuously welded ducts: Additional sealing not required.
      f. Other joints: Apply two part hard-setting joint tape to:
         1) Longitudinal joints.
         2) Horizontal joints.
         3) Transverse joints.
         4) TDC or Duct-Mate joints.
         5) Duct penetrations.
         6) Screws through duct.
         7) Gores of elbows
   2. Insulation
      a. Duct Board with Vapor Barrier
         1) Insulation: ASTM C612; rigid, noncombustible board.
            a) 'K' ('Ksi') value: ASTM C518, 0.23 at 75 degrees Fahrenheit.
            b) Maximum service temperature: 350 degrees Fahrenheit.
            c) Maximum moisture absorption: 0.20 percent by volume.
      b. Vapor Barrier Jacket - factory installed (FSK).
         1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
         2) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm.
         3) Secure with pressure sensitive tape.
      c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based, adhesive.
      d. Installed conductance: 0.23 BTU-inch/hr./square foot/degree Fahrenheit.
      e. 1-inch Thickness, 3.0 pounds per cubic foot.
      f. Factory applied jacket.
         1) Foil-scrim-kraft laminate.
            a) Aluminum foil facing.
            b) Glass scrim reinforcing.
   3. Self-Adhesive, Field-Applied, Outdoor Jackets
      a. Manufacturers:
         1) Alumaguard, Alumaguard All-Weather, Alumaguard Lite
         2) 3M.
         3) MFM Building Products Corp.

b. General Requirements for Self-Adhesive Outdoor Jacket: Laminated vapor barrier and waterproofing membrane with perm rating of 0.00 perm, when tested according to ASTM E 96/E 96M, for installation over either fiberglass or foam board insulation located above ground outdoors; consists of a foil polymer laminated film with a coating of rubberized bituminous compound or acrylic adhesive that allows membrane to self-adhere to the substrate.

c. Alumaguard: Composite membrane consisting of a multi-ply embossed UV resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt.
   1) Alumaguard Membrane Thickness: 56-mils
   2) Alumaguard Cool Wrap Membrane Thickness: 59-mils.
      a) Solar Reflectance, CRRC Initial Rating: 0.86.
      b) Solar Reflectance, CRRC 3-Year Rating: 0.77.
      c) Thermal Emittance, CRRC Initial Rating: 0.82.
      d) Thermal Emittance, CRRC 3-Year Rating: 0.86

d. Alumaguard Lite® is a multi-ply aluminum foil/polymer composite film coated with an aggressive, low-temperature acrylic adhesive.
   1) Smooth Silver Thickness: 7-mils.
   2) Stucco Embossed Silver Thickness: 9-mils
   3) White Matte Cool Wrap Finish Thickness: 9-mils
      a) Solar Reflectance, CRRC Initial Rating: 0.86.
      b) Solar Reflectance, CRRC 3-Year Rating: 0.77.
      c) Thermal Emittance, CRRC Initial Rating: 0.82.
      d) Thermal Emittance, CRRC 3-Year Rating: 0.86.
   4) Alumaguard Lite White Thickness: 9-mils

e. Alumaguard All-Weather: Hybrid product combining the UV-resistant aluminum foil/polymer laminate and rubberized asphalt used in the Alumaguard product, with a metalized film coated with low temperature acrylic adhesive.
   1) Alumaguard All-Weather Membrane Thickness: 35-mil
   2) Alumaguard All-Weather with Cool Wrap Coating Thickness: 38-mils
      a) Solar Reflectance, CRRC Initial Rating: 0.86.
      b) Solar Reflectance, CRRC 3-Year Rating: 0.77.
      c) Thermal Emittance, CRRC Initial Rating: 0.82.
      d) Thermal Emittance, CRRC 3-Year Rating: 0.86

D. Double Wall Round Ducts and Fittings
1. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of aluminum/galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Ducts to have a solid inner liner, a 1-inch layer of fiberglass insulation (1-1/2 pounds per cubic foot density) and an outer pressure cell.
2. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated. Outer duct to be aluminum.
3. Inner Duct: Minimum 0.028-inch solid wall galvanized sheet steel.
4. Duct Joints:
   a. Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket. Seal all connections water tight.
5. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
6. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

7. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:
   a. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
   b. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
   c. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
   d. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   e. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   f. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
   g. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
   h. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
8. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   a. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   b. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
   c. Coat insulation with antimicrobial coating.
   d. Cover insulation with polyester film complying with UL 181, Class 1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. All duct to be installed in strict accordance with manufacturer’s installation instructions and/or guidelines.

3.02 INSTALLATION OF DUCT SYSTEMS

A. Supports
   1. It shall be the responsibility of the contractor to ensure that the ductwork system is properly and adequately supported. A number of support systems are approved for use by AQC Industries. It shall be the responsibility of the contractor to ensure that the chosen method of support is compatible with ductwork fabricated from the Pal Phenolic Duct System and AQC Industries. Submit all supports for Duct
   2. Supports on straight runs of the QDuct ductwork System shall be positioned at center’s not exceeding 10 ft for ductwork sections fabricated in 10 ft lengths, and 13 ft for ductwork sections fabricated in 13 ft lengths.

3. Additionally, ductwork shall be supported at changes of direction, at branch duct connections, tee fittings and etc.
4. All ductwork accessories such as dampers shall be independently supported.

B. Hangers and Supports
1. Hanger Materials: SMACNA Approved duct supports shall be utilized in accordance with SMACNA Standards for Phenolic Duct.
2. Penetration into the QDuct system duct is not permitted.
3. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
4. Exterior Duct Supports:
   a. To meet all SMACNA and ASHRA requirements.
   b. Supports to be installed on the outside finished QDuct System
   c. Supports to be manufactured by PHP System/Design, Miro or Approved Equal.

3.03 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps and duct joints shall be clean and free of visual blemishes and all sealant shall be internal to joint and not visible. Ducts shall have no external markings or tags. All duct beads shall be parallel.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

G. Hanger and Support Installation
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
2. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   a. Where practical, install concrete inserts before placing concrete.
   b. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   c. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   d. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
3. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
4. Hangers Exposed to View: Threaded rod and angle or channel supports.

5. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.
6. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.04 DUCT PRESSURE TESTING

A. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. Supply, Return, Exhaust, and Outdoor Air Ducts: Test 100% of installed duct sections.
   b. Field installed plenums. Test 100% of all field installed plenums.
3. Allow 24 hours for sealant to cure after final assembly before testing the duct system. Additional curing time may be required in high ambient conditions
4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advanced notice for testing.

B. General:
1. Pretesting shall be conducted prior to conducting test in presence of Architect. Once all required ductwork has passed the pretest duct pressure test, the Architect shall be notified to visit the site for witness testing.
2. Use portable high-pressure blower and necessary instruments to indicate amount of leakage.
3. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual and make test before duct sections are concealed.
4. Procedure:
   a. Seal openings in ducts and plenums to be tested.
   b. Connect test apparatus to test section using flexible duct connection or hose.
   c. Close damper on blower suction side, to prevent excessive buildup of pressure.
   d. Start blower and gradually open damper on suction side of blower.
   e. Build up pressure in test section equal to static pressure class.
   f. Noise generated from duct leakage not acceptable. Seal as required.
   g. Determine amount of air leakage by makeup air flow measurements:
      1) Maximum permitted leakage for HVAC ductwork shall be:
      2) $CFM_{max} = \left(\frac{A}{100}\right) C_L P^{0.65}$
      3) Where,

CFM_{max} = The maximum permitted leakage, cubic feet per minute (cfm).
A= Surface area of the tested duct sections, square feet.
C_L= Duct leakage class, cfm/100 square feet at 1 inch water column.
= 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts
= 3 for round/flat oval sheet metal or fibrous glass ducts
P= Test pressure which shall be equal to the design duct pressure class rating, inches water column.

4) Allowable leakage can also be calculated as 1 percent of the design operating air volume for the entire system. If this method is used, the total system leakage must first be determined and then compared with the 1 percent (of system volume flow) allowable leakage. Acceptance is indicated if the actual measured leakage of the entire system is less than the calculated allowable leakage.
5) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

5. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation:
1. Submit certification of test results of compliance to Architect.
2. Include certified test results showing compliance per Section 230010 – Mechanical General Provisions.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:
1. Exposed ends of unlined installed ducts at the end of each day.
2. Exposed ends of lined ducts or plenums whether in storage or installed.

D. Duct cleaning:
1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust.
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning.
3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room.

3.06 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.07 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position.

3.08 TESTING AND ADJUSTING

A. After starting the duct systems: Check for noise and leakage. Repair as required at no additional cost to the Owner.

B. See Section 230593 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:
   1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers.
   2. Install missing dampers.

END OF SECTION

SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Duct Access Doors.
2. Manual Dampers.
3. Fire Dampers.
4. Wall Louvers.
5. Equipment stands/plenums

1.03 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Architect as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

1.04 SUBMITTALS

A. See Section 230010 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings according to the following table.
1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Access doors	R2			R
Balancing dampers	R2			R
Fire dampers	R	R		R
Wall louvers	R			R
Equipment plenum/stand shop drawings	R			R

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

2.02 DUCT ACCESS DOORS

A. Manufacturers
   1. Ventfabrics, Inc.
   2. Duo Dyne, Corporation.
   3. Ruskin Mfg. Company.
   4. PCI Industries – Pottorff.
   5. Ductmate.

B. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings.

C. Construction:
   1. Galvanized steel.
   2. Rating same as duct pressure class.
   3. Where duct is insulated:
      a. Fiberglass insulation, thickness to match duct insulation installed R-value, see 230713 – Duct Insulation.
      b. Double wall.
   4. Removable type with safety chain linking door permanently to frame.
   5. Positive seal polyethylene gasket.
   6. Paired progressive cam-locks, quantity as required for tight, low leakage fit.
   7. No tools required for opening and closing.

D. Size:
   1. 20 inches x 14 inches unless otherwise indicated in the Drawings.
   2. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inch less than duct width.
   3. Larger sizes where required for access.

E. Provide in the following locations:
   1. Coils in ducts (including at VAV boxes).
      a. Entering and leaving side for cooling coils.
      b. Entering side for heating coils.
   2. Automatic dampers: linkage side.
   3. Smoke dampers.
   4. Fire dampers.
   5. Smoke detection heads.
   6. At the top of each lined duct riser accessible from the fan room floor (for inspection of duct liner).
   7. Fan bearings enclosed in ducts.
   8. Sprinkler heads in ducts.
   9. Motors, actuators, or other accessories that require access or service inside ducts.
   10. Outdoor air plenums as required to clean plenum from dirt and debris.
   11. Where otherwise indicated on the Drawings.

2.03 MANUAL DAMPERS

A. Manufacturers:
1. Ruskin Manufacturing Company.
2. Greenheck Fan Corp.
3. PCI Industries - Pottorff
4. Johnson Controls

B. Manual Dampers:
1. Conform to requirements of SMACNA HVAC Duct Construction Standards.
2. General:
a. Blades of same material as duct where damper is located.
b. Damper Hardware:
1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less.
2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class.
c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal.
d. Bearing at one end of damper rod: Ventlok No. 609 or equal.
e. Sealed bushings installed at both ends to avoid duct leakage.
f. Accessible quadrant at other end of damper rod.
1) With lever and lock screw: Ventlok No. 635 or equal.
2) Insulated ducts.
a) Quadrants mounted on collar to clear insulation.
b) Ventlok Nos. 637, 638, or 639 or equal.
c) Selection based on insulation thickness.
g. For dampers above non-removable ceilings and without ceiling access panels provide Ventlok No. 677 or equal concealed damper regulator.
1) With paintable cover plate.
2) Required interconnecting hardware.
3. Round, Inline
a. Heavy 26-gauge G-90 Galvanized Steel Body (all sizes)
b. Extra Heavy 24-gauge G-90 Galvanized Steel Blade
c. 3/8" Square Axle Secured to Blade with U-bolts
d. Nylon bushings on thru and end (all sizes)
e. 2" Stool with Locking Quadrant and Handle (all sizes, wing nuts not acceptable)
f. Sealed on all Seams
g. BO3 (2") Build-out, 3/8" Square Shaft (solid rod), U-bolt, Locking Quadrant, Handle
h. Flexmaster Co. Connecting Sleeve (SL-BO3), Crown 175-XS2 or equal.
4. Rectangular
a. Single blade dampers:
1) Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings.
2) Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter.
b. Multi-blade dampers.
1) Low Pressure/Low Velocity Systems (2-inch water column or less static pressure class and 1500 fpm or less face velocity).
a) Opposed blade damper.
b) Ruskin Model CD35 or equal.

5. High Pressure/High Velocity Systems (greater than 2-inch water column static pressure class or greater than 1500 fpm face velocity):
    1) Rectangular.
        a) Opposed blade damper.
        b) Ruskin Model CD60 or equal.
    2) Round and Oval.
        a) Oval: Ruskin Model CDR25 and DO25 or equal.
        b) Round: Up to 20-inch diameter: Ruskin Model MDRS25 or equal.
        c) Round: Larger than 20-inch diameter: Ruskin Model CDRS25 or equal.

2.04 FIRE DAMPERS

A. Manufacturers:
1. Ruskin Manufacturing Company.
2. Greenheck Fan Corp.
3. Air Balance Inc.
4. PCI Industries – Pottorff.

B. Ratings (test conditions and label) per UL Standard 555.
1. 250 degrees Fahrenheit minimum.
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings.
3. Dynamic (closes against air flow).

C. Factory sleeve.

D. Damper.
1. Multi-bladed, equipped with fusible link, spring loaded type.
2. Style:
    a. As indicated on the Drawings.
    b. Ducted, rectangular duct: Style B (out of airstream).
    c. Ducted, round duct: Style A (in airstream) with damper sleeve 2” in each dimension larger than duct; plus, cap and collar.
    d. Un-ducted: Style A (in airstream).

E. Fusible Link.
1. UL listed.
2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service.
3. Temperature rating: Per code.

F. Type:
1. Rectangular type up to 1000 feet per minute: Ruskin DIBD2 or DIBD10 Style A or equal.
2. Rectangular type 1000 feet per minute and higher: Ruskin DIBD2 or DIBD10 Style B or equal.
3. Circular and oval type: Ruskin DIBD2 Style CR and CO, or DIBD10 Style R and LO or equal.

G. Status end switches:
1. Where indicated on the Drawings.
2. Ruskin SP100 or equal Switch Package.

2.05 WALL LOUVERS

A. Manufacturers:
   1. Ruskin Manufacturing Company.
   2. Greenheck Fan Corp.
   3. PCI Industries – Pottorff.
   4. United Enertech

B. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

C. Materials.
   1. Frame.
      a. Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch, nominal.
      c. Depth: 6 inches minimum.
      d. Downspouts and caulking surfaces.
   2. Blades.
      a. Horizontal rain resistant style.
      b. Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch, nominal.
      d. 2 inch blade spacing.

D. Screen (1/4" opening hardware cloth on intake, 1/2" opening on exhaust/relief).
   1. Aluminum wire screen.
   2. 14 gauge.
   3. Frame: Removable, rewireable.
   4. Mounted on inside of louver.

E. Gutters: Drain gutter in head frame.

F. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.

G. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.

H. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

I. Assembly: Factory assemble louver components; mechanically fastened.

J. Blank off panels for unused portions of louvers: 20 gage galvanized sheet metal.

K. Factory Finish:
   1. Kynar 500 (70% Kynar Resin) 2-Coat Fluoropolymer Coating or equal, unless otherwise specified on Drawings.
      a. Conform to AAMA 2605-98.
      b. Apply coating following cleaning and pretreatment.
      c. Cleaning: AA-C12C42R1X.
      d. Dry louvers before final finish application.
      e. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees Fahrenheit for 10 minutes.

f. Warranty: Limited 20 year warranty on standard colors.
g. Color: Color as selected by Architect from manufacturer's standard colors.

L. Basis of Design Louvers:
1. Outside air intake: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver.
2. Exhaust outlet: Greenheck EHH-601 or equal. 6-inch deep wind-driven rain louver.
3. Combination louver/damper: Greenheck EACA-601 or equal, 6” frame.

2.06 EQUIPMENT STAND

A. Provide structural equipment support stand for blower coils, furnaces, etc. for stand-alone indoor above floor raised equipment applications. Stand may be welded angle iron braced frame, with minimum 2" x 1/4" flat steel bar feet, where separate duct/connections are indicated. Prime/paint fame. Size of structural frame to match unit base at height indicated.

B. Where platform also acts as an air distribution plenum, construction shall include structurally sound ductwork grade minimum 20-gauge galvanized sheet metal. Plenum size to match application. Contractor shall submit detail of proposed plenum construction, size, and connections, bracing, etc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2010 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Volume dampers.
1. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.
b. Provide also in wyes and branch take-offs to outlets whether indicated on the Drawings or not, except.
1) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided).
2. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Fire dampers.
   1. Provide in ducts and openings as indicated in the Drawings.
   2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
   2. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   3. At each change in direction and at maximum 50-foot spacing.
   4. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Label access doors according to Section 230553 Mechanical Identification to indicate the purpose of access door.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
   4. Inspect turning vanes for proper and secure installation.
   5. Operate remote damper operators to verify full range of movement of operator and damper.

3.03 TESTING AND ADJUSTING

A. After starting duct accessories.
   1. Check for noise and leakage; repair as required at no additional cost to the Owner.
   2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

B. See Section 230593 – Testing, Adjusting, and Balancing

END OF SECTION

SECTION 23 34 23 HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Ceiling Exhaust Fans.

1.03 REFERENCE STANDARDS

A. ANSI/AFBMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings.

B. AMCA 99 – Standards Handbook.

C. AMCA 211 – Product Rating Manual for Fan Air Performance.

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.

E. AMCA 311 – Fan Sound Performance.

F. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

G. UL 705 – Standard Power Ventilators.

1.04 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Conform to AMCA Bulletins regarding construction and testing.
1. Fans shall bear AMCA certified rating seal.

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

1.05 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. "R" means required.
   2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fans	R	R		R
Performance curves	R			
Sound Power ratings	R			
Motor ratings and electrical characteristics	R			
Dampers, housings, linkages, and operators	R			
Roof curbs	R			R
Fan speed controllers and other accessories	R	R		

C. Include:
   1. Complete graph of fan curves, not just curve for design conditions.
   2. Sound power levels:
      a. Fans 1 horsepower and larger: dB by octave bands.
      b. Fans less than 1 horsepower: sones.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.
   1. Loren Cook.
   2. Greenheck.
   3. PennBarry.
   4. Or equal.

2.02 GENERAL

A. AMCA certification in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans.

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance.
1. See fan schedule on the Drawings.
2. Capacities: minimum as scheduled on the Drawings.
3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings.
4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent.
5. Motor horsepower: No larger than that scheduled on the Drawings or compensate Division 26 contractor for any associated cost to increasing motor size.
6. Sized for a critical speed of at least 125% of maximum RPM.

D. Painting.
1. Electrostatically applied, baked polyester powder coating, minimum 2 mil thick.
2. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

E. Discharge: As indicated on Drawings.

F. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA Certified Transit Tested Packaging

2.03 CEILING EXHAUST FANS

A. Description
1. Fan shall be ceiling mounted centrifugal exhaust fan.

B. Housing: Fan housing shall be galvanized steel and acoustically insulated. Galvanized steel shall be minimum as required by manufacturer model number on plans.

C. Fan Wheel: Wheel shall be centrifugal forward curved type

D. Motor:
1. Motor shall be totally enclosed, not ventilated (TENV) electronically commutated (EC) with permanently lubricated bearings, built-in thermal overload protection and disconnect plug. Motor shall have an adjustable speed range from 500 to 1725 rpm. Motor shall be furnished at the specified voltage.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Sound Data: Maximum sound data allowed per schedules.

H. Accessories:
1. Isolation: Rubber-in-shear vibration isolators.
2. Fan Speed Controller: pre-wired.
3. EC Controls:
a. Internally mounted potentiometer speed controller with leads for connection to 0-10 VDC signal.

b. Remote Speed Control: 0-10V rotary speed control with stainless steel faceplate mounted on 2x4 electrical junction box. Provided with control transformer.
c. 1” Pressure Control: Allow modulation of motor RPM via 0-10V signal to maintain a differential pressure across the pressure ports. LCD readout of pressure and setpoint on home screen. NEMA 1 enclosure. Provided with control transformer.

4. Ceiling Mounted Motion Sensor: Motion detector with adjustable shutoff timer from 20 seconds to 30 minutes. Wall or ceiling as required by schedule or coordinated with professional. Provided, installed, and wiring by Division 23 HVAC Contractor.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install fans in accordance with manufacturer’s written installation instructions.

C. See Section 233113 – Metal Ducts for duct connections.

D. Flexible duct connection at inlet and outlet: See Section 233113 – Metal Ducts.

E. Backdraft Dampers.
1. Comply with ASHRAE 90.1 and IMC.
2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings.
3. See schedules on the Drawings and Section 233300 – Air Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

3.02 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.03 PRE-OPERATING CHECKS

A. Do not operate fans for any purpose, temporary or permanent, until:
1. Ductwork is clean.
2. Filters in place.
3. Bearings lubricated.

3.04 TESTING AND ADJUSTING

A. Before starting fans install belts and motor guards.

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

F. Balancing: See Section 230593 – Testing, Adjusting and Balancing.

3.05 TRAINING

A. See Section 230010 – Mechanical General Provisions.

END OF SECTION

SECTION 23 37 00 AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment

1.03 REFERENCE STANDARDS

A. ARI Standard 650 – Air Outlets and Inlets.

B. ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets.

C. AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating.

D. NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems.

E. NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.04 QUALITY ASSURANCE

A. Comply with ARI Standard 650, ASHRAE Standard 70, AMCA Standard 500, NFPA Standard 90A, and NFPA Standard 90B.

B. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

1.05 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Grilles, registers, and diffusers	R			R
Accessories	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.
1. Titus.
2. Price.
3. Nailor.
4. Or equal.

2.02 AIR DISTRIBUTION DEVICES

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Material:
1. All grilles are to be of steel construction unless otherwise indicated on schedules.

D. Volume dampers:
1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on drawings.
2. Opposed blade volume damper key-operated adjustable from face of diffuser on register except as noted.

E. Diffuser frame:
1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling drawings.
   a. At plaster or drywall ceilings:
      1) Lay-in diffuser with drywall frame (Titus TRM to match diffuser material). Drywall frame to match diffuser color.
2. No visible screw allowed on diffusers or frames, unless otherwise indicated on the Drawings.
3. Linear and bar diffusers shown as one collinear piece on plans shall be constructed as one piece within manufacturing limitations and to appear as one section if manufacturing limitations require multiple pieces. Provide with Border Type shown on plans. Coordinate exact border type with design professional before ordering.

F. Color:
1. Face and frame: Factory-baked #26 white enamel unless otherwise indicated on the Drawings.
2. Internal parts of grille visible from occupied space, including all parts behind perforated face diffusers and visible parts of plenums: flat black.

G. Provide square to round adapters where required.

H. Provide one-, two-, three- or four-way discharge patterns as indicated on plans.

I. See mechanical schedules for type and sizes.

2.03 SCREENED OPENINGS

A. Mesh:
1. 3/4 in. square pattern.
2. No. 16 galvanized wire.
3. Interwoven.
4. Welded or secured to frame.

B. Frames:
1. 1 inch by 1 inch by 1/8 inch galvanized steel angles.
2. Continuous around perimeter of screen (welded at corners).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer's written installation instructions and Section 233113 – Metal Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black.

E. Transfer grilles.
1. See indications on the Drawings.
2. Wall installations, unless otherwise indicated, provide two grilles.
a. One on each side of wall, except where open to return air plenum.
b. Connecting sheet metal collar with 18 inch elevation offset for sound and light attenuation.

F. Provide duct screens at termination ducts as indicated on the Drawings.

3.02 MOUNTING AND ALIGNMENT

A. All air outlets and inlets shall be secured to building.
1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gauge ceiling wires, two 22-gauge by 1 inch galvanized sheet metal strap or two #10 sheet metal screws.
2. Comply with IBC.

B. Mount directional grilles as indicated on the Drawings.

C. Adjust grille throw patterns.
   1. As indicated on the Drawings.
   2. For double-deflection grilles, adjust rear blades horizontal and front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
   3. Adjust grille throw patterns prior to test and balance. See Section 230593 – Testing, Adjusting, and Balancing.

3.03 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.04 TESTING AND ADJUSTING

A. See Section 230593 – Testing, Adjusting, and Balancing.

END OF SECTION

SECTION 23 40 00 AIR CLEANING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Filter media.

1.03 REFERENCE STANDARDS

A. ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. ANSI/UL 900 – Test Performance of Air Filter Units.

1.04 QUALITY ASSURANCE

A. Filters shall have MERV ratings in accordance with ASHRAE Standard 52.2 with preconditioning as specified in Appendix J of that Standard.

1.05 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
   1. “R” means required.
   2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Filters	R			

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Filter Media and Frames:
1. Camfil/Farr Filtration Group.
2. Flanders/Precisionaire.
3. American Air Filter.
4. Or equal.

2.02 FILTERS

A. General.
1. UL 900 listed.
2. Disposable type.
3. Each filter shall consist of media, media support grid, and enclosing frame.
4. Each filter shall have flow direction and MERV rating permanently affixed to frame.

B. Type 1: Pleated Filter:
1. 2 inch or 4 inch pleated.
2. Media: Cotton & synthetic media (no polyester).
3. Minimum performance:
a. MERV 8 for use after construction period.
b. MERV 11 for use at startup and during construction period.
4. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
5. Camfil/Farr 30/30 or equal.

C. Type 2: Bulk Media:
1. 1 inch fiberglass.
2. Filter media shall consist of a continuous filament fiberglass of graduated density. Media shall include a skin on the leaving air side. Furthermore, the media shall be treated with a non-toxic, non-flammable, odor free adhesive.
3. UL listed, Class 2.

PART 3 - EXECUTION

3.01 FILTER MEDIA

A. Media as selected in equipment schedules on the Drawings.

B. Construction filters:
1. Type 1 for all equipment: roll media not acceptable.
2. Type 2 filter media is intended to be utilized over return/exhaust air grilles, registers and/or open ductwork during the construction period when the systems are being operated. This filter media is not to be utilized inside the housing of any HVAC systems.

C. Spare Filters:
   1. Provide three (3) sets of spare filters for each piece of HVAC equipment and filter grille except the following (provide only one (1) spare set):
      a. Ductless split-systems.

3.02 INSTALLATION

A. Factory installed in air handling equipment.

B. Coordinate with work of other trades.

C. Install Air Cleaning Devices in accordance with manufacturer's written installation instructions.

D. See Section 230593 – Testing, Adjusting, and Balancing.

3.03 START-UP PROCEDURES

A. Do not operate air handling unit fan systems for any reason until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

B. Supply fans shall not be operated unless filters are installed, including temporary filters for use during test and balance.

C. If the final pressure drop of the temporary filters is reached during test and balance, replace them with a spare set.

D. Before turning system over to the Owner, remove temporary construction filters and install clean final filters:
   1. Remove prefilters in front of cartridge, bag, and HEPA filters after construction and do not replace. Prefilters shall not be used during normal operation.
   2. See also Section 230593 – Testing, Adjusting, and Balancing, Section 230010 – Mechanical General Provisions and Section 230500 – Basic Materials and Methods for media installation during temporary equipment operation and test and balance periods.

3.04 INSPECTION

A. Verify that adequate clearance between Air Cleaning Devices and adjacent walls or equipment is available to permit maintenance and replacement of filters.

B. Verify that filters are firmly seated in frame to minimize bypass.

3.05 TRAINING

A. See Section 230010 – Mechanical General Provisions.

END OF SECTION

SECTION 23 74 16.12 PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   1. Packaged rooftop air conditioning units.
   2. Controls.
   3. Accessories.

1.01 REFERENCE STANDARDS

A. AHRI 340/360 – Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. AHRI 270 – Sound Performance Rating of Outdoor Unitary Equipment.

C. AHRI 1060 – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

D. AMCA 211 – Certified Ratings Program Product Rating Manual for Fan Air Performance.

E. AMCA 311 – Certified Sound Ratings Program for Air Moving Devices.

F. ASHRAE Standard 15 – Safety Standard for Refrigeration Systems.

G. ASHRAE Standard 33 – Methods of Testing Forced Circulation Air Cooling and Air Heating Coils.

H. ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality.

I. ASHRAE Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

J. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems.

K. NFPA 90B – Standard for the Installation of Warm Air heating and Air-Conditioning Systems.

L. NFPA 70 – National Electrical Code.

1.01 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for both sound and performance.

C. Units shall be designed and manufactured in strict accordance with AHRI 340/360.

D. Energy performance shall meet or exceed the energy performance requirements described in ASHRAE Standard 90.1, latest adopted edition.

E. Schedule equipment performance is minimum capacity required.

1.01 SUBMITTALS

A. See Section 23 00 10 Mechanical General Provisions.

B. Submit product data, O&M data, and samples and show item on shop and coordination drawings (where shop and coordination drawings are required) according to the following table.
   1. "R" means required.
   2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Packaged units	R	R		R
Coils, performance data	R	R		
Fans, performance data	R			
Acoustical performance data	R			
Motors	R	R		
Dampers and actuators	R	R		
Filters	R			
Factory installed controls	R	R		
Accessories	R	R		R
BACnet PICS statement	R	R		

C. Additional submittal requirements.
   1. List of exceptions to the specifications including section number and a detailed description of alternative materials and methods. If there are no exceptions, so state in precise language.
   2. List of proposed manufacturers for fans, filters, coils, motors, drives, dampers and other components.
   3. Complete graph of fan curves (not just curve for design conditions) indicating efficiency, BHP, and RPM.
   4. Sound power levels per ARI 270 by octave bands; radiated and at inlet and discharge.
   5. Coil performance and flow rates.
   6. Filter and filter frame product data.
   7. Wiring diagram.
   8. Control panel location, including elevation indicating height above the ground.
   9. Internal static pressure drop with filters clean and dirty.

10. Casing materials of construction and methods of assembly.
11. Construction details including panel sealing, thermal break, door seal and hardware, shipping split and field treatment of panel penetration (sleeve) details.
12. Complete dimensional data including exterior dimensions and dimensions of internal components.
13. Coordination Drawings: Submit with Shop Drawings. Show space layout and relationships between components and adjacent structural and mechanical elements. Show service clearance requirements, and support locations, type of support, and weight on each support. Indicate and certify field measurements.

1.01 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.
   1. Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
   2. Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
   3. Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
   4. Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.01 MAINTENANCE MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan Belts: Two sets for each belt-driven fan.
   2. Filters: See Section 234000 Air Cleaning Devices.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models are acceptable.
   1. Daikin.
   2. Trane.
   3. JCI/York.
   4. Lennox Enlight.
   5. Or equal.

2.01 GENERAL

A. Types and performance as scheduled on Drawings.

B. Performance certified under AHRI Standard 340/360.

C. Units prepared for shipping with all openings securely covered and watertight.

D. All outdoor openings shall have a 1/2 inch mesh bird-screen provided on louvers.

2.01 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Standard factory finish.
   1. Units painted immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

C. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   1. Materials: ASTM C 1071, Type I, 3/4 pound density.
   2. Thickness: 1/2 inch.
   3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric. Material shall meet the requirements of NFPA 90A.
   4. Liner Adhesive: Comply with ASTM C 916, Type I.

D. Condenser Hail Coil Guards: Provide factory tool-less heavy-duty louvered, factory primed and painted to match unit enclosure and mounted in a rigid frame with a minimum of 2” clearance to coils.

E. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1 and NFPA 90A.

F. Unit base shall consist of a one piece welded assembly with 14 gauge structural members.

2.01 ACCESS DOORS

A. Access to compressors, evaporator fan, relief fan, controls and air filter sections shall include hinged access doors with weatherproof gasketed seal and quarter turn latches.

B. Remaining unit panels shall be removable for inspection and access to all internal components.

2.01 FANS, MOTORS, AND DRIVES

A. Comply with Section 233400 – HVAC Power Ventilators and Section 230513 – Motors and Controllers.

B. Type.
   1. Supply Fans: Aluminum or painted-steel wheels, and galvanized or painted-steel fan scrolls.
      a. Belt Drive: Forward curved type (or backward inclined) DWDI Class I centrifugal type specifically designed and suitable for the operating pressure conforming to AMCA 211. Provide adjustable pitch sheave. Motors shall be installed on an adjustable fan base resiliently mounted in the casing.
      b. Direct Drive: (Units 5 tons and less): Variable speed, direct drive. Motor shall be resiliently mounted in the fan inlet.

2. Condenser Fans: Direct-drive, variable-speed propeller, mounted on shaft of permanently lubricated multispeed motors.

C. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

D. Duty: Continuous duty at ambient temperature of 104 ˚F and at altitude of 3300 feet above sea level.

E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.01 DRAIN PANS

A. Under cooling coil.

B. 304 stainless steel: minimum 16-gauge; in accordance with ASHRAE 62.1.

C. Corners soldered, welded or brazed.

D. Pitched to drain flange to fully drain; double broken, double sloped to ensure no standing water.

E. Drain flange.
1. Minimum per code.
2. Stainless steel or brass.
3. Welded or soldered into bottom of pan.

F. Accessible for cleaning.

G. Insulation: minimum 1 in. thick, coated fiberglass board or injected foam insulation, NFPA-90 or UL listed: Intermediate drain pans need not be insulated.

2.01 FILTER SECTION

A. Holding Frames: Holding frames shall be factory fabricated of 16-gage galvanized steel and shall be equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 25 pounds pressure without deflection and be attached or removed without the use of tools.

B. Filter type, MERV rating, and arrangement shall be provided as defined in Section 234000 – Air Cleaning Devices.

C. Filters shall be lifted out where access is available upstream of the filter, or side slide out when front access is not available.

D. Performance: Select fan for mean pressure drop (midway from clean to maximum).

E. Manufacturer shall provide one set of startup filters.

2.01 ECONOMIZER (OUTDOOR AIR AND RETURN AIR DAMPERS)

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated or galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   1. Low Leakage Outdoor Air Damper: As required by ASHRAE 90.1.
   2. Damper motor: Fully modulating, 0-100%, with adjustable minimum position.
   3. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IES 90.1, with bird screen and hood.

B. Outdoor air intake weather hood with moisture eliminator.

C. Barometric relief dampers.

2.01 VIBRATION ISOLATION

A. Internally isolated.

2.01 COILS

A. Evaporator Coil:
   1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
   2. Evaporator coils for multi-circuited systems shall be split face design.
   3. Each circuit shall have factory-installed independent thermostatic expansion device, service pressure ports and refrigerant line filter driers.

B. Condenser Coil:
   1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
   2. Provide a separate air cooled condenser circuit for each multi-compressor separate circuited installation(s). If compressors are paralleled, provide not less than two independent circuits, and no less separate circuits or distinct levels of control than scheduled. A common-housing may be used, but each coil shall be provided with separate controls to operate individual condenser fans for each coil.

C. Hot-Gas Reheat Refrigerant Coil:
   1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
   2. Suction-discharge bypass valve.

2.01 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:
   1. Refrigerant: R-410A.
   2. Expansion valve with replaceable thermostatic element.
   3. Refrigerant filter/dryer.

4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Individual compressor isolation valves shall be provided where compressors are installed in tandem arrangement on the same refrigerant circuit.
10. Three phase compressors shall have protection from phase loss, reversal, and high/low voltage.
11. Low-ambient kit high-pressure sensor.

2.01 GAS FURNACES

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

B. Burners: Stainless steel.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension.

E. Safety Controls:
1. Gas Control Valve: Staged.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.01 ELECTRICAL

A. Packaged units shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

B. Three-phase units shall be provided with phase loss/reversal and brownout protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage, or the voltage is more than 10% under or over design voltage. These electrical controls shall include automatic restart capability.

C. Unit shall be provided with a factory installed 115 volt, 15 amp ground fault service receptacle where scheduled on Drawings. Receptacle to be factory powered.

2.01 CONTROLS

A. Factory Unit Controls:
1. Solid-state, microprocessor controller
2. Control-voltage transformer.
3. Default control to ensure proper operation after power interruption.
4. Fan On/Off delay.
5. Service relay output.
6. Unit diagnostics and diagnostic code storage.

7. Field-adjustable control parameters.
8. Low-ambient control, allowing operation down to 0˚F.
9. Evaporator frost control: Frostat.
10. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
11. Low-refrigerant pressure control.

B. DDC Controller:
1. Controller shall have volatile-memory backup.
2. Safety Control Operation:
   a. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40˚F.

C. Building Automation System (BAS) Interface:
1. BACnet Communication Interface Card. The BACnet Communication Interface for integration into the Energy Management and Control System. BACnet Communication Interface shall utilize the BACnet protocol over an RS- 485 MS/TP communications link.
2. See Drawings for minimum points mapped through BAS interfaces.

D. Wall Mounted Programmable Thermostat (WIFI ENABLED):
1. LCD touchscreen display.
2. Heating and cooling stages to match application specified.
3. 7-day programmable.
4. 10k thermistor.
5. Proportional plus integral (PI) control.
6. Touchscreen lockout.
7. Setpoint adjustment.
8. Override control.
9. Fan speed control.
10. Clock.
11. Display includes local 5-day forecast.
12. Manufacturer:
   a. Honeywell RTH9580 WF
   b. Or equal.

E. Wall Mounted Humidity Sensor or Humidistat.
1. 55% RH setpoint.
2. Compatible with hot-gas reheat, dehumidification control.
3. Compatible with packaged unit controller.

2.01 ACCESSORIES

A. Low-ambient kit using variable-speed condenser fans for operation down to 0˚F.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Remote potentiometer to adjust minimum economizer damper position.

D. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

E. Vertical vent extensions to increase the separation between the outdoor-air intake and the flue-gas outlet.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of packaged units.

C. Examine roughing-in for packaged units to verify actual locations of piping and duct connections before equipment installation.

D. Verify that adequate clearance between packaged units and adjacent walls or equipment is available to permit maintenance and repairs.

E. Examine roofs for suitable conditions where RTUs will be installed.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. Install packaged units in accordance with manufacturer’s written installation instructions. Units shall be installed level and plumb, maintaining manufacturer’s recommended clearances.

H. Mount units sufficiently high to allow for proper condensate trapping and drainage.

I. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
   1. Construct concrete bases (with chamfered edges) of dimensions indicated, but not less than 6 inches larger than supported equipment and minimum 6 inches above finished ground elevation.
   2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   3. Install anchor bolts to elevations required for proper attachment to supported equipment.
   4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   5. Use 3000-psi, 28-day compressive-strength concrete and reinforcement with No. 6 rebar on 12-inch centers, both ways.
   6. Install packaged units on concrete base using elastomeric pads per unit manufacturer’s recommendations.

J. Piping.
   1. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
   2. Install piping adjacent to units to allow service and maintenance.
   3. Gas piping shall comply with Section 231123 Facility Natural Gas Piping. Connect gas piping to unit full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for heat exchanger removal and service.
   4. Do not block access doors with piping. Access doors shall be capable of opening 90 degrees.

K. Duct Connections: Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   1. Install ducts to termination at top of roof curb.
   2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   3. Connect supply and return ducts to packaged units with flexible duct connectors specified in Section 233300 Air Duct Accessories.

L. The Contractor shall be responsible to coordinate all installation requirements with other trades to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.

M. The Contractor shall verify that the following items have been completed prior to scheduling the packaged unit manufacturer's final inspection and start up:
   1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
   2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
   3. All gas piping connections have been completed and pressure tested.
   4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
   5. All power wiring and disconnects, serving the unit has been completed.
   6. All automatic temperature and safety controls have been completed.
   7. All dampers are fully operational.
   8. All shipping materials have been removed.
   9. All (clean) filter media has been installed in the units.

3.01 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
   1. After installing packaged units and after electrical circuitry has been energized, test units for compliance with requirements.
   2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Package unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.01 CLEANING

A. Clean packaged units externally and internally, on completion of installation, according to manufacturer’s written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing modular air-handling and air-distribution systems, clean filter housings and install new filters.

3.01 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.
1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15˚F above return-air temperature:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.

26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.
29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.01 TESTING AND ADJUSTING

A. Do not operate fans for any purpose, temporary or permanent until:
    1. See Section 230500 – Basic Mechanical Materials and Methods.
    2. Ductwork is clean.
    3. Filters are in place.
    4. Bearings are in place.
    5. Bearings are lubricated.
    6. Fan(s) has been run under observation.

B. Start and test fans in accordance with manufacturer’s written installation instructions.

C. Test cooling coil drain pans. See Section 233300 – Duct Accessories.

D. Start-up and adjust completed air handling units to insure proper operation.

E. See Section 230593 – Testing, Adjusting, and Balancing.

F. After starting fans: Check for objectionable noise and/or vibration. Correct as needed at no additional cost to the Owner.

3.01 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

B. See Section 230010 – Mechanical General Provisions.

END OF SECTION

SECTION 23 81 43 DUCTLESS SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Wall Mounted.

1.03 REFERENCE STANDARDS

A. AHRI Standard 210/240 – Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment.

B. U.S. Environmental Protection Agency – Energy Star Products.

1.04 SUBMITTALS

A. See Section 230010 – Mechanical General Provisions

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.
1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
DSS outdoor units	R	R		R
DSS indoor units	R	R		R
DSS controls and accessories	R	R		

1.05 QUALITY ASSURANCE

A. Ductless split-system heat pumps rated and certified in accordance with AHRI Standard 210/240.

B. Ductless split-system heat pumps Energy Star rated.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 01 Section "Substitutions."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of split-system heat pump units that fail in materials or workmanship within specified warranty period.

C. Warranty Period: Five year parts from date of substantial completion with first year labor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.
1. Daikin.
2. Trane-Mitsubishi.
3. Hitachi.

2.02 WALL-MOUNTED HEAT PUMP INDOOR UNITS

A. General: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant piping shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
1. The unit shall have multi-directional drain and refrigerant piping arrangements providing options for four (4) directions for refrigerant piping and two (2) directions for draining.
2. Unit shall have a separate back plate which secures the unit firmly to the wall.

C. Fan:
1. The evaporator fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor, be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
2. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

3. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
4. The indoor fan shall be capable of four (4) speeds, High, Mid 1, Mid 2, and Low, two of which may be selected by the room controller.

D. Filter:
1. Return air shall be filtered by means of an easily removable washable filter.

E. Coil:
1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing with inner grooves for high efficiency heat exchange.
2. All tube joints shall be brazed with phoscopper or silver alloy and shall be pressure tested at the factory.
3. A condensate pan and drain shall be provided under the coil.
4. The condensate pump shall be able to raise drain water 33 inches above the condensate pan.

F. Electrical:
1. The unit electrical power shall be 208 volts, 1 phase, 60 hertz. (Contractor shall be responsible for coordinating unit electrical characteristics with actual site electrical service.)

G. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2.03 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
1. Compressor Type: DC inverter driven twin rotary with manual-reset high-pressure switch and automatic-reset low-pressure switch.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.

D. Heat Pump Components: Reversing value and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 0 ˚F.

H. Mounting Base: Polyethylene.

2.04 ACCESSORIES

A. Thermostat: Remote, hard-wired control compressor and evaporator fan, with the following features:
   1. Status monitoring.
   2. Seven day programming of system stop and start.
   3. Liquid-crystal display indicating mode, temperature, set-point temperature, indoor temperature, time setting, operating mode, fan speed, air-flow direction, filter sign and error alarm and code.
   4. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Diamondback refrigerant line sets (or equal) with flared fittings, each end pre-insulated.

D. Refrigerant Valves and Piping:
   1. Valves in the variable refrigerant flow system shall be Diamondback BV series ball valves (or equal) with HKG-20HF insulation kits (or equal). Valve shall be a 700 psig Schrader valve for service connections. This valve kit shall be used with all systems.
   2. Refrigerant piping between outdoor units and indoor units shall be pre-charged, pre-insulated, copper line sets provided by the equipment manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install all system components in accordance with manufacturer’s written installation instructions.

C. Provide access space around indoor and outdoor units for service. Provide no less than minimum as recommended by manufacturer.

D. Install units level and plumb.

E. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that units are installed and connected according to the Contract Documents.

C. Lubricate bearings, adjust belt tension, and change filters.

D. Perform startup checks according to manufacturer's written instructions and do the following:
1. Fill out manufacturer's checklists.
2. Check for unobstructed airflow over coils.
3. Check operation of condenser capacity-control device.
4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain units.
1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units. See Section 230010 “Mechanical General Provisions.”
2. Review data in maintenance manuals. Refer to Section 230010 “Mechanical General Provisions.”

END OF SECTION

SECTION 26 05 00 - GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to all Division 26 Specification Sections.

1.2 INTENT OF DOCUMENTS

A. The intent of the drawings and specifications is to obtain complete systems furnished, installed, tested, adjusted and ready for operation per industry standards, applicable codes and manufacturer's recommendations.

B. Incidental materials and details not typically shown or specified, but required for proper installation and operation shall be deemed part of this Specifications and shall be provided.

1.3 REFERENCED CODES & STANDARDS

A. Agencies or publications referenced in this Specification refer to the following:

1.	ADA	Americans with Disabilities Act
2.	AEIC	Association of Edison Illuminating Companies
3.	AHJ	Authority Having Jurisdiction
4.	ANSI	American National Standards Institute
5.	ASME	American Society of Mechanical Engineers
6.	ASTM	American Society for Testing and Materials
7.	BICSI	Building Industry Consulting Services International
8.	EIA	Electronic Industries Association
9.	FCC	Federal Communications Commission
10.	IBC	International Building Code
11.	ICEA	Insulated Cable Engineers Association
12.	IEEE	Institute of Electrical and Electronics Engineers
13.	IESNA	Illuminating Engineering Society of North America
14.	IFC	International Fire Code
15.	NEC	National Electrical Code
16.	NECA	National Electrical Contractors Association
17.	NESC	National Electrical Safety Code
18.	NETA	National Electrical Testing Association
19.	NFPA	National Fire Protection Association
20.	NIST	National Institute of Standards and Technology
21.	OSHA	Occupational Safety and Health Administration
22.	TIA	Telecommunications Industries Association
23.	UL	Underwriters Laboratories, Inc.

B. Work shall be performed in accordance with the latest edition of Codes and Standards unless indicated otherwise.

C. Electrical equipment and material and their installation and connection shall strictly comply with the latest editions and applicable sections of the following Codes and Standards as well as additional applicable Codes and Standards referenced in the technical Sections of this Specification for the products and systems to be provided.

1. NFPA 70 - National Electrical Code (NEC)
2. NFPA 101 - Life Safety Code
3. International Building Code (IBC)
4. International Fire Code (IFC)
5. National Electrical Safety Code (ANSI-C2)
6. Americans with Disabilities Act

D. Rules, regulations and ordinances of Federal, State and Local Authorities and Utility Companies in force at the time of execution of this Contract shall become part of this Specification.

E. All equipment and material shall be manufactured in compliance with applicable NEMA, ANSI and NEC standards and requirements.

F. All electrical equipment and materials provided shall be listed by Underwriter's Laboratory (UL) when such listings are issued for the type of equipment or materials. All equipment/material shall be installed and connected in full compliance with their UL listing.

1.4 CONTRACTOR QUALIFICATIONS

A. The Electrical Contractor shall be licensed in the State in which the project is located as an Electrical Contractor with Electrical Contracting as their primary business function. The Electrical Contractor's on-site project Superintendent shall be a licensed Jouneyman Wireman (JW) or similar recognized licensing and shall be familiar with the systems, equipment and materials; their installation, connection and operation; and associated governing codes and standards typical for the type of facility(ies) being constructed as part of this project. The Electrical Contractor's Superintendent shall be on-site whenever any electrical construction work for this project is being performed.

B. The successful Electrical Contractor shall submit to the Professional within 2 weeks of award of the project Contract and prior to any electrical construction work being performed a resume on his proposed project Electrical Superintendent for approval. The Superintendent's resume shall include a minimum of 5 previously performed projects of similar scope and complexity within 10 years of this project's contract date in which he was the project superintendent. For each project listed include an electrical construction cost, general description of the electrical work performed, Owner/Using Agency's name and a contact person with phone number.

C. It is not the intent of this Specification to reiterate or list all the requirements of the published Codes and Standards applicable to this project. It shall be the Contractor's responsibility to be familiar with, understand and adhere to the minimum requirements of the applicable Codes and Standards. Where this Specification requires more stringent requirements than the applicable Codes and Standards, this Specification shall govern.

D. By submitting a price or bid for the work associated with this project, the Electrical Contractor testifies that he has adequate experience in the type of work to be performed and the systems to be provided to satisfactorily complete the project, and that he is familiar with the applicable Codes and Standards.

1.5 SUBMITTAL REQUIREMENTS

A. Refer to and comply with Division 01 - Submittal Procedures.

B. Submit to the Professional appropriate shop drawings and product data for equipment and material for the electrical systems indicated in the technical Sections of the Specifications. Submittals shall be provided for approval for indicated equipment or material whether or not substituted equipment or materials.

C. Shop Drawing Log: The Contractor shall provide, as a separate submittal prior to submitting any Product Data/Shop Drawings or included with his first submittal for the project, a Log of Shop Drawings/Product Data to be provided as part of the project. The Log shall include the following information as a minimum:

1. Title/Heading Lines including:
   a. Project Name
   b. General Contractors Name
   c. Electrical Contractors Name and Contact Information
   d. Date - This date shall be changed to reflect future updates and changes to the log.

2. Submittal Information for each Submittal in Table Format including:
   a. Submittal Number, if assigned as part of the project submittal tracking.
   b. Associated Specification Section Number.
   c. Specification Section Name.
   d. Specific Equipment Description.
   e. Date Submitted or Date to be Submitted.
   f. Column(s) for Indicating Review Status: Approved, Approved as Noted, Rejected, etc.
   g. Date of Approval.

D. Shop Drawings and Product Data shall be submitted in electronic format using pdf files as follows:

1. Shop Drawings and Product Data shall be separated into separate pdf files with one file for each Technical Section of the Specifications in which information is being provided.
2. PDF files shall be originally generated files and shall not be scanned or faxed reproductions.
3. All information listed on the shop drawings shall be typed. Handwritten notations or information are not acceptable.
4. Any notations made by the Contractor shall be in a legible color other than “red”.
5. Each pdf file shall have a Title Page indicating the following as a minimum:

   (a) Project Name and Address
   (b) Electrical Contractor Company’s name, address and contact information.
   (c) Electrical Distributor Company’s name, address and contact information.
   (d) The Specification Section Number and Name.

6. Each pdf file shall have an Index Page indicating the following as a minimum:

   (a) The Specification Section Number and Name.
   (b) An index style general listing of the type of equipment/material included.
   (c) Space for the Electrical Professional's review stamp and comments. This space shall be clearly labeled as to its use and shall have a minimum size of 7" wide X 5" high.

7. Samples: Submit the number stated in each technical section of this Specification.

E. All submitted equipment/material and associated options, accessories, special features, etc. shall be clearly marked and indicated on the shop drawings by highlighting or underlining in distinguishable color. Provide appropriate shop drawings on all required accessory equipment.

F. For all substituted equipment or material, the Contractor shall clearly indicate on the shop drawings or product data sheets a deviation statement indicating all variations in dimensions, function, operation, installation, connection, etc. of the proposed substitution equipment or material. Failure to provide this information shall be interpreted to mean that the proposed substituted equipment is identical to the specified equipment in all respects.

Substituted equipment or material provided and found to not be equal to the specified equipment and whose submittal documents did not indicate the deviation(s) from the specified equipment shall be replaced at the Contractor's expense with equal equipment or material whether or not installed, connected and/or energized.

G. All shop drawings for all systems, equipment and materials including any required one-line drawings, diagrams, etc. from all sections of the Specification shall be submitted together. Partial submittals will not be reviewed without prior consent. The Professional shall reserve the right at his discretion to hold partial submittals until all submittals have been submitted for the project.

H. Do not submit shop drawings for equipment/material that is not requested in this Specification.

I. The Professional's review and approval of the shop drawings is only for general conformance with the design concept of the Project and the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; information that pertains solely to the fabrication process or to the means and methods of construction; coordination of work of all trades; and performing all work in a safe and satisfactory manner. Review and/or approval of the shop drawings does not modify the Contractor's duty to comply with the Contract Documents. Any equipment or work found in the judgement of the Professional to be defective or otherwise unsuitable due to substituted equipment or material shall be repaired or replaced by the Contractor at no additional cost to the Owner.

J. The Professional's review of shop drawings for any technical section of the specifications or any single piece of equipment or material shall be limited to three (3) reviews. After the third submittal is rejected for any reason, the Contractor shall provide the specified equipment or material at no additional cost to the Project.

1.6 SUBMITTALS

A. Electrical Contractor qualifications and certifications.

B. Project Electrical Superintendent resume, qualifications, licenses and certifications.

1.7 COORDINATION

A. This Contractor shall familiarize himself with the general construction and building systems of all divisions specified in the Contract Documents. Fully coordinate the installation of all electrical equipment and materials with the general construction work and work of other divisions of the specifications prior to the start of the installation. Notify the Professional, prior to installation, of conflicts between electrical and structural, architectural, mechanical, etc. work.

B. Layout and installation of Division 26 work shall be the responsibility of this Contractor and all conflicts with other trades shall be resolved by the Contractor and approved by the Professional prior to installation.

C. Sequence, coordinate and integrate installing electrical equipment and materials for efficient flow of the work. Coordinate the installation and positioning of large equipment before closing in the building. Providing appropriate pathways, lifting devices, etc. for the installation of electrical equipment and/or materials in new or existing facilities is the responsibility of this Contractor.

D. Fully coordinate prior to installation all Utility Company services including metering facilities for the facility with the appropriate serving Utility Company. Comply with the requirements of the serving Utility Companies.

E. Electrical drawings are not to scale. Follow architectural, equipment supplier shop drawings, and manufacturer's shop and installation drawings for accuracy. Coordinate the installation of electrical devices, equipment and/or materials with the architectural drawings, features and finishes for the space where installed.

1.8 TEST & OBSERVATIONS

A. The complete project shall be, during and/or after construction, subject to the tests and observations as herein specified and as indicated on the Drawings. Deficiencies found as a result of these tests and observations shall be corrected by the Contractor within a reasonable period and at no expense to the Owner.

B. The complete project shall be subject to observations and tests conducted by the Professional or for him in his presence. Upon notice, the Contractor shall furnish not to exceed two men, one to include the project Superintendent, and required tools to assist and be directed by the Professional for a reasonable amount of time to make such tests and observations as are requested by the Professional.

C. The complete project shall be subject to observations and tests conducted by any Federal, State and/or local authority having jurisdiction. The Contractor shall make all corrections of any deficiencies required by the authority having jurisdiction to allow building occupancy.

D. The complete project shall be subject to observations and tests conducted by the Owner's Insurance carrier. After inspection by this agency, Contractor shall make corrections of any deficiencies found adversely affecting the insurance to be carried by the Owner. Acceptance of this report or subsequent reports lie with the Professional or Owner.

1.9 RECORD DOCUMENTS

A. Refer to and comply with Division 01 - Contract Closeout.

B. In addition to the requirements of Division 01, the Contractor shall provide to the Professional with the Close-Out Documents the following:

1. Scanned drawings in pdf format of same scale as original drawings indicating “as built” conditions of the work legibly marked in red showing all variations in the installed work from the requirements of the original Contract Documents. The “as-built” drawings shall include all addenda, approved and installed change orders, field condition changes and other departures from the original Drawings and Specifications.
2. Electronic files in pdf format of the approved shop drawings reflecting the manufacturer's shop fabrication of the equipment and materials actually installed and the approved product data information required by this Specification.
3. Operation and maintenance manuals and manufacturer’s instructions for all equipment and systems installed.
4. Copy of all reports of system, equipment or material test as required by this Specification.

1.10 WARRANTY

A. Refer to and comply with Division 01 for general warranty requirements.

B. The Contractor shall guarantee to the Owner all equipment provided under this contract to be free from defects in workmanship and materials for a period of one year from the date of final acceptance by the Professional and the Owner except as hereinafter noted.

C. The Contractor shall guarantee to the Owner that all power and control wiring provided under this contract and associated connections and terminations to be free from defects in workmanship, installation methods and methods for a period of five years form the date of final acceptance by the Professional and the Owner. This guarantee shall not be valid for wiring damaged by overload, fire, lightning, vandalism, theft or misuse.

D. Refer to technical sections for specific additional warranty requirements and/or time frames for associated equipment/material.

E. The Contractor shall correct, repair and/or replace upon notice from the Owner or his authorized representative within a reasonable period of time any defects in the work performed under this Contract arising during the warranty period.

F. Warranty repair work shall include labor, material and travel and shall be provided at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIAL & EQUIPMENT

A. Use only new equipment and materials of current manufacturer. Equipment/material shall be of current production from manufacturers’ of long experience in the manufacture of such types of equipment/material and who are regularly engaged in the production of this type of equipment/material.

B. Notwithstanding any reference in the specifications to any equipment, material or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Where the phrase “or approved equal” is used in the Division 26 Specification, substitute equipment, equivalent in all respects to that specified, of any qualified manufacturer is permitted with the written approval of the Professional. Approval will not be considered until after award of contract and only if submitted by the successful Contractor. Where a list of manufacturers and/or catalog numbers is provided and the phrase “or approved equal” is omitted, substitute equipment, equivalent in all respects to that specified, from one of the listed manufacturers is permitted with the written approval of the Professional.

C. Equipment is specified by manufacturer's name and catalog number and is intended to establish the minimum standards of quality acceptable. The manufacturer’s name and/or catalog number first mentioned in this Specification shall be considered the specified equipment. The "or equal" manufacturers mentioned or other manufacturers proposed by the Contractor shall be considered as substituted equipment.

D. Substituted equipment shall meet the dimensional and functional requirements of the building as represented by the Drawings and Specifications. All revisions to the contract precipitated by the use of substituted equipment shall be incorporated by the Contractor, after approval in writing by the Professional, and at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE & HANDLING

A. Deliver products to the construction site under provisions of Division 01.

B. Store and protect products under provisions of Division 01 and the associated manufacturer’s recommendations.

C. Store all electrical equipment and material in a clean, dry space.

D. Maintain factory wrapping or provide suitable protective covering to protect equipment from dirt, water, construction debris, traffic, etc.

E. Handle in accordance with manufacturer’s written instructions. Handle carefully to avoid damage to components, enclosures and finish. Lift only with lugs provide for the purpose.

F. Provide supplemental heat if required to prevent moisture contamination.

3.2 GENERAL EQUIPMENT INSTALLATION

A. Equipment and materials shall be installed and connected in strict compliance with manufacturer’s recommendations unless these requirements are exceeded as indicated on the Drawings or specified herein.

B. Perform all work in a “neat and workmanlike” manner as defined in ANSI/NECA 1, Standard for Good Workmanship in Electrical Contracting.

C. Install equipment and materials level, plumb, and parallel and perpendicular to other building systems’ elements and components unless otherwise indicated.

D. Install equipment to facilitate service, maintenance, and repair or replacement of components.

E. Install electrical equipment with required “working space” clearances and “dedicated equipment spaces” per NFPA 70 (NEC).

F. Install electrical equipment and associated raceways and accessories to permit access to equipment for maintenance, removal, repair or changes. Do not install electrical equipment in a manner to block required access to non-electrical equipment or components.

G. Electrical equipment and devices shall be mounted at the height specified in the technical sections of this Specification or as indicated on the drawings. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the required height. All heights shall be consistently cut above or below the block coursing so that they are the same height above the reference.

H. The mounting heights of electrical equipment and material shall reference the height above the finished floor or grade above which they are mounted. Mounting heights specified shall reference the center of the box, device, switch or circuit breaker operating handle unless indicated otherwise.

I. Locate electrical outlets and equipment to fit details, panels, decorating or finishes at space. The Professional may direct the Contractor to move the location of any outlet or equipment connection and associated raceways up to 10 feet in any direction within the same space from the location indicated on the drawings if so directed prior to the installation of the work.

3.2 EQUIPMENT SUPPORTS

A. Provide supporting steel not indicated on the drawings as required for the installation of electrical equipment and materials including angles, channels, beams, hangers, etc. Support steel located out of doors or in wet or corrosive environments shall be hot-dipped galvanized.

3.3 IDENTIFICATION

A. Refer to Section 260553 “Electrical Systems Identification” and associated technical sections of this Specification.

3.4 FIRE STOPPING

A. Openings around electrical penetrations through smoke and/or fire rated wall, partition, floor or ceiling assemblies shall be smoke and/or fire stopped using an approved UL listed system designed for the materials encountered to maintain the smoke and/or fire rating of the assembly.

B. All fire proofing in rated walls, partitions, floors or ceiling assemblies shall be performed by a certified Fire Proofing Contractor. The Division 26 Contractor shall be responsible for procuring and coordinating with the Fire Proofing Contractor to provide the required fire proofing of all electrical penetrations in or through rated assemblies.

3.5 CUTTING & PATCHING

A. Refer to the General Conditions of the Contract and Division 01 - Cutting and Patching.

B. Cut, channel, chase and/or drill floors, walls, partitions, ceilings and other surfaces required to permit electrical installations. Obtain permission in writing from the Professional and the General Contractor prior to cutting or penetrating any structural member.

C. Repair and refinish disturbed finish materials and other surfaces indoors and out-of-doors to match adjacent undisturbed surfaces and/or to existing condition prior to work performed.

D. Use experienced and skilled mechanics of the trades involved or employ appropriate sub-contractor to perform all repair and refinishing.

3.6 CLEANING & PROTECTING

A. Properly protect equipment and installations during the construction period to ensure that components, coatings, finishes, cabinets and enclosures are without damage or deterioration at the time of acceptance by the Owner.

B. On completion of construction within an area, inspect exposed finish of outlets, devices, fixtures, equipment, etc. Remove burrs, dirt, paint spots and construction debris.

C. Remove construction debris from all electrical enclosures prior to energizing.

D. Provide touch-up paint on equipment finishes marred during the construction or installation process. Paint shall be as recommended by the equipment manufacturer and shall match the installed equipment finish.

E. Where louvers and vent panels are provided in electrical equipment for cooling purposes, vacuum free of dust, dirt and debris. Provide new filter medium after construction site clean up.

END OF SECTION

SECTION 260505 - SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.2 EXISTING CONDITIONS

A. This project requires renovations and/or additions to existing facilities, additions and modifications to existing systems and associated demolition. The Contractor is responsible for visiting the site and verifying all existing conditions prior to bid and making necessary adjustments to the electrical installations to accommodate the existing conditions.

1.3 FIELD CONDITIONS

A. Owner Occupancy:

1. The Owner will vacate and cease operations in the facility or in the area of demolition during the construction period.
2. The Owner will maintain operations in adjacent facilities.

B. Testing of Existing Systems:

1. Prior to the beginning of any new work or demolition, the Contractor shall review and test the existing system(s) to be modified and note in writing to the Professional any deficiencies or visible code violations. It is advised that the condition and operation of existing systems in close proximity to the new work be noted as well. These notations will be used to determine the responsibility of the final operating condition of systems at the completion of the project.

C. Existing Systems To Remain Active:

1. Telecommunication: The existing telecommunication equipment shall remain energized and active throughout the construction period to support normal business activities in adjacent buildings. Maintain and protect the telecommunication equipment.
2. Fire Detection & Alarm System: The existing Fire Detection & Alarm System shall remain energized and active during the construction period to provide protect for the building. Maintain and protect the Fire Detection & Alarm System equipment. Provide proper protective dust covers over smoke and heat detectors while construction work is being performed.

1.4 DEFINITIONS

A. Disconnect and Remove: Disconnect equipment from electrical power source. Remove serving electrical branch and/or feeder circuits including raceways and conductors. Remove safety disconnect switches, control panels, operator stations, etc. Place serving overcurrent protection device in the “Off” position and label as spare unless reused in new work.

B. Disconnect: Disconnect equipment from serving branch and/or feeder circuits. Remove serving electrical branch and/or feeder circuits including raceways and conductors back to safety disconnect switch. Place serving overcurrent protection device in the “Off” position and re-label.

C. Disconnect and Reinstall: Disconnect equipment from electrical power source. Remove serving electrical branch and/or feeder circuits including raceways and conductors. Remove safety disconnect switches, control panels, operator stations, etc. Place serving overcurrent protection device in the “Off” position and label as spare unless reused in new work. Maintain and protect equipment for reinstallation and/or relocation under new work.

D. Existing to Remain: Existing items that are not to be disconnected, disconnected and removed or dismantled. Maintain and protect throughout construction period.

1.5 DEMOLISHED MATERIALS OWNERSHIP

A. The Owner shall have first rights of salvage of all demolished equipment and/or material. Demolished equipment and/or material not retained by the Owner shall become the property of the Contractor and shall be removed from the site.

B. Properly dispose of all demolished equipment, material and debris per applicable governmental laws and regulations.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Electrical Equipment & Material: Verify that all electrical services to equipment have been placed in the “Off” position at the source of power and properly locked and tagged.

B. Area or Space Demolition: Verify that all electrical branch circuits and feeder circuits serving the area or space in which demolition is being performed have been de-energized and disconnected and removed or properly locked-out and tagged-out if to remain.

C. Building Demolition: Verify that all electrical service entrances to the facility have been physically disconnected from their source of power.

3.2 REQUIREMENTS

A. Area or Space Demolition: In the areas shown on the Drawings to be renovated, other areas specifically noted, or as required for the installation of the new work, disconnect and remove all existing electrical equipment, lighting luminaires, wiring devices, etc. and associated branch circuits unless indicated on the Drawings or herein specified otherwise. Removal of branch circuits shall include exposed conduits, surface boxes and conductors back to next in-line active device, junction or over-current protection device.

B. Equipment Services:

1. Equipment To Be Removed: Disconnect and remove existing electrical service(s) including but not limited to final connections, disconnect switches, branch circuits, control panels, etc. Unless specifically indicated to be removed or space is required in existing electrical distribution equipment for new electrical services, serving circuit breaker shall become spare and shall be labeled as such and left in the Off position.

2. Equipment To Be Replaced: Where indicated on the Drawings for new equipment to be connected to the existing branch circuit(s) that served the removed equipment, provide the following:

   a. Existing Disconnect Switch & Branch Circuit(s) To Remain: Provide and connect new final connection branch circuit(s) from existing disconnect switch(es) to new equipment connection point(s). Branch circuit(s) conduit & conductors shall match existing construction unless indicated otherwise.
   b. Existing Branch Circuit To Remain: Provide and connect new disconnect switch(es) as indicated. Extend and connect existing branch circuit(s) to associated new disconnect switch(es). Provide and connect new final connection branch circuit(s) from disconnect switch(es) to new equipment connection point(s). Branch circuit(s) conduit & conductors shall match existing construction unless indicated otherwise.

3. If existing electrical services or a portion thereof are not specifically indicated to be reused for the connection of new or replacement equipment, the electrical service(s) shall be new.

C. Lighting Luminaires, Wiring Devices, Feed-Thru Devices: Disconnect and remove indicated luminaires and devices and associated outlet box(es) and serving branch circuit(s). Remove branch circuit back to next in-line active outlet box(es) or junction box(es). Reroute, relocate, refeed, etc. feed-thru branch circuits interrupted by demolition and serving remaining active outlets.

D. Electrical Service & Distribution System: Disconnect and remove the existing electrical service entrance equipment, electrical distribution equipment and associated feeder circuits unless indicated on the Drawings or herein specified otherwise. Removal of feeder circuits shall include exposed conduits, surface boxes and conductors back to over-current protection device.

3.3 RACEWAY DEMOLITION

A. Surface and Exposed Raceways serving Demolished Equipment: Disconnect and remove including boxes, conduits and conductors.

B. Concealed or Abandoned Raceways serving Demolished Equipment: Cut back flush with finish or surface and cap. Provide blank plate or cover on all abandoned flush mounted junction boxes in existing walls to remain without new finishes.

3.4 CIRCUITS TO REMAIN

A. Maintain and restore, if interrupted, all existing feed-thru feeder and/or branch circuits serving areas not under renovation, other areas outside the scope of this project or existing equipment to remain.

B. Reroute and connect as indicated, as directed or required all existing branch and feeder circuits routed through areas of demolition that will conflict with the new construction. Raceways and conductors required to accomplish this work shall be sized per the existing rerouted circuit and connected to the existing circuit by specified splicing methods in a properly sized junction box unless indicated on the Drawings or herein specified otherwise.

B. Comply with NFPA 70 (NEC).

3.5 CLEANING

A. Clean adjacent equipment, finishes and improvements of dust, dirt and debris caused by electrical demotion operations.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Copper Conductors, rated 600V or less.
2. Connectors, Splices and Terminations rated 600V or less.

1.2 REFERENCES

A. ANSI/IEEE C2 - National Electrical Safety Code.

B. ANSI/NFPA 70 - National Electrical Code.

C. ANSI/UL 467 - Grounding and Bonding Equipment.

D. ASTM B 1 - Standard Specification for Hard-Drawn Copper Wire.

E. ASTM B 8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

F. NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-19-81).

G. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (ICEA S-61-402).

H. UL 44 - Thermoset-Insulated Wires and Cables.

I. UL 83 - Thermoplastic-Insulated Wires and Cables.

J. UL 486A-486B - Wire Connectors.

K. UL 486C - Splicing Wire Connectors.

L. UL 486D - Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.

M. UL 2196 - Standard for tests for Fire Resistive Cables.

1.3 DEFINITIONS

A. Branch Circuit: An electrical power circuit consisting of the overcurrent protection device, the power and equipment grounding conductors, the raceway system, the safety disconnect device (when required by Code) and the final connection to the outlet, device or equipment.

B. Branch Circuit Homerun: The power and equipment grounding conductors and associated raceways connecting the branch circuit overcurrent device(s) to an outlet box for electrical connection to a device or equipment or to a homerun junction box for separation of the individual branch circuit conductors for routing to their respective loads when conductors for multiple branch circuits are combined in the same raceway.

C. Homerun Junction Box: A junction or outlet box in a branch circuit raceway system where all of the associated branch circuit conductors are combined into a single raceway for routing to the serving electrical distribution equipment. A Homerun Junction Box shall be located in an accessible location as close to the connected outlets, devices and equipment served by the associated branch circuits as reasonably possible.

1.4 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Product Data:

1. Listed Manufacturer: None Required.
2. Proposed Equal Manufacturer: For each type of proposed product.

1.5 SUBMITTALS FOR CLOSE-OUT

A. Field Acceptance Test Reports on installed low-voltage power conductors.

1.6 DELIVERY, STORAGE & HANDLING

A. Visually inspect conductors prior to installation and during installation for damage and signs of mis-handling.

B. Store in a clean, dry space. Protect from dirt, fumes, water, corrosive substances and construction debris.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Southwire Company
B. General Cable Corporation
C. American Insulated Wire Corporation; a Leviton Company
D. Approved Equal

2.2 COPPER CONDUCTORS

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70 (NEC) by a qualified testing agency and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

D. Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

2.3 CONNECTORS & SPLICES

A. Description: Factory-fabricated connectors, splices and lugs of size, ampacity rating, material, type and class for application and service indicated; compatible with indicated conductors; listed and labeled as defined in NFPA 70 (NEC) by a qualified testing agency and marked for intended location and use.

B. Lugs: One piece, seamless, compatible with indicated conductor.

1. Material: Copper or Aluminum.
2. Type: One or two hole with standard barrel as required for termination.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. All power conductors shall be copper.

B. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded. All final connections to motors and vibrating equipment shall be made with stranded conductors.

C. Minimum Conductor Sizes shall be as follows:

1. Power Conductors: #12 AWG minimum.
2. Control/Signal Systems: #14 AWG minimum unless indicated otherwise.

D. Branch Circuit Wiring Length Limitations:

1. 208Y/120V Branch Circuits over 100 feet in Length: Increase conductor size one size for each 100 feet of length. Increase raceway size as required in compliance with NFPA 70 (NEC).
2. 480Y/277V Branch Circuits over 150 feet in Length: Increase conductor size one size for each 150 feet of length. Increase raceway size as required in compliance with NFPA 70 (NEC).

3.2 CONDUCTOR INSULATION APPLICATIONS

A. Electrical Service Entrance: Type THHW, THWN, XHHW-2, rated 90ºC for wet locations, single conductor in raceway.

B. Underground Feeder Circuits: Type THWN-2, rated 90ºC for wet locations, single conductor in raceway.

C. Feeder Circuits: Type THHN/THWN-2, rated 90ºC for dry and wet or damp locations, single conductor in raceway.

D. Branch Circuits: Type THHN/THWN-2, rated 90ºC for dry and wet or damp locations, single conductor in raceway

E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS

A. All power conductors shall be installed in conduit and raceway systems unless specifically indicated otherwise.

B. Install conductors only after:

1. Building interior is enclosed and weather-tight.
2. Raceway system installation, connection, termination and support is complete.
3. Mechanical work likely to damage conductors has been completed.

C. Use manufacturer-approved pulling compound or lubricant where necessary. Compound used shall not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Support cables and conductors according to Section 260529 "Hangers and Supports for Electrical Systems."

F. All 120V and 277V branch circuits shall have dedicated neutral conductor of same size as associated phase conductors.

G. Neatly train and lace conductors inside boxes, equipment and panelboards.

H. Branch Circuit Homeruns shall not exceed the number of circuits and conductors indicated on the drawings.

I. Wiring at Outlets: Install conductors at each outlet with a minimum of 6 inches of slack.

J. Provide crimp type lug on conductors where stranded conductors are terminated. Do not place bare stranded conductors directly under screw-type terminals.

3.4 CONNECTORS, SPLICES & TERMINALS

A. Connectors:

1. Except where equipment is furnished with bolted or screw type lug, use compression set pressure connectors with insulating covers. Use compression tools and die compatible with the connectors being installed.
2. When allowed, use compression-set type with application of insulating tape, pre-stretched or heat-shrinkable insulating tubing for splices and taps of #8 AWG conductors and larger. Install with hydraulic compression tool.
3. Use pre-insulated “twist-on” connectors (wire nuts) with integral spring for splices and taps of #10 AWG conductors and smaller. Push-on type connectors shall not be used.
4. Tighten electrical connections and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Splices:

1. Make splices, terminations and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
2. Make splices and connections in accessible boxes, gutters or cabinets only.
3. Conductors #8 AWG and larger shall be spliced only with specific approval from the Professional.

C. Terminals:

1. Eye type crimped terminal for removable screw type terminal. Forked torque terminal when terminal screw can not be removed.
2. Train wires to eliminate fanning of strands, crimp with proper tool and die.
3. Torque screw termination per manufacturer’s recommended values.

3.5 IDENTIFICATION

A. Conductors of 600V and less electrical service entrances, feeder circuits and branch circuits shall have conductor insulation colors as listed below.

1. Where conductor type, size, etc. does not allow specified insulation colors, conductors shall be identified using products specified in Section 260553 “Electrical Systems Identification” at each accessible location and termination.

B. Color coding for 480/277V Circuits:

1. Phase A: Brown, Phase B: Orange; Phase C: Yellow
2 Neutral Conductor: Gray
   a. Dedicated Neutral to Phase A: Gray with Brown tracer.
   b. Dedicated Neutral to Phase B: Gray with Orange tracer.
   c. Dedicated Neutral to Phase C: Gray with Yellow tracer.
3. Equipment Ground: Green

C. Color coding for 208/120V Circuits:

1. Phase A: Black, Phase B: Red; Phase C: Blue

2 Neutral Conductor: White
   a. Dedicated Neutral to Phase A: White with Black tracer.
   b. Dedicated Neutral to Phase B: White with Red tracer.
   c. Dedicated Neutral to Phase C: White with Blue tracer.
3. Equipment Ground: Green

D. Color coding for 240/120V Circuits:

1. Phase A: Black, Phase B: Orange (High Leg); Phase C: Red
2 Neutral Conductor: White
   a. Dedicated Neutral to Phase A: White with Black tracer.
   b. Dedicated Neutral to Phase C: White with Red tracer.
3. Equipment Ground: Green
4. Single phase, 240/120V Color Coding similar without Phase B.

E. Properly identify each spare conductor at each end with proper identification to locate other end and label as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Conductor insulation test shall be performed on all electrical service entrance conductors, switchboard/panelboard and transformer feeder conductors and branch circuit conductors #2 AWG and larger. An insulation test shall be performed on any feeder or branch circuit as requested by the Professional for trouble shooting purposes. The “600V Conductor Insulation Test Report” found at the end of this section shall be completed with test results and shall be submitted to the Professional prior to substantial completion of the project.

B. 600 volt conductor insulation tests shall be performed using a 500 volt megger. Each conductor shall be tested with all splices made but no equipment or devices connected. Feeder/branch circuits with paralleled conductors shall have conductors tested separately prior to paralleling. The ohmic value measured shall be recorded and the results shall meet the minimum requirements of the conductor manufacturer. Conductors not meeting these minimum requirements shall be replaced or repaired as directed by the Professional.

END OF SECTION

SECTION 260526 - GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Grounding and bonding of electrical systems shall be in accordance with Article 250 of NFPA 70 (NEC).

1.2 REFERENCE STANDARDS

A. ANSI J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

B. ASTM B 3 - Specification for Soft or Annealed Copper Wire.

C. ASTM B 8 - Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.

D. ASTM B 33 - Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.

E. IEEE C2 - National Electrical Safety Code (ANSI).

F. NETA MTS - Maintenance Testing Specifications.

G. NFPA 70 (NEC) - National Electrical Code.

H. UL 467 - Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Product Data - None

1.4 CLOSEOUT SUBMITTALS

A. Indicate on As-Built Drawings location and routing of Grounding Electrode System.

B. Results of Grounding System Ground Resistance Testing.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements

1. Electrical Components, Devices and Accessories shall be listed and labeled as defined in NFPA 70 (NEC).

2. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper conductor insulated for 600V with insulation characteristics similar to current-carrying conductors.

1. Insulation Color: Green or Green with Yellow Tracer.

B. Bare Conductors: Copper

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: #4 or #6 AWG, stranded copper.
5. Bonding Jumper: Copper Tape, braided conductors, terminated with copper ferrules, 1 5/8" wide and 1/16" thick.
6. Tinned Bonding Jumper: Tin coated Bonding Jumper.

C. Grounding Bus: Annealed copper with terminal screws as required for terminated conductors, ampere rating as indicated or per NEMA standards.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to the AHJ for applications in which used and for specific types, sizes and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by the manufacturer for materials being joined and installation conditions.

C. Bolted Connectors for Conductors and Pipes: Copper or copper-alloy, bolted pressure type with a least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

D. Compression Connectors: Irreversible type.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch diameter by 10 foot length.

2.4 GROUNDING BUSBARS

A. Pre-drilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, 24 inches in length, with 9/32 inch connect holes per ANSI Joint Standard J-STD-607-A. Stand-off insulated mounting brackets for wall mounting.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Provide solid copper conductor for #10 AWG and smaller and stranded copper conductors for #8 AWG and larger unless indicated otherwise.

B. Underground Grounding Conductors: Provide bare copper conductor, #2/0 AWG minimum or as indicated on the drawings.

C. Grounding Busbar: Provide in telecommunication rooms and electrical room housing electrical service entrance equipment.

D. Grounding Conductor Terminations and Connections:

1. Pipe and Equipment Connections: Bolted connectors.
2. Underground Connections: Exothermic-weld.
3. Ground Rod Connections: Exothermic-weld.
4. Structural Steel Connections: Exothermic-weld or irreversible compression type connector.

3.2 GROUNDING ELECTRODE SYSTEM

A. Where new electrical service entrances are provided, provide and connect grounding electrode system consisting of grounding electrode conductor, driven ground rods, incoming metallic cold water pipe and building structural steel.

B. The number of ground rods for the grounding electrode system shall be per the following or as required to obtain the maximum resistance to ground of the grounding electrode system to 10 ohms.

1. Service Equipment Rating less than 400A: One ground rod minimum.
2. Service Equipment Rating 400A to 799A: Two ground rods minimum.
3. Service Equipment Rating 800A and greater: Three ground rods minimum.

C. Ground Rods shall be installed with top a minimum 12 inches below the finished grade with a minimum distance between interconnect ground rods of 10 feet. Install ground rods in a straight line or triangular pattern.

D. Grounding Electrode Conductor: Bare copper sized as indicated on the drawings or per NFPA 70 (NEC) Article 250 if size not indicated.

E. Interconnect all grounding electrode system driven ground rods with continuous un-spliced grounding electrode conductor. Grounding electrode conductor shall extend unspliced along the shortest path possible and connect to the Ground Bus of the associated electrical service entrance equipment. Install grounding electrode conductor a minimum of 18 inches below finished grade.

F. Route grounding electrode conductor from electrical service entrance equipment to beyond the building perimeter in Schedule 40 electrical-grade PVC conduit.

G. The incoming metallic water pipe where present and of the proper characteristics shall be bonded to the grounding electrode system. Connection shall be made within 5 feet of the pipe's point of entry into the building and shall be accessible for inspection.

H. The building's structural steel where present shall be bonded to the grounding electrode system and the connection shall be accessible for inspection.

3.3 GROUNDING AT ELECTRICAL SERVICE ENTRANCE

A. Connect Grounding Electrode Conductor to ground bus of electrical service entrance equipment.

B. Bond the electrical service entrance equipment grounded (neutral) bus and equipment grounding bus together with a Main Bonding Jumper (MBJ). MBJ shall be the same size as the indicated Grounding Electrode Conductor or equivalent factory installed bussing. The grounded (neutral) conductors and the equipment grounding conductors shall not be bonded together at any other location in the system except at separately derived systems as defined by NFPA 70 (NEC).

C. Bond all sections, cubicles, conduits and non-current carrying metallic parts of the electrical service entrance equipment shall be bonded together and connected to the equipment grounding bus using a #6 AWG bare copper conductor.

3.4 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Where separately derived systems (i.e dry-type transformers, engine generators, etc.) are being provided, provide grounding electrode system at each separately derived system.

1. Bond the grounded (neutral) bus to the equipment grounding bus or conductor by a main bonding jumper. This bonding shall occur within the equipment's enclosure at the connection terminals of each bus.
2. Bond the grounded (neutral) bus to the nearest grounding electrode by a grounding electrode conductor. The grounding electrode may be the building's structural steel where effectively grounded and bonded to the electrical service entrance grounding electrode system, the incoming metallic water pipe where the connection can be made within five (5) feet of the pipes entry into the building and/or the building's electrical service grounding electrode system.

3. The grounding electrode conductor and the main bonding jumper of each separately derived system shall be bare copper sized as indicated on the drawings or per Article 250 of NFPA 70 (NEC) whichever size is largest. The grounding electrode conductor shall run continuous without splices and utilizing the most direct path from the separately derived system's grounded (neutral) bus to the grounding electrode(s). The grounding electrode conductor shall be routed in electrical grade Schedule 40 PVC conduit to the point of connection to the grounding electrode system. All connections of the grounding electrode conductor to the grounding electrodes shall be made by exothermic weld(s).
4. All metallic piping systems (water, natural gas, fire protection, etc.) located within the area served by the separately derived system shall be bonded to the separately derived system's grounding electrode system in accordance with Article 250 of the NFPA 70 (NEC).

3.5 EQUIPMENT GROUNDING

A. Provide and connect insulated equipment grounding conductor in all feeders and branch circuits.

B. Size of equipment grounding conductor for branch circuits: For branch circuits with #12 and #10 AWG phase conductors, size equipment grounding conductor the same size as phase conductors. For branch circuits with #8 or larger phase conductors, size equipment grounding conductor as indicated or per Article 250 of NFPA 70 (NEC) if size not indicated.

C. Size of equipment grounding conductor for feeder circuits: Size as indicated or per Article 250 of NFPA 70 (NEC) if size not indicated.

D. Bond equipment grounding terminal of all grounding-type power receptacles and devices to the equipment grounding conductor and to the outlet box or enclosure housing the device.

E. Bond all metallic boxes, enclosures, wireways, etc. that are connected to the electrical power system to the equipment grounding conductor.

F. Branch circuit conduits 1 1/4 inch and larger and all feeder circuit conduits shall be provided with a grounding bushing at all connections to an enclosure. Bond bushing together using #8 AWG bare copper equipment grounding conductor and then bond to enclosure at grounding equipment conductor lug or ground bus.

G. Couple conduits together and connect to boxes, fittings and enclosures so as to provide effective electrical continuity. Assure ground continuity on all GRC feeder and GRC branch circuits 1 1/4 inch and larger by two locknuts, one inside and one outside the connected box or enclosure.

H. All metallic piping systems (water, natural gas, fire protection, etc.) within or attached to the building shall be bonded to the grounding electrode system per NFPA 70 (NEC).

I. Bond the building's structural steel to the grounding electrode system per NFPA 70 (NEC).

J. Where a lightning protection system is provided or exist on the building, the lighting protection system's grounding electrode system shall be bonded to the electrical service entrance grounding electrode system using a same size bare copper conductor as the lighting protection system grounding electrode conductor.

K. Manholes: Provide driven ground rod through floor, close to wall, and set rod depth so 4 inches will extend above the floor. Bond all exposed metallic components and parts within the manhole to the ground rod using #4 AWG bare copper conductor. Train conductors level and plumb around corners and fasten to manhole walls. Connect to medium-voltage cable armor and shields according to written instructions of manufacturer's of splicing and termination kits.

L. Pad-Mounted Transformers and Switches: Provide two driven ground rods at opposite corners and provide ground ring around the equipment pad. Ground pad-mounted equipment per manufacturer's recommendations to the ground ring at ground rod connections. Ground ring and equipment grounding taps shall be #2/0 AWG bare copper minimum. Bury ground ring not less than 12 inches from the pad perimeter and a minimum of 18 inches below finished grade.

M. Pole Supporting Outdoor Lighting Luminaires: Provide ground rod at each pole and bond to pole grounding terminal using #6 AWG copper conductor.

N. Metallic Fences Around Electrical Equipment: Comply with the requirements of IEEE C2. Bond to equipment ground grid using #8 AWG minimum size copper conductor. Provide flexible bonding jumper and bond gates to the associated fence.

O. Isolated Grounding Receptacle: In addition to the equipment grounding conductor in the serving branch circuit, provide an insulated and isolated grounding conductor and connect to the receptacle grounding terminal. Isolate the conductor from the raceway system and terminate on the isolated ground bus at the serving panelboard.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid placing conductors where they may be subjected to strain, impact or damage.

B. Ground Rods: Drive rods until tops are 12 inches below finished grade unless otherwise indicated. Make all connections using exothermic welds.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

D. Grounding for Steel Building Structure: Provide a driven ground rod at the base of each corner column and at intermediate exterior columns at distances not mor than 60 feet apart. Bond column to ground rod using #1/0 bare copper conductor. Exothermic weld all connections.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors and connection methods so metal in direct contact are galvanically compatible.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Provide inspection of all grounding and bonding connections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted electrical connections.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified and at electrical service entrance equipment grounding terminal/bus.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform test by fall-of-potential method according to IEEE 81.

B. Provide report for inclusion in Close-Out Documents indicating measure ground-resistance at the electrical service entrance equipment and other locations where maximum ground-resistance levels are specified.

C. Where ground-resistance levels exceed specified values, promptly notify the Professional and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529 - HANGERS & SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support systems.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components including mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.
7. Concrete housekeeping equipment pads.

1.2 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Shop Drawings: Provide construction details, material descriptions, dimensions, profiles and finishes for the indicated equipment support assemblies.

1.3 REFERENCED STANDARDS

A. AWS D1.1/D1.1M - Structural Welding Code - Steel.

B. ASTM A 36/A 36M - Carbon Structural Steel.

C. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 827/724 MPa Minimum Tensile Strength.

D. ASTM A 780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

E. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.

F. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

G. MFMA-4 - Metal Framing Standards Publication.

H. NECA 1 - Standard Practices for Good Workmanship in Electrical Construction.

I. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

J. NFPA 70 - National Electrical Code.

K. SSPC-PA 1 - Paint Application Specification No. 1: Shop, Field and Maintenance Painting of Steel.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Comply with NFPA 70 (NEC).

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear and pullout force to resist maximum loads calculated or imposed with a minimum structural safety factor of 5 times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Material for Channel, Fittings and Accessories: Galvanized Steel unless indicated otherwise.
2. Channel Width: Selected for applicable load criteria, minimum 1 5/8 inches.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer’s standard PVC, polyurethane or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer’s standard painted coating applies according to MFMA-4.

C. Conduit and Cable Support Devices: Steel and malleable iron hangers, clamps and associated fittings designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes and bars; black and galvanized.

F. Mounting, Anchoring and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical Expansion Anchors: Insert-wedge-type, stainless steel for use in hardened portland cement concrete with tension, shear and pullout capacities appropriate for supported loads and building materials used.
2. Concrete Inserts: Steel or malleable iron, slotted support system units similar to MSS Type 18, comply with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: MSS SP-58 threaded steel with adjusting and lock nuts.

2.2 FABRICATED METAL FRAMING EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural steel plates, shapes, tubes and bars. Shop or field fabricated to fit dimensions of supported equipment.

B. Assemblies Installed Outdoors: Welded, hot-dipped galvanized after fabrication.

1. Assembly Construction: Constructed of structural steel shapes, tubes and bars welded together to accommodate the equipment to be mounted. Length and height of assembly as required for mounted equipment.

a. Vertical Uprights: 6-inch steel channels, length as required, minimum 2 per mounting frame, 6-feet maximum spacing between vertical uprights. Set uprights in concrete with minimum depth 24-inches below finished grade with a minimum of 4-inches of concrete coverage on all sides.
b. Horizontal Members: 3-inch steel angle iron or tubing, length as required, minimum 2 per mounting frame, spacing as required for mounting of equipment, weld to vertical uprights.
c. Concrete Equipment Pad: Reinforced concrete pad per Specification Section “Cast In-Place Concrete”, 3000 psi, 4-inch minimum thickness with minimum 8-inch turn-downs around perimeter. Pad dimensions shall be 12-inches beyond each end of equipment frame and provide a minimum of 36-inches of working depth in front of panelboards, control panels, etc. measured from the face of the largest enclosure.

C. Assemblies Installed Indoors: Welded or bolted, galvanized components.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements of this Specification are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC and GRC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70 (NEC).

1. Size steel hanger rods for individual and trapeze supports for supported load with specified structural safety factor.
2. Minimum hanger rod size shall be 3/8 inch.

C. Multiple Raceways or Cables: Provide trapeze-type supports fabricated with steel slotted or other support system. Size trapeze supports so that capacity and load can be increased by 25 percent without exceeding design load limits.

1. Secure raceways and cables to trapeze supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1 1/2 inch and smaller raceways serving branch circuits and communication systems above accessible ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified herein.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load for strength determination shall be weight of supported components plus 200 pounds.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by Code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Existing Concrete: Expansion anchor set in epoxy.
4. To Masonry: Approved toggle-type bolt on hollow masonry units and expansion anchor fasteners on solid masonry units.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M with lock washers and nuts or beam clamps (MSS SP-58, Type 19,21,23,25 or 27) complying with MSS SP-69.

6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

E. Do not support raceway by other raceway.

F. Do not support equipment or raceway from metal roof decking or floor decking.

G. Do not support or impose the weight of electrical equipment, raceways or lighting luminaires on support provided for other trade systems (i.e. suspended ceiling supports, mechanical equipment and piping supports, etc.).

H. Where raceways are indicated to be routed on the roof, provide conduit mounting pedestals as required to support conduits. Maximum spacing of supports shall be 10 feet. Install pedestal on roof deck and flash into roofing material. Contract Roofing Contractor to perform all roofing work to water proof the installation. Roofing Contractor shall be certified by roof manufacturer as required to maintain any and all warrantees.

I. Punching, drilling or welding of building structural steel or welding attachment to building structural steel is not allowed unless approved in writing by the Structural Engineer.

3.3 CONCRETE HOUSEKEEPING PADS

A. Construct concrete housekeeping pads for all floor-mounted electrical equipment except dry-type transformers 150KVA and smaller unless otherwise indicated.

B. Dimensions: 3 inches high and not less than 2 inches larger in both directions than supported equipment so that anchors will be a minimum of 10 bolt diameters from the edge of the pad.

C. Use 3000 psi, 28-day compressive-strength concrete. For concrete materials, reinforcement and placement requirements comply with Division 3 Section “Cast-In-Place Concrete”.

D. Anchor equipment to concrete pad as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer’s setting drawings, templates, diagrams, instructions and directions furnished with the items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.

3.4 FINISH TOUCH-UP

A. Galvanized Surface: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533 - RACEWAYS & BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Rigid non-metallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures and cabinets.
5. Handholes and boxes for exterior underground branch circuit wiring.
6. Raceway sleeves and sleeve seals.
7. Miscellaneous fittings and accessories.

1.2 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. EMT: Electrical metallic tubing.

D. FMC: Flexible metallic conduit.

E. LFMC: Liquid-tight flexible metallic conduit.

F. RNC: Rigid non-metallic conduit.

G. PVC: Polyvinyl chloride.

H. HDPE: High density poly ethylene.

I. Circuit Definitions.

1. Branch Circuit: An electrical power circuit consisting of the overcurrent protection device, the power and equipment grounding conductors, the raceway system, the safety disconnect device (when required by Code) and the final connection to the outlet, device or equipment.
2. Branch Circuit Homerun: The power and equipment grounding conductors and associated raceways connecting the branch circuit overcurrent device(s) to an outlet box for electrical connection to a device or equipment or to a homerun junction box for separation of the individual branch circuit conductors for routing to their respective loads when conductors for multiple branch circuits are combined in the same raceway.
3. Homerun Junction Box: A junction or outlet box in a branch circuit raceway system where all of the associated branch circuit conductors are combined into a single raceway for routing to the serving electrical distribution equipment. A Homerun Junction Box shall be located in an accessible location as close to the connected outlets, devices and equipment served by the associated branch circuits as reasonably possible.
4. Feeder Circuit: An electrical power circuit consisting of the overcurrent protection device, the power and equipment grounding conductors and the raceway system connecting components of the electrical distribution system.

1.3 REFERENCED STANDARDS

A. ANSI/NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

B. ANSI C80-1 - Rigid Steel Conduit - Zinc Coated (GRC).

C. ANSI C80-3 - Electrical Metallic Tubing - Zinc Coated (EMT).

D. ANSI C80-6 - Intermediate Metal Conduit - Zinc Coated (IMC).

E. ANSI/SCTE 77 - Specification for Underground Enclosure Integrity.

F. ASTM A 53/A 53M - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

G. BICSI TDMM - Telecommunications Distribution Methods Manual, latest edition.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 V Maximum).

I. NEMA FB 1 - Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.

J. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

K. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

L. NEMA RN 1 - Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

M. NEMA TC 2 - Electrical Polyvinyl Chloride Conduit.

N. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

O. NEMA TC 7 - Standard for High Density Polyethylene (HDPE) Raceway Conduit.

P. NFPA 70 - National Electrical Code

Q. TIA-569-B - Commercial Building Standard for Telecommunication Pathways and Spaces.

R. UL 1 - Flexible Metal Conduit.

S. UL 6 - Electrical Rigid Metallic Conduit - Steel.

T. UL 360 - Liquid-Tight Flexible Steel Conduit.

U. UL 514A - Metallic Outlet Boxes.

V. UL 514B - Conduit, Tubing and Cable Fittings.

W. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.

X. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings.

Y. UL 797 - Electrical Metallic Tubing - Steel.

Z. UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.

AA. UL 2024 - Optical Fiber and Communication Cable Raceway.

1.4 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections and attachment details.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with NFPA 70 (NEC).
2. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE & HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris and traffic.

B. Protect PVC conduit from sunlight.

C. Comply with manufacturer’s written instructions.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT

A. Galvanized Rigid Steel Conduit (GRC): ANSI C80.1, UL 6; heavy wall galvanized steel.

B. Intermediate Metal Conduit (IMC): ANSI C80.6; UL 1242; thinner wall galvanized steel.

C. PVC Coated Rigid Steel Conduit: NEMA RN 1; with plastic protector caps.

D. Fittings - Couplings, Conduit Bodies, Connectors and Bushings: NEMA FB 1, UL 514B, galvanized steel, threaded, connectors with double locknuts and steel insulating bushings, thermoplastic insulating bushings for conduits 2 inches and smaller, cast metal conduit bodies with cast aluminum cover and stainless steel screws and neoprene gaskets, PVC coated to match attached conduits.

2.2 ELECTRICAL METALLIC TUBING (EMT)

A. ANSI C80.3, UL 797; galvanized steel tubing.

B. Fittings - Couplings, Conduit Bodies and Connectors: NEMA FB 1, UL 514B: steel, compression-type connectors with insulated throat. Covers for conduit bodies shall be aluminum with stainless steel screws and neoprene gasket.

2.3 FLEXIBLE METAL CONDUIT (FMC)

A. UL 1; interlocked steel.

B. Fittings: NEMA FB 1, UL 514B, steel.

2.4 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. UL 360; interlocked steel with PVC jacket.

B. Fittings: NEMA FB 1, UL 514B; steel.

2.5 RIGID NON-METALLIC CONDUIT (RNC)

A. Non-metallic conduit shall be listed and labeled as defined in NFPA 70 (NEC) by a qualified listing agency and marked for the intended location and application.

B. Type EPC-40 PVC minimum, electrical-grade, comply with NEMA TC 2 and UL 651. Type EPC-80 PVC where indicated.

C. Rigid and Continuous HDPE: Schedule 40 minimum, Schedule 80 where indicated, comply with UL 651A.

D. Where raceways are indicated on the drawings to be PVC, similarly-rated HDPE may be used as a direct substitution.

2.6 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, UL 514A: galvanized steel with stamped knockouts.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

B. Cast-Metal Outlet Boxes: NEMA FB 1, cast or malleable iron, Type FD with gasketed cover and threaded hubs.

C. Trim and Extension Rings: Same material and finish as box in which attached.

2.7 PULL & JUNCTION BOXES

A. Indoor - Small Sheet Metal Pull and Junction Boxes: NEMA OS 1, UL 514A; galvanized steel.

B. Indoor/Outdoor - Large Metal Pull and Junction Boxes: NEMA 250; steel, NEMA 1 or 3R per installed location, hinged or screw cover, manufacturer’s standard enamel finish inside and out.

C. Outdoor - Cast-Metal Outlet and Device Boxes: NEMA FB 1, cast or malleable iron, Type FD with gasketed cover with stainless steel screws.

2.8 METAL WIREWAYS

A. NEMA 250, UL 80: sheet metal trough with hinged or removable cover.

B. NEMA Type 1 enclosure where installed in dry indoor locations, NEMA 3R enclosure where installed outdoors or in damp or wet indoor locations, or NEMA 4X stainless steel enclosure for corrosive environments. No knockouts.

C. Provide hinged cover for surface-mounted installations and removable cover for flush-mounted installations. Provide flanged and gasketed cover for all wet locations.

D. Cross-sectional size and length as indicated or required for the installation requirements and per the box fill requirements of NFPA 70 (NEC).

E. Finish: Manufacturer's standard enamel finish inside and out.

2.9 HANDHOLES & BOXES FOR EXTERIOR UNDERGROUND WIRING

A. For Medium-Voltage and Feeder Circuits, refer to Section 260543 Underground Duct and Raceways for Electrical Systems.

B. General Requirements for Handholes and Boxes: Designed, identified, listed and labeled as defined in NFPA 70 (NEC) for intended location and application.

C. Polymer-Concrete Handholes and Boxes: Molded of sand and aggregate, bound together with polymer resin and reinforced with steel, fiberglass or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless indicated otherwise.
3. Cover: Weatherproof, secured by tamper-resistant locating devices and having structural load rating per the following:
   (a) Installation in areas not subject to vehicular traffic: Tier 5 (5200 pounds) load rating.
   (b) Installation in drives, parking lots, etc. or adjacent to such areas subject to occasional non-deliberate heavy-truck vehicular traffic: Tier 10 (10,400 pounds) load rating.
   (c) Installation in streets or other areas with deliberate heavy-truck vehicular traffic: AASHTO H-20 (20,800 pounds) load rating.
4. Basis of Design: Quazite Style PG or approved equal.
5. Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS" as appropriate for systems installed within.

2.10 EXPANSION FITTINGS

A. Malleable iron, hot dip galvanized allowing 2 inches of raceway movement.

B. Basis of Design: OZ/Gedney AX Series or approved equal.

2.11 RACEWAY & SLEEVE PENETRATION SEALS

A. Description: Modular sealing device, designed for field assembly to fill annular space between wall/floor penetration or sleeve and conduit or cable.

B.

1. Sealing Elements: EPDM, NBR or Silicon per application interlocking links shaped to fit surface of conduit or cable.
2. Pressure Plates: Reinforced Nylon Polymer.

3. Connecting Bolts/Nuts: Stainless Steel.

B. Basis of Design - Thunderline Link-Seal Modular Seal or approved equal. Select Model appropriate for installed environment and probable contact elements.

2.12 RACEWAY SEALING FITTINGS

A. Non-Hazardous Locations: Basis of Design - OZ/Gedney CSB Series or approved equal.

B. Hazardous Locations: Basis of Design - OZ/Gedney EYA Series with sealing compound or approved equal.

C. Field Applied Sealant Basis of Design - American Polywater Corporation FST Foam Duct Sealant or approved equal.

2.13 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E Grade B, Schedule 40, galvanized steel, plain ends with integral water stop.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. All power branch circuit and feeder circuit wiring and other Systems's wiring where specified shall be in metallic conduit unless specifically indicated otherwise on the drawings or herein specified.

B. Outdoor Branch Circuit Installations: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, IMC.
2. Concealed Conduit, above ground: GRC, IMC.
3. Underground Conduit: RNC, Type EPC-40 minimum, Type EPC-80 where indicated, direct buried or concrete encased as indicated.
4. Connection to Vibrating Equipment: LFMC.
5. Boxes and Enclosures, above ground: NEMA 250, NEMA 3R.
6. Boxes and Enclosures, corrosive areas: NEMA 250, NEMA 4X.

C. Indoor Branch Circuit Installations: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT, IMC or GRC.
2. Exposed, Subject to Physical Damage: IMC, GRC.
3. Concealed in Ceilings and Interior Walls/Partitions: EMT.
4. Connection to Vibrating Equipment: FMC.
5. Damp or Wet Locations: IMC, GRC.
6. Size 1 1/4 inch or larger: IMC, GRC.
7. Within Poured Concrete: IMC, GRC.
8. Boxes and Enclosures: NEMA 250, NEMA 1 except NEMA 3R in damp or wet locations.
9. Boxes and Enclosures, corrosive areas: NEMA 250, NEMA 4X.

D. Feeder Circuit Installations: Apply raceway products as specified below unless otherwise indicated:

1. Indoor: IMC, GRC.
2. Exposed Conduit, outdoor: IMC, GRC.
3. Concealed Conduit, above ground: IMC, GRC.
4. Underground Conduit: RNC Type EPC-40 with GRC bends and vertical risers, IMC, GRC.
5. Under Slab Conduit: RNC Type EPC-40 with GRC bends and vertical risers, IMC, GRC.
6. Within Poured Concrete: IMC, GRC.
7. Concrete Encasement: Provide as indicated on drawings or herein specified.

E. Minimum Raceway Size: 1/2 inch except branch circuit homerun conduits shall be minimum 3/4 inch.

F. Homerun Raceways: Branch circuit homeruns shall not be combined in a raceway unless indicated on the Drawings to be routed in that manner. Provide the number of branch circuit homerun raceways as indicated on the Drawings unless otherwise directed by the Professional. Scheduled equipment electrical services shall have dedicated homerun branch circuits and raceways unless indicated otherwise on the Drawings.

G. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. GRC and IMC: Threaded galvanized rigid steel unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Coated GRC: Use only fittings listed for use with this type of conduit with similar coatings. Patch and seal all joints, nicks and scrapes in coating after installing conduits and fittings. Use sealant recommended by manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. FMC: Use fittings listed for use with flexible conduit. Comply with NEMA FB 2.10.
5. LFMC: Use fittings listed for use with liquid-tight flexible conduit that maintain liquid-tight rating.

H. Where GRC conduit is direct-buried underground, it shall be coated prior to installation with polyvinyl, polyethylene or asphaltum coating. Coating shall cover entire underground conduit and associated fittings extend a minimum of 6 inches above finished grade.

I. RNC may only be used where indicated on the drawings or herein specified.

3.2 COMMUNICATION RACEWAY APPLICATION

A. Provide outlet boxes and serving raceway to accommodate devices indicated by symbols on the drawings and as herein specified.

B. Minimum Communication Raceway Size: 3/4 inch unless otherwise indicated.

C. Minimum Communication Outlet Box Size: 4 11/16 inches square by 2 1/8 inch depth unless specifically indicated otherwise or required to accommodate wall construction. Provide single-gang trim ring unless indicated otherwise or required for installed devices.

3.3 RACEWAY INSTALLATION

A. Comply with the requirements of Section 260529 “Hangers and Supports for Electrical Systems” for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on the drawings or herein specified are stricter. Comply with NFPA 70 (NEC).

C. Coordination: Raceway locations indicated on the drawings are approximate and representative unless dimensioned. Coordinate raceway installation with building elements, construction methods, other trades systems, etc.

D. All conduits shall be routed concealed above ceilings within walls, partitions, floors, etc. unless specifically indicated on the drawings or herein specified otherwise. Route conduits parallel or perpendicular to building lines weather concealed or exposed.

E. Size conduits as indicated on the drawings or where size is not indicated follow the requirements of NFPA 70 (NEC).

F. Install raceways with the minimum number of bends in the shortest practical distance considering building construction and obstructions and other requirements of the drawings and this specification. Provide junction/pull boxes in accessible locations per NFPA 70 (NEC) to limit distance between conductor pull points to 100 feet or in conduit runs to limit bends between pull points to a total of 360 degrees.

G. Do not route branch circuit, telecommunication or other Systems’ conduits within or under floor slab unless specifically indicated on the drawings to be installed in that manner, the adjacent building construction prohibits concealed overhead routing, or the nature of the connected device or outlet (i.e. floor box) requires this type of routing.

H. Where conduits are indicated or required to be concealed in concrete floor slabs, conduits 1/2 inch through 1 inch may be installed within floor slabs. Conduits larger than 1 inch shall be installed under floor slab.

1. Where conduits are indicated to be concealed in floor slab and thickness of floor slab is less than 4 inches, route all conduits below floor slab.
2. Conduits shall be routed as required so as not to compromise the structural integrity of any concrete.
3. Arrange conduits to cross building expansion joints at right angles with proper expansion fitting.
4. Where conduits penetrate top of floor slab, provide PVC coated GRC up to a minimum of 2 inches above the top of the floor slab.

I. Where the building floor slab and structure are elevated on pilings or other structural supports due to poor soil conditions, do not route branch circuit or feeder circuit raceways serving building outlets, devices or equipment in the earth. Raceways required to be routed under the floor slab shall be routed on the bottom of the elevated building structure.

1. Exceptions:

a. Underground electrical and communication service entrance raceways.
b. Raceways connecting equipment located away from the building on the adjacent site.
c. Raceways connecting the building to other adjacent buildings or facilities.

J. Arrange conduit stub-ups so curved portion of bends are not visible above finished floor. Protect conduit stub-ups above floor slabs, finished grade, etc. from damage during and after

construction. Provide temporary closures to prevent entrance of moisture, dirt and construction debris into conduits.

K. Do not route raceways horizontally on roof unless specifically indicated on the drawings to be routed in that manner or with specific approval from the Professional. Do not install raceways or boxes on or within 2 inches of the bottom side of a metal roof deck.

L. Turn-outs of concealed vertical “stub-up” raceways from outlet boxes shall be located to be above the finished ceiling line where ceilings exist or are provided. In open structure spaces with block or masonry walls, turn-outs shall occur above the bottom of the overhead structure.

M. Do not route raceways in the air space between exterior wall assemblies and the brick veneer without specific approval from the Professional. Raceways may cross air spaces perpendicular to the associated wall.

N. Make bends in raceways using large-radius preformed ells. Field bending shall be according to NFPA 70 (NEC) minimum radii requirements.

O. Support conduits within 12 inches of enclosures in which attached, within 12 inches on both sides of any bend, and maximum distance between supports per NFPA 70 (NEC) based on conduit size and material.

P. Vertical raceways runs 1 1/4 inch and larger passing through floors shall be supported at each floor with pipe riser clamps.

Q. Keep raceways at least 6 inches away from parallel runs of flues, steam, hot-water pipes or other sources of heat.

R. Complete raceway installation and ensure conduits are clear of all foreign debris prior to installing conductors.

S. Provide a nylon pull cord with not less than 200 pounds tensile strength in all empty conduits. Leave a minimum of 12 inches of slack at each end. Cap raceways at both ends.

3.4 OUTLET BOX APPLICATION & INSTALLATION

A. Provide outlet boxes and serving branch circuit to accommodate device or outlet provisions indicated by symbols on the drawings and in conformance with NFPA 70 (NEC) requirements for number and size of conductors, terminations and splices.

B. Locations of all outlets and devices indicated on the drawings are approximate and representative unless dimensioned or specifically noted as to mounting height and location. See Architectural drawings, details or shop drawings for specific outlet locations. Any outlet box and associated raceways may be moved from the location indicated on the drawings in any direction up to a distance of 10 feet by direction of the Professional if so directed before the outlet and associated raceways have been installed at no additional cost.

C. Mount outlet boxes at heights indicated on the Drawings and associated typical device mounting heights specified herein. Mounting heights may be adjusted slightly to permit cutting of masonry block to the top or bottom of the block course nearest the specified mounting height. Mounting heights shall be consistently cut above or below block coursing such that outlet boxes for similar devices will be the same height above the finished floor.

D. Size outlet boxes at interior locations in accordance with NFPA 70 (NEC) and the following minimum outlet box requirements. Minimum conductor size used to determine power wiring box size shall be #12 AWG.

1. Switch/Handy Box: Non-feed-through outlet applications with toggle switch or lighting control device, 5 conductors maximum.
2. 4 inch octagon box, 1 1/2 inch depth: feed-through and non-feed-through outlet locations, 9 conductors maximum.
3. 4 inch octagon box, 2 1/2 inch depth: feed-through and non-feed-through outlet locations, 13 conductors maximum.
4. 4 inch square box, 1 1/2 inch depth: feed-through and non-feed-through outlet locations, pull and junction box locations, 9 conductors maximum.
5. 4 inch square box, 2 1/8 inch depth: feed-through and non-feed-through outlet locations, pull and junction box locations, 13 conductors maximum.
6. 4 11/16" square, 2 1/8 inch depth: feed-through and non-feed-through outlet locations, pull and junction box locations, 18 conductors maximum.

E. Where a single outlet box is installed in a metal or wood stud wall, the box shall be attached to the studs using a metal mounting bracket with support leg to prevent movement of box in wall at unattached side. Where two or three outlet boxes are shown and/or intended to located adjacent to each other in a metal or wood stud wall, the boxes shall be attached to the studs using a common metal mounting bracket with bracket stabilizer leg to support the middle portion of the bracket.

F. Provide single or double gang trim rings as required for outlets installed in hollow walls, square corner trim rings for outlet in tile walls. Mount outlet boxes with trim ring flush with finished surface. Face of outlet box or associated trim ring shall not be installed more than 1/4 inch behind finished face of wall.

G. Outlet boxes installed in masonry wall shall be embedded in masonry grout so as to properly secure the box in place and prevent movement. Materials and labor required for this installation are the responsibility of the Division 26 Contractor.

3.5 PULL & JUNCTION BOX APPLICATION & INSTALLATION

A. Provide pull or junction boxes as required by NFPA 70 (NEC), field conditions encountered and where indicated on the Drawings. Box locations shall be fully coordinated with the Professional where boxes are to be exposed or where installation affects architectural elements, structural construction or mechanical systems.

B. Boxes sizes shall be as indicated on the Drawings; per NFPA 70 (NEC) for the conduit sizes, conductors and situation encountered; as herein specified; or as directed by the Professional.

C. Wireways or gutters shall not be used unless specifically indicated on the Drawings or with specific approval from the Professional.

D. All pull and junction boxes shall be labeled in accordance with Section 260553 “Identification for Electrical Systems” indicating system being served, branch circuit or feeder circuit identification, etc. Where installed in concealed locations (i.e. above accessible ceilings) or in unfinished areas, identification shall be made on outside of box cover. Where installed exposed in finished locations, identification shall be made on inside of box cover. Fire Alarm System pull and junction boxes where not exposed in a finished space shall have covers painted “red” in color.

E. Close all unused knockout holes in junction/pull boxes and install proper cover. Junction/pull boxes install flush or exposed in finished spaces shall be installed with the same requirements as outlet boxes.

3.6 COMMUNICATION RACEWAY INSTALLATION

A. Communication raceways shall comply with the applicable installation requirements of power raceways with the following additional requirements.

B. Regulatory Requirements:

1. Comply with TIA-569-B.
2. Comply with NFPA 70 (NEC).

C. Raceway routing shall follow most direct route possible to the designated termination point(s) within the constraints of this Section with no more than 180 degrees of bends between pull points or junction boxes. For raceway runs greater than 100 feet, provide junction box(es) sized per NFPA 70 (NEC) such that no conduit segment exceeds 100 feet.

D. Conduit minimum bend radius:

1. 6 times the internal diameter for conduits with internal diameters 2 inches or less.
2. 10 times the internal diameter for conduits with internal diameters greater than 2 inches.

E. Communication outlet raceways serving outlets located in rooms with accessible ceilings shall have 4 inch square minimum in-line junction box surface-mounted directly above the outlet and above the accessible ceiling to allow access to the raceway from within the room.

F. Conduit bends shall be smooth, even and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.

G. Provide insulating bushing on end of each raceway.

H. Provide a nylon pull cord with not less than 200 pounds tensile strength in all empty conduits. Leave a minimum of 12 inches of slack at each end.

3.7 INSTALLATION OF UNDERGROUND CONDUIT

A. Engage Utility Locating Service to locate, mark and identify all existing underground utilities in the area of work prior to any excavation.

B. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. After installation of conduit, install select backfill, compact in 6 inch layers and mound for settlement. Start at tie-in point and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. After placing backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfill.

C. Directional-Bored Conduits:

1. Install using proper machinery using personnel fully-trained and experienced in the process and the associated machinery.

2. Use continuous-length HDPE piping of indicated rating and size.
3. Excavate significant area at raceway termination locations to install required conduit bends.
4. After installation of conduit, install select backfill, compact in 6 inch layers and mound for settlement.

D. Requirements:

1. Conduit installed under structural concrete floor slabs and other installations with sub-grade compaction requirements of other Divisions of the specifications shall be installed to meet the minimum specified compaction requirements.
2. Provide manufactured long-radius elbows for stub-ups at poles, equipment and building entrances through floor slab unless otherwise indicated or prohibited by adjacent construction or existing conditions.
3. Use GRC conduit for all bends, vertical runs and exposed sections of RNC raceways.
4. Minimum Burial Depths:

    a. Branch Circuit Raceway 1 1/4" Inch and Smaller: 18 inches to top below finished grade.
    b. Branch Circuit Raceway 1 1/2 Inch and Larger: 24 inches to top below finished grade.
    c. Feeder Circuit Raceway: 36 inches to top below finished grade.
    d. Electrical Service Entrance Raceway: 36 inches to top below finished grade.
    e. Communication Raceway: 30 inches to top below finished grade.

5. Underground Warning Tape: Provide per the requirements of Section 260553 “Identification for Electrical Systems”.

    a. Provide Warning Tape at all underground primary and secondary feeder circuits and branch circuits rated 100A and greater routed beyond the perimeter of the building’s slab.

3.8 INSTALLATION OF UNDERGROUND HANDHOLES & BOXES

A. Provide exterior in-grade handholes and boxes as indicated on the drawings, as required for the installation of the work per NFPA 70 (NEC) and as required by the serving Utility Companies.

B. Size handholes and boxes as indicated or where size is not indicated comply with the requirements of NFPA 70 (NEC).

C. Excavate as small an area as required to install box and associated raceways. Support units on a level bed of crushed stone or gravel, graded 1/2 inch sieve to #4 sieve, minimum 6 inches in depth and compacted to same density as adjacent undisturbed earth. Aggregate base shall cover entire box bottom and extend a minimum of 6 inches beyond the perimeter of the box on all sides. Backfill around box with select fill and compact to the same density as adjacent undisturbed earth.

D. Elevation: In paved areas, set so cover is flush with finished surface. In other areas, set so cover is 1 inch above the finished grade.

E. Conduits shall enter box from the bottom to prevent weakening the enclosure sides unless adjacent site conditions prevent such installation. When enclosure side walls must be field cut to accept raceways, follow manufacturer’s written instructions and use recommended tools.

F. Handholes and boxes larger than 24 inches in length or width shall be provided with 6 inch square concrete collar around the perimeter to provide added support.

3.9 APPLICATION & INSTALLATION OF FLEXIBLE CONDUIT

A. Comply with NEMA RV 3.

B. Application:

1. Dry, Indoor Locations: FMC.
2. Damp or Wet, Indoor Locations: LFMC.
3. Outdoor Locations: LFMC.
4. Connections to Vibrating Electrical Distribution Equipment: LFMC.

C. Use a maximum of 72 inches of flexible conduit for connection to lighting luminaires, equipment subject to vibration, noise transmission or movement, and for transformers and motors.

3.10 APPLICATION & INSTALLATION OF EXPANSION FITTINGS

A. Provide expansion fitting at all locations where conduits cross building or structural expansion joints, where conduits are mechanically connected to two separate structures, and where conduits pass above ground from interior to exterior of the building.

B. Provide fittings that provide expansion and contraction for at least 0.0004 inches per foot of length of straight conduit run per degree F of temperature change.

C. Install each expansion-joint fitting with position, mounting and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

3.11 APPLICATION & INSTALLATION OF RACEWAY SLEEVES

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

B. Use pipe sleeve unless penetration arrangement requires rectangular sleeved opening.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

G. Provide sleeve and raceway seals where penetrations are made in exterior walls, through on-grade slabs or below grade wall.

3.12 APPLICATION & INSTALLATION OF RACEWAY & SLEEVE PENETRATION SEALS

A. Seal space outside of sleeves with grout for penetrations of concrete or masonry and approved joint compound for gypsum board assemblies.

B. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

C. Above Ground, Exterior Wall Penetration: Seal penetration using sleeves and mechanical sleeve seals. Select sleeve size as required for annular clear space between raceway and sleeve for installing mechanical sleeve seals.

D. Underground, Exterior Wall Penetration: Seal penetration using cast-iron pipe for sleeves and mechanical sleeve seals. Select sleeve size as required for annular clear space between raceway and sleeve for installing mechanical sleeve seals.

E. Sleeve Seal Installation: Use type and number of sealing elements recommended by the manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve per the manufacturer's written instructions.

F. Provide chrome- or nickel-plated escutcheons where raceways pass through walls, floors or ceilings and are exposed in finished public areas.

3.13 APPLICATION & INSTALLATION OF RACEWAY SEALING FITTINGS

A. Provide listed watertight raceway seal-off fitting to prevent the passage of moisture and water vapor through raceway where:

1. Raceway passes from interior to exterior of the building.
2. Raceway passes from interior conditioned spaces to attic space of the building.
3. Raceway passes between areas of different temperature (i.e. cold rooms, coolers, freezer, air handling systems, etc.).

B. Provide field-applied raceway sealant to prevent the passage of moisture in all raceways that contain wiring, enter the building from below grade, and that terminate or have fittings located at an elevation that is below a horizontal line 24 inches above the adjacent exterior finished grade.

B. Provide listed raceway seal-off fitting with sealing compound where raceways enter or leave hazardous locations as defined by NFPA 70 (NEC).

3.14 FIRESTOPPING

A. Openings around electrical penetrations through smoke or fire rated wall, partition, floor or ceiling assemblies shall be smoke and/or fire stopped using an approved UL listed system designed for the materials encountered to maintain the smoke and/or fire rating of the assembly.

B. All firestopping of penetrations in rated walls, partitions, floors or ceiling assemblies shall be performed by a certified Fireproofing Contractor. The Division 26 Contractor shall be responsible for procuring and coordinating with the Fireproofing Contractor to provide the required firestopping of all electrical penetrations in or through rated assemblies.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification products and methods.
2. Warning labels and signs.
3. Instruction signs and posted drawings.
4. Miscellaneous identification products.

1.2 REFERENCED STANDARDS

A. ANSI A13.1 - Scheme for the Identification of Piping Systems.

B. ANSI C2 - National Electrical Safety Code.

C. ANSI Z535.4 - National Standards for Product Safety Signs and Labels.

D. 29 CFR - Labor, Part 1910 - Occupational Safety and Health Standards, Section 1910.145 - Specifications for Accident Prevention Signs and Tags.

E. NFPA 70 - National Electrical Code.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A12.1 and ANSI/IEEE C2.

B. Comply with NFPA 70 (NEC).

C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors and other features with Contract Documents, Shop Drawings, manufacturer's wiring diagrams, O&M Manuals and those required by codes, standards, 29 CFR 1910.145. Use consistent designations throughout the project.

B. Coordinate installation of identifying devices with completion of covering, finishes and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors and manufacturer's nameplates, warning labels, instruction labels, etc..

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY & CONDUCTOR IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather and chemical resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves with diameter sized to suit diameter of raceway it identifies and to stay in place by gripping action when placed in position.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant, 1 or 2 inches wide, compounded for outdoor use.

E. Marker Tapes: Vinyl or vinyl cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 UNDERGROUND WARNING TAPE

A. Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 WARNING LABELS & SIGNS

A. Comply with NFPA 70 (NEC) and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless indicated otherwise.

C. Engraved Plastic Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 square inches and 1/8 inch thick for larger signs.

1. Engrave legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

D. Baked-Enamel Warning Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners with colors, legend and size required for application. 1/4 inch grommets in corners for mounting. Nominal size - 7 inch X 10 inch.

E. Metal-Backed, Butyrate Warning Signs for Exterior Use: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing; with colors, legend and size required for application. 1/4 inch grommets in corners for mounting. Nominal size - 10 inch X 14 inch.

2.4 INSTRUCTION SIGNS & POST DRAWINGS

A. Instruction Signs: Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 square inches and 1/8 inch thick for larger signs.

1. Engrave legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

2.5 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Engraved, Three-Layer, Laminated Acrylic or Melamine Nameplate: Punched or drilled for screw mounting. Minimum legend letter height shall be 3/8 inch unless indicated or specified herein otherwise.

B. Stenciled Legend: Non-fading, waterproof ink or oil-based, alkyd enamel paint. Minimum legend letter height shall be 1 inch unless indicated or specified herein otherwise.

C. Nameplates shall be colored-coded for each system as follows:

1. Normal Power - white lettering on black field.
2. Emergency/Life-Safety Power - black lettering on a red field.
3. Legally Required/Critical Standby Power - black lettering on an orange field.
4. Optional/Equipment Standby Power - black lettering on a yellow field.

2.6 WIRING DEVICE IDENTIFICATION

A. Self-adhesive, clear label with 3/16 inch high printed black legend. Legend printed using thermal transfer.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS.

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 pound minimum.
3. Temperature Range: -40 degrees F to 185 degrees F.
4. Color: Black, except where used for color coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Refer to the technical Sections of the Division 26 Specification for identification requirements for the specified material, equipment, components, etc.

B. Warning Labels for Indoor Cabinets, Boxes and Enclosures: Comply with 29 CFR 1910.145 and NFPA 70 (NEC). Apply self-adhesive warning labels to exterior of door, cover or other access to equipment. Provide the following warning labels and those required by other codes, standards and regulatory agencies as a minimum.

1. Equipment with Multiple Power Sources. Including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance per NFPA 70 (NEC): Apply to door or cover except flush-mounted equipment or equipment in finished spaces. Labeling for flush-mounted equipment or equipment in finished spaces shall be applied inside equipment door. Indicate clearance requirements per NFPA 70 (NEC) for voltage of equipment.
3. Available Fault Current Labels: Install per NFPA 70 (NEC) for each piece of electrical service entrance equipment. Locate labels so they are visible to the personnel before examination, adjustment, servicing or maintenance of the equipment.

C. Instruction Signs: Provide instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend printed in all capital letters of 12 point minimum font size where instructions are needed for system or equipment operation.

D. Equipment Identification Nameplates: Each unit of electrical equipment shall be provided with a nameplate indicating the equipment designation consistent with the Drawings, connected voltage and phase, serving equipment designation and other specified information. Refer to the technical Sections of this Specification for the specified equipment for additional requirements.

1. Nameplate: Engraved, laminated acrylic or melamine nameplate. Equipment designation legend using 1/2 inch high lettering, other legend information using 1/4 inch high lettering.

3.2 INSTALLATION

A. Verify identity of each item before producing and installing identification products.

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surface before application, using materials and methods recommended by manufacturer of identification device. Install parallel to equipment lines.

E. Install non-adhesive signs and plastic nameplates parallel to equipment lines. Attach with screws and auxiliary hardware appropriate for the location and substrate. Locate to inside of door where equipment is flush-mounted in finished spaces.

F. Post Drawings and Operating Instructions: Mount drawings and operating procedures on the wall immediately adjacent to the piece of equipment for which the instructions apply. If sufficient wall space is not available, mount directly to one of the sheet metal panels of the equipment as directed by the Professional.

G. Warning Signs: Install warning signs where there is hazardous exposure or danger associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location. Mount permanently in an appropriate and effective location. Comply with ANSI A13.1 standard color and design.

H. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side-by-side. Locate bands at changes in direction, at penetrations of wall and floors, at 50 foot maximum intervals. Locate bands on conductors and cables in raceway at all accessible locations.

I. Underground Warning Tape: During backfilling of trenches install continuous underground warning tape directly above line at approximately 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 24 inches overall.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Branch-circuit panelboards.

1.2 DEFINITIONS

A. EGP: Electronic-grade panelboard.

B. GFCI: Ground-fault circuit interrupter.

C. GFEQ: Ground-fault equipment protection.

D. K.A.I.C.: Kilo-ampere interrupt capacity.

E. MCCB: Molded-case circuit breaker.

F. PQM: Power quality meter.

G. SCCR: Short circuit current rating.

H. SPD: Surge protection device.

1.3 REFERENCED STANDARDS

A. NECA 407 - Recommended Practice for Installing and Maintaining Panelboards

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum)

C. NEMA AB 1 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

F. NFPA 70 - National Electrical Code

G. UL 50 - Enclosures for Electrical Equipment

H. UL 67 – Panelboards

I. UL 486A-486B - Wire Connectors

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures

K. UL 869A - Reference Standard for Service Equipment

1.4 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Product Data: For each type of panelboard.

1. Submit catalog data showing specified features of standard product including materials, switching and overcurrent protection devices, SPDs, accessories and components indicated.
2. Include dimensions and manufacturer’s technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings:

1. Submit for review prior to manufacturer. For each panelboard, include complete description, front view, dimensions, voltage, phase, wire, main bus ampacity, neutral bus rating, circuit breaker arrangement and sizes, short circuit current rating, and factory settings of protection devices.
2. Indicate panelboard designation per Contract Drawings in minimum 10 point font on top right corner of each associated shop drawing sheet.

1.5 QUALITY ASSURANCE

A. Obtain panelboards, overcurrent protection devices, components and accessories from one source and by single manufacturer.

B. Regulatory Requirements:

1. Comply with NFPA 70 (NEC).
2. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE & HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris and traffic.

B. Comply with NEMA PB 1.1 and manufacturer’s written instructions.

C. Do not deliver or install panelboard interiors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above panelboards is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Branch Circuit Panelboards

1. Basis of Design: ABB/General Electric Types AQ, AE or AD.
2. Equal in Square D Company, Siemens or Eaton.

B. Distribution Panelboards

1. Basis of Design: ABB/General Electric Spectra Series.
2. Equal in Square D Company, Siemens or Eaton.

2.2 BRANCH CIRCUIT PANELBOARDS

A. NEMA PB 1, UL 67.

B. Fabrication:

1. Commercial-grade, dead-front, factory assembled.
2. Incoming Feeder Lugs: Size and number per phase to match indicated feeder conductors size, material and number per phase.
3. Sub-feed or feed-thru lugs where indicated or required for multi-section panelboards.
4. Wiring terminals for field installed conductors: Pressure wire connectors except wire-binding screws for #10 AWG or smaller conductors.

C. Panelboard Buses:

1. Material: Copper.
2. Ampere rating as indicated.
3. Neutral Bus: Insulated, 100% of main bus rating unless indicated on Drawings to be 200% rated.
4. Ground Bus: Uninsulated, bonded to panelboard cabinet.
5. Terminals: One terminal per connected conductor.

D. Cabinet:

1. NEMA 250, UL 50.
2. NEMA Type 1 or Type 3R enclosure as indicated on Drawings or as required for installed environment.
3. Surface- or flush-mounted as indicated on Drawings.
4. Front: Door and trim with concealed hardware and cylinder-type lock and catch.
5. Boxes and fronts made of code-gauge steel.
6. Manufacturer standard gray enamel finish over prime coat.

E. Molded-Case Circuit Breakers:

1. NEMA AB 1, UL 489.
2. Bolt-On Type, labeled for 75 degree C copper and aluminum conductors.
3. Quick-make, quick-break, with thermal-magnetic trip.
4. Common internal trip on multi-pole breakers. Handle ties are not permitted.
5. Ampere rating and number of poles as scheduled.
6. Listed as Type SWD for lighting circuits.
7. Listed as Type HACR for air-conditioning equipment circuits.
8. Bussing, device mounting hardware and steel knockouts in dead front where space is indicated.
9. Tandem circuit breakers are not permitted.
10. Locks on trip handles with red device for circuits serving Fire Alarm Systems.
11. Shunt-trip device with 120V coil and auxiliary contacts where specified or indicated.
12. GFCI device, rated at 4-6 mA trip for protection of personnel where specified or indicated.
13. GFEP device, rated 30 mA trip to provide equipment protection where specified or indicated and for branch circuits serving heat tracing.

F. Short Circuit Current Rating:

1. Each panelboard with minimum short circuit current rating as indicated on the Drawings.
2. Fully-rated. Series-rated panelboards are not acceptable.

G. Surge Protection Device:

1. Device ratings and connection per requirements of Section 264313 “Surge Protection Devices” for the installed location of the panelboard in the electrical distribution system.
2. Provide where indicated on the Drawings or herein specified.
3. Provide for all panelboards connected to an Emergency Power System.

2.3 DISTRIBUTION PANELBOARDS

A. NEMA PB 1, UL 67.

B. Fabrication:

1. Commercial-grade, dead-front, factory assembled.
2. Incoming Feeder Lugs: Size and number per phase to match indicated feeder conductors size, material and number per phase.
3. Sub-feed or feed-thru lugs where indicated or required for multi-section panelboards.
4. Wiring terminals for field installed conductors: Pressure wire connectors except wire-binding screws for #10 AWG or smaller conductors.

C. Panelboard Buses:

1. Material: Copper.
2. Ampere rating as indicated.
3. Neutral Bus: Insulated, 100% of main bus rating unless indicated on Drawings to be 200% rated.
4. Ground Bus: Uninsulated, bonded to panelboard cabinet.
5. Terminals: One terminal per connected conductor.

D. Cabinet:

1. NEMA 250, UL 50.
2. NEMA Type 1 or Type 3R enclosure as indicated on Drawings or as required for installed environment.
3. Surface- or flush-mounted as indicated on the Drawings.
4. Front: Door and trim with concealed hardware and cylinder-type lock and catch.
5. Boxes and fronts made of code-gauge steel.
6. Manufacturer standard gray enamel finish over prime coat.

E. Molded-Case Circuit Breakers:

1. NEMA AB 1, UL 489.
2. Bolt-On or I-LineType, labeled for 75 degree C copper and aluminum conductors.
3. Quick-make, quick-break, with thermal-magnetic trip.
4. Common internal trip on multi-pole breakers. Handle ties are not permitted.
5. Ampere rating and number of poles as scheduled.
6. Listed as Type HACR for air-conditioning equipment circuits.
7. Bussing, device mounting hardware and steel knockouts in dead front where space is indicated.
8. Shunt-trip device with 120V coil and auxiliary contacts where specified or indicated.

F. Short Circuit Current Rating:

1. Each panelboard with minimum short circuit current rating as indicated on the Drawings.
2. Fully-rated. Series-rated panelboards are not acceptable.

G. Surge Protection Device:

1. Device ratings and connection per requirements of Section 264313 “Surge Protection Devices” for the installed location of the panelboard in the electrical distribution system.
2. Provide where indicated on the Drawings or herein specified.

2.4 SERVICE ENTRANCE

A. UL 869A.

B. Panelboards labeled as suitable for use as service entrance equipment where applicable and shall include connection for bonding and grounding neutral conductor.

2.5 EXISTING PANELBOARDS

A. Existing Panelboards Indicated for New Branch/Feeder Circuits: Provide and connect new branch circuits as indicated on the Drawings to be served from the existing equipment in available space(s) per the following:

1. Circuit breaker(s) be from the same manufacturer of the existing equipment and fully compatible with the equipment.
2. Short Circuit Current Rating: New circuit breakers shall have the same short circuit interrupt capacity (KAIC rating) as the existing breakers in the equipment.
3. Existing Spare Circuit Breakers: Existing spare circuit breakers of proper ratings may be used for new branch/feeder circuits unless indicated otherwise.
4. Circuit Breaker Hardware: Provide and connect all required hardware and accessories necessary for the installation of the new circuit breaker(s) including but not limited to mounting kits, strap kits, panelboard trim pieces, etc.
5. Inadequate Space for New Circuit Breaker(s): Provide and connect new panelboard section with sufficient pole capacity and same ratings as the existing panelboard and serve by tapping the bus of the existing panelboard. Provide and connect tap connection conductors sized per NFPA-70 (NEC).
6. Identification: Provide new panelboard labeling and/or directory properly identifying new connected electrical loads.
7. Existing Conditions: The Contractor shall be responsible for visiting the site and verifying the existing conditions prior to bidding.

PART 3 - EXECUTION

3.1 COORDINATION WITH MANUFACTURER

A. Instruct manufacturer about the requirement and location for additional gutter space when required for wiring or specified accessories.

B. Instruct manufacturer about the location of the main lugs or main circuit breaker location based on incoming feeder entrance location.

C. Instruct manufacturer to provide multiple lugs where feeder circuit utilizes paralleled conductors and where sub-feed or feed-thru lugs are indicated or required.

3.2 INSTALLATION

A. Provide panelboards complete with feeder circuit, circuit breakers and branch circuits as scheduled and indicated on the Drawings.

B. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

C. Panelboard Mounting:

1. Fasten panelboards firmly to walls and structural surfaces ensuring they are permanently and mechanically anchored.
2. Anchor and fasten panelboards and their supports to building structural elements by methods described in Section 260529 “Hangers and Supports for Electrical Systems.”
3. Install two rows minimum of steel slotted channel with a minimum of 4 attachment points for each panelboard section.
4. When not directly located on structural wall, provide support frame of steel slotted channel anchored to floor and ceiling structure.
5. Install such that top circuit breaker handle is a maximum of 6 foot 6 inches above the finished floor or working platform with handle in its highest position.
6. Install so as to maintain minimum working space clearance in all directions and dedicated electrical equipment spaces per NFPA 70 (NEC).
7. Flammable surfaces used for mounting panelboards shall be painted with 2 coats of flame resistant paint.

D. Tighten electrical connectors and terminals according to equipment manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A-486B.

E. Install filler plates in unused spaces.

F. Leave all spare circuit breakers in the OFF position.

G. At all flush-mounted branch circuit panelboards, install four 3/4 inch spare conduits stubbed into ceiling space or above the bottom of the overhead structural steel

H. At flush-mounted distribution panelboards, provide spare conduit(s) routed to accessible ceiling location for each spare circuit breaker provided properly sized for a four conductor feeder and associated grounding conductor of the same ampere rating as the associated spare circuit breaker

I. Verify that the egress doors to electrical room(s) containing panelboardswith ampere ratings of 800A or greater open in the direction of egress and are equipped with listed panic hardware.

1. The Division 26 Contractor is responsible for coordinating the electrical space door and egress requirements with the General Contractor and providing the panic hardware if not provided with the door(s) supplied.

3.3 CONNECTIONS

A. Ground panelboards according to Section 260526 “Grounding and Bonding for Electrical Systems.

B. Connect wiring according to Section 260519 “Low-Voltage Electrical Power Conductors”.

C. Connect SPD according to Section 264313 “Surge Protection Devices”.

3.4 IDENTIFICATION

A. Provide engrave plastic nameplates per Section 260553 “Identification for Electrical Systems”. Nameplate legend shall include panelboard designation per the Drawings; voltage, phase and wire; and “Fed From:” source designation.

1. Attach to face of trim for panelboards located in non-public or non-finished spaces and inside door for panelboards located in public or finish spaces.
2. Attach to panelboard using small metal screws or rivets.

B. Branch Circuit Panelboards: Provide typewritten directory with transparent plastic cover indicating all connected circuit loads and install in directory frame mounted inside panelboard door. Directory shall also include listing of panelboard designation, voltage, phase, wire and “Fed From:” source.

C. Distribution Panelboards: Provide self-adhesive, engraved plastic nameplates at each circuit breaker indicating load served per the load designations indicated in the Contract Documents.

D. Circuit Numbering: Branch circuit panelboard circuits shall be numbered in sequence vertically down the left side then vertically down the right side and all circuits shall be arranged in the panelboard exactly as they are shown on the Drawings. Numbering to be consecutive across double and triple section panelboards.

E. Label all spare circuit breakers as SPARE.

3.5 SPECIAL CONDITIONS & ACCESSORIES

A. Verify that the egress doors to electrical room(s) containing panelboards with ampere ratings of 800A or greater shall open in the direction of egress and shall be equipped with panic hardware. The Division 26 Contractor is responsible for coordinating the door requirements with the General Contractor and providing the panic hardware if not provided with the door(s) supplied.

B. Panelboards served from the secondary side of a dry-type transformer constituting a separately derived system per NFPA 70 (NEC) shall be provided with a main circuit breaker sized as indicated on the Drawings or per the NFPA 70 (NEC) if size not indicated.

C. Branch circuit breakers serving outlets and equipment located under a kitchen exhaust hood equipped with at fire suppression system shall be the shunt-trip type.

D. Branch circuit breakers serving elevator motors shall be the shunt-trip type with auxiliary contacts.

3.6 FIELD QUALITY CONTROL

A. Inspect for physical damage, proper alignment, anchorage and grounding.

B. Check phase-to-phase and phase-to-ground insulation resistance levels prior to energizing panelboard.

C. Check panelboards for electrical continuity of circuits and short-circuits prior to energizing panelboard.

3.7 ADJUSTING

A. Adjust fronts, covers, hinges, doors and locks for proper alignment and operation. Adjust doors and locks for smooth operation.

3.8 CLEANING & TOUCH-UP

A. Clean panelboard interiors and exteriors. Remove paint splatters and other spills. Completely remove dirt and debris from panelboard interior.

B. Touch-up chips, scratches or marred finishes to match original finish using manufacturer-supplied paint kit.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-Use Snap (Toggle) Switches.
2. Power Receptacles.
3. Device Covers and Plates.

1.2 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. GFCI: Ground-fault circuit interrupter.

C. GFEQ: Ground-fault equipment protection.

D. Pigtail: Short wiring lead used to connect a device to a branch circuit conductor.

E. SPD: Surge protection device.

1.3 REFERENCED STANDARDS

A. ANSI/NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

B. IEEE C62.41.2 - Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.

C. IEEE C62.45 - Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits.

D. NFPA 70 - National Electrical Code.

E. NFPA 99 - Health Care Facilities Code.

F. NEMA FB 11 - Plugs, Receptacles, and Connector of the Pin and Sleeve Type for Hazardous Locations.

G. NEMA WD-1 - General Color Requirements for Wiring Devices.

H. NEMA WD-6 - Wiring Devices - Dimensional Requirements.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum).

J. UL 20 - General-Use Snap Switches.

K. UL 498 - Attachment Plugs and Receptacles.

L. UL 943 - Ground-Fault Circuit-Interrupters.

M. UL 1010 - Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.

N. UL 1436 - Outlet Circuit Testers and Similar Indicating Devices.

O. UL 1449 - Standard for Surge Protection Devices.

P. UL 1472 - Solid State Dimming Controls.

Q. UL 1917 - Solid-State Fan Speed Controls.

1.4 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Obtain wiring devices from one source and by single manufacturer.

B. Regulatory Requirements:

1. Comply with NFPA 70 (NEC) for components and installation.
2. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE & HANDLING

A. Store in clean, dry space.

B. Maintain factory unopened packaging until ready for installation.

PART 2 - PRODUCTS

2.1 GENERAL-USE (TOGGLE) SWITCHES

A. Manufacturers:

1. Hubbell Incorporated
2. Legrand/Pass & Seymour
3. Cooper Wiring Devices
4. Leviton Manufacturing Company

B. Comply with NEMA WD-1 and UL 20.

C. Switches: Heavy-duty, specification-grade; back and side wired; flush or surface mounting; for connection to copper conductors.
Body and Handle: Thermoplastic with toggle handle

1. Ratings: 120-277 Volts AC, 20 A minimum.
2. Single pole, double pole as indicated.
3. Three- or Four-way where indicated.
4. Key-operated where indicated.

2.2 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated
2. Legrand/Pass & Seymour
3. Cooper Wiring Devices
4. Leviton Manufacturing Company

B. Comply with NEMA WD-1, NEMA WD-6 configuration 5-20R, and UL 498.

C. Receptacle: Heavy-duty, specification-grade; back and side wired; flush or surface mounting; straight-blade; 2 pole, 3 wire grounding; for connection to copper conductors.
Body: Thermoplastic.

1. Ratings: 125 Volts AC, 20 A minimum.
2. Single, duplex or double-duplex as indicated.
3. Special features and types and combination of types as indicated on the Drawings.
4. GFCI Type:

   a. Additional compliance with UL 943 Class A.
   b. Leakage current trip level: 4 to 6 mA.
   c. Trip Time: 0.025 seconds nominal.
   d. Test and reset buttons.
   e. Reverse line-load function to prevent device from functioning if wired incorrectly.
   f. Self-test feature to prevent device from delivering power if GFCI protection is lost.
   g. Indicator Light: Illuminated when device is tripped.

5. Tamper Resistant (TR) Type:

   a. Requires insertion of object in both left and right contacts to energize.

6. Twist-Locking Type:

   a. NEMA WD-6 configuration as indicated on Drawings.

7. Hospital-Grade:

   a. Listed and labeled “Hospital Grade” with UL green dot symbol on face of device.
   b. Provide in all patient-care rooms and spaces and as indicated on the Drawings in health care facilities governed by NFPA 99.

8. Switched Receptacles for Automatic Control:

   a. NFPA 70 (NEC) required marking on device face indicating outlets controlled.

9. USB Charging Type:

   a. Duplex receptacle with duplex, Type-A, 5V, 5A USB charging ports.

10. Isolated-Ground Type:

    a. Insulation-barrier to isolate device from metallic raceway system.
    b. Isolated-ground “triangle” symbol on face of device.

11. Surge-Protection Type:

    a. Integral surge protection within device.
    b. SPD indication symbol on face of device.

D. Special Purpose Receptacles: Heavy-duty, specification-grade device, rated for voltage and amperage with NEMA configuration as indicated on the Drawings.

E. Hazardous Location Receptacles: Comply with NEMA FB 11 and UL 1010.

2.3 CORD & PLUG DROPS

A. Receptacle: Voltage and ampere rating and NEMA configuration as indicated on the drawings. Nylon body with integral cable-clamping jaws.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW jacket. Phase and neutral conductors as required with insulated green equipment grounding conductor.

C. Provide properly-sized kellems cable grips at each end of cord.

2.4 DEVICE COVERS & PLATES

A. Plates: Single and combination types to match corresponding wiring devices.

1. Material for Finished Spaces: stainless steel, satin finish, 0.035 inch thick.
2. Material for Unfinished Spaces: galvanized steel.

B. Weatherproof Covers: NEMA 250 complying with Type 3R, die-cast aluminum, weather-resistant.

1. Covered Exterior Spaces: Spring-loaded and gasketed snap-shut outlet covers.
2. Uncovered Exterior Spaces: Die-cast aluminum “In-Use” hinged cover with exit holes in bottom for wiring and locking provisions.

C. Tamper Resistant (TR): Slide cover over receptacle.

2.5 FINISHES

A. Color of Switch Handles and Receptacle Face: Gray except as listed below or manufacturer’s standard color as selected by the Professional. Verify device color with the Professional prior to ordering equipment.

1. Switches and Receptacles connected to a Standby or Emergency Power System: Red; plate shall be engraved with red lettering “EMERGENCY”.

    a. Where the entire electrical system of a facility is connected to a Standby or Emergency Power System only the devices connected to the Life-Safety Branch of the System shall be Red in color.

2. Receptacles connected to UPS System: Orange

PART 3 - EXECUTION

3.1 COORDINATION

A. Verify location of wiring devices with Architectural interior elevation drawings, furniture drawings and millwork/casework drawings prior to rough-in.

B. Special Purpose Receptacles: Coordinate final selection of NEMA configuration of device with configuration of plug on utilization equipment.

C. Receptacle for Owner-Furnished Equipment and Equipment Furnished under other Divisions of the Specification: Verify and coordinate final selection of NEMA configuration of device with configuration of plug on utilization equipment.

D. Coordination with Other Trades:

1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers guided by riding against outside edge of box.
2. Keep outlets free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint and other foreign material that may contaminate the raceway system, conductors and cables.
3. Install device boxes in brick or block walls so that the device cover plate does not cross a masonry joint unless the joint is troweled flush with the face of the wall.

4. Verify wall openings are neatly cut around outlet boxes in a manner that they will be completely covered by wall plates. Notify General Contractor of openings that require correction. Do not use oversize plates.

3.2 PREPARATION

A. Verify that outlet boxes are firmly attached and secured to prevent movement prior to installing wiring and device.

B. Clean all debris from outlet boxes.

3.3 DEVICE APPLICATION

A. Provide and connect wiring devices as specified herein and as indicated on the Drawings by symbols with associated serving branch circuits.

B. GFCI Receptacles: Provide GFCI type device as indicated on the Drawings and per the following:

1. Within 6 feet of a counter-top or floor-mounted sink, bathtub or shower stall.
2. Toilets/Restrooms.
3. Indoor damp or wet locations.

C. Weatherproof GFCI Receptacles: Provide weatherproof GFCI receptacles with proper cover per installed location as indicated on the Drawings and per the following:

1. Outdoors.
2. Rooftops within 25 feet of roof-top mechanical equipment without integral convenience outlet.

3.4 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise specified, scheduled or indicated. Indicated mounting heights shall be to center of device.

B. Conductors:

1. Do not strip insulation from conductors until just before they are splice or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking solid wire or cutting strands of stranded wire.
3. Length of free conductors at outlets for devices shall meet provisions of NFPA 70 (NEC) without pigtails.
4. Do not use stranded conductors for termination to devices unless crimp-on fork terminals are used for terminations.

C. Device Installation:

1. Keep device in its manufacturer's package or otherwise protected until it is installed.
2. Do not remove surface protection, such as plastic film and smudge covers until last possible moment.
3. Devices shall be connected to serving branch circuit using pigtails a minimum of 6 inches in length. Do not connect receptacles in a feed-through manner.
4. Terminate conductors for all devices using side terminal binding-head screw terminals. Wrap solid conductor tightly clockwise around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
6. When conductor larger than #12 AWG are installed for 15A or 20A branch circuits, splice #12 AWG pigtails to branch circuit for device connections.
7. Tighten unused terminal screws on the device.
8. When mounting devices in metal boxes, remove fiber or plastic washers to hold device mounting screws in yoke, allowing metal-to-metal contact.
9. Install devices plumb, level with finished surfaces and free from blemishes.
10. Install lighting switches vertically on latch side of door. Where adequate space for switch installation does not exist on latch side of door, mount switch on hinge side of door so switch is not located behind door in open position. First switch of single or ganged switch bank shall be mounted within 12 inches of door frame or edge of door.
11. Install devices above counters, 4 inches to centerline of the device above the countertop or backsplash where present. Install all devices at same height above any one counter or fixed cabinet.
12. Group adjacent switches under single, multigang wall plate.
13. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conduct. Ground per the requirements in Section 260526 "Grounding and Bonding for Electrical Systems".

D. Device Mounting Heights:

1. Switches: 48 inches to center above finished floor unless indicated otherwise.
2. Receptacles: 18 inches to center above finished floor unless indicated otherwise.
3. Receptacles at Counter Top: 4 inches to center above top of counter or backsplash unless indicated otherwise.
4. Receptacles in Shops/Garages: 48 inches to center above finished floor unless indicated otherwise.

5. Equipment Receptacles: Height and location as directed by equipment provider for proper equipment connection with supplied equipment power cord and for concealment behind equipment in public spaces (i.e. electric drinking fountains).
6. Comply with requirements of ADA-2010.
7. Device mounting heights may be adjusted slightly to allow cutting of masonry block to the top or bottom of the nearest block course maintaining specified mounting height and ADA-2010 requirements.

E. Device Installation Orientations:

1. Install ground pin of vertically-mounted receptacles up, and on horizontally-mounted receptacles to the right.
2. Install switches with handle operating vertically with “ON” position up.
3. Unless otherwise indicated or where adequate space is not available due to adjacent construction, mount devices flush with long dimension vertical.

F. Device Cover Plates:

1. Provide cover plate on all outlet boxes whether or not a device is installed. Provide blank plate on empty, spare or future outlet boxes.
2. Plates shall be properly secured to outlet box with all four corners in contact with wall finish and oriented parallel/perpendicular to adjacent building surfaces.
3. Plates shall not be installed such that corners are protruding from edge of outlet box or wall surface creating a snagging or sharp edge condition.

3.5 IDENTIFICATION

A. Provide self-adhesive clear label with black lettering on the face of all receptacles indicating serving panelboard and branch circuit number.

B. Receptacles connected to standby power system shall have engrave plates as herein specified.

3.6 FIELD QUALITY CONTROL

A. Inspect wiring devices for defects and replace as required.

B. Operate wall switches with connected circuits energized and verify proper operation and equipment controlled.

C. Perform the following tests:

1. Test all receptacles with receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed neutral and ground reversed. Rewire receptacles with faults and retest.
2. Test each GFCI receptacle for proper operation. Perform testing with an instrument specifically designed and manufactured for testing ground-fault circuit interrupters. Test for compliance with specified functions.

D. Adjust devices and associated plates to be flush with wall finish, level and plumb.

3.7 CLEANING

A. Clean devices and cover plates after painting is complete. Replace stained or improperly painted devices and cover plates.

B. Clean all devices and plates of dust, dirt, stains, spills and construction debris.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible and non-fusible disconnect switches.
2. Circuit breakers in individual enclosures.
3. Toggle-switch disconnects.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. K.A.I.C.: Kilo-ampere interrupt capacity.

D. MCCB: Molded-case circuit breaker.

E. MMS: Manual motor switch for the purpose of the Division 26 Specifications, a manual motor switch shall be a toggle-switch disconnect with lockout bracket.

F. SCCR: Short circuit current rating.

G. SPDT: Single-pole, double throw.

1.3 REFERENCED STANDARDS

A. ANSI/NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting.

B. NEMA AB 1 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.

C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. NFPA 70 - National Electrical Code.

E. UL 98 - Enclosed and Dead Front Switches.

F. UL 486A - 486B - Wire Connectors.

G. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.

H. UL 869A - Reference Standard for Service Equipment.

1.4 SUBMITTALS

A. Refer to Section 260500 “General Requirements for Electrical Systems” for additional requirements.

B. Product Data: For each type and rating of switch or enclosed circuit breaker.

1. Submit catalog cut sheet of manufacturer's standard product indicating voltage, amperage, HP ratings, enclosure type, dimensions, fuse clip features, terminal lugs and all accessories including interlock devices, short circuit current ampere rating and factory settings of individual protective devices.

1.5 QUALITY ASSURANCE

A. Obtain disconnect switches and enclosed circuit breakers and accessories from one source and by single manufacturer.

B. Regulatory Requirements:

1. Comply with NFPA 70 (NEC).
2. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.6 DELIVERY, STORAGE & HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris and traffic.

B. Comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Disconnect Switches

1. Basis of Design: ABB/General Electric.
2. Equal in Square D Company, Siemens or Eaton.

B. Enclosed Circuit Breakers

1. Basis of Design: ABB/General Electric.
2. Equal in Square D Company, Siemens or Eaton.

2.2 DISCONNECT SWITCHES

A. NEMA KS 1, UL 98.

B. Load interrupter enclosed knife switch, heavy-duty type.

1. Exception: General-duty type switches may be used for water heaters located within millwork or casework with space limitations.

C. Fusible or non-fusible type as indicated on the Drawings or specified herein.

D. Switch Interiors:

1. Switch blades that are visible in "OFF" position when enclosure door is open.
2. Plated current carrying parts.

3. Removable arc suppressors to permit easy access to line-side lugs.

E. Switch Mechanism:

1. Quick-make, quick-break with visible blades and externally operable handle.
2. Lockable only in “OFF” position.
3. Dual cover interlock to prevent unauthorized opening of enclosure door when operating handle is in the “ON” position and to prevent closing of switch mechanism with enclosure door open.
4. Defeater mechanism to bypass interlock.
5. Operating handle integral part of enclosure.
6. Handle to physically indicate “ON” and “OFF” position.

F. Ratings:

1. Ampere rating as indicated on Drawings.
2. Horsepower rated.

G. Fusible Switches:

1. Rejection clips for Class R fuses.
2. Provisions for Class J or Class L fuses as applicable.
3. Where indicated to be fused, provide current-limiting, dual-element, time-delay fuses of indicated ampere rating.

a. Basis of Design: Bussman Fusetron Series or approved equal.

2.3 ENCLOSED CIRCUIT BREAKERS

A. NEMA AB 1, UL 489.

B. Enclosed molded-case circuit breakers:

1. Tripped indication clearly shown on breaker handle taking position between “ON” and “OFF” positions.
2. Thermal-magnetic trip unless indicated otherwise.

C. Breaker Mechanism:

1. Quick-make, quick-break.

D. Ratings:

1. Ampacity and number of poles as indicated on the Drawings.
2. Breaker ampere rating shall be visible with enclosure door open and all interior covers in place.
3. Listed as Type HACR for air conditioning equipment circuits.
4. Listed as Type SWD for lighting circuits.

2.4 TOGGLE-SWITCH DISCONNECT

A. Comply with the requirements of Section 262726 “Wiring Devices” for device.

B. Toggle-switch ratings:

1. Ampere Rating: As indicated, minimum 20 amperes.
2. Voltage Rating: 120/277V.
3. Poles: 1-, 2- or 3-pole as required for branch circuit.

C. Enclosure: Standard 4" square box with galvanized surface cover with permanently attached lockout bracket.

1. Lockout Bracket: Equal to Leviton LKOUT-40, stainless steel construction, tamper-resistant attachment screws.

D. Use Limitations:

1. Where indicated on the Drawings
2. Motors: Rated 3/4 HP or less, 250 volt maximum, single or three phase.
3. Equipment: Rated 16 full-load amperes or less, 250 volt maximum, single or three phase.
4. Indoor, dry location use only.
5. Do not use where disconnect/safety switch is specified unless directed by the Professional.

2.5 LUGS

A. Front removable lugs.

B. Labeled for 75 degree C copper and aluminum conductors.

C. Multiple lugs to match indicated number of conductors per phase.

D. Termination of field installed conductors: Pressure wire connectors, except wire-binding screws for #10 AWG or smaller conductors.

2.6 ACCESSORIES

A. Equipment ground kit.

B. Solid Neutral Assembly, where required.

C. Auxiliary Contacts, NO/NC, where indicated or required.

1. Elevators: Switches serving elevator motor and control circuits shall be provided with auxiliary contacts.

D. Shunt-trip circuit breaker, 120 volt coil, where indicated or required.

2.7 ENCLOSURES

A. NEMA KS 1, NEMA AB 1, UL 98, UL 489, as applicable.

B. NEMA Type 1, NEMA Type 3R, NEMA Type 4X stainless-steel as required by NFPA 70 (NEC) for the installed environment and the following:

1. Indoor, dry locations: NEMA Type 1
2. Indoor, wet locations: NEMA Type 3R

3. Indoor, corrosive locations: NEMA Type 4X
4. Outdoor, covered or uncovered locations: NEMA 3R

C. Code-gauge galvanized steel with manufacturer's standard gray enamel finish over prime coat. All NEMA Type 4X enclosures shall be stainless steel.

D. Surface-mounted. Flush-mounted circuit breaker enclosure where indicated.

2.8 SERVICE ENTRANCE

A. UL 869A.

B. Switches and circuit breakers indicated to be used for electrical service entrance equipment shall be labeled for this application and shall be provided with solid neutral assembly and equipment ground bar and shall include connection for bonding and grounding neutral conductor.

2.8 SHORT CIRCUIT CURRENT RATING

A. Each circuit breaker shall have minimum K.A.I.C. rating as indicated on the drawings. If rating not indicated, use same rating as serving electrical distribution equipment.

PART 3 - EXECUTION

3.1 EXAMINATION & COORDINATION

A. Examine areas and surfaces to receive disconnect switches, enclosed circuit breakers and manual motor switches for compliance with requirements, installation tolerances and other conditions affecting performance.

B. Verify that space indicated for mounting devices meets access and working space clearances required by NFPA 70 (NEC).

1. Coordinate mounting location of devices with the work of other trades to ensure accessibility and working clearances are maintained after installation of other work.

3.2 INSTALLATION

A. Provide and connect enclosed circuit breakers and switches as specified herein and as indicated on the drawings by symbols and schedules.

B. Install in accordance with ANSI/NECA 1.

C. Install disconnect switches, enclosed circuit breakers and toggle-switch disconnects level and plumb in accordance with manufacturer's written instructions.

D. Mounting of Disconnect Switches and Enclosed Circuit Breakers:

1. Fasten devices firmly to walls and structural surfaces, ensuring they are permanently and mechanically anchored.
2. Comply with Section 260529 "Hangers and Supports for Electrical Systems".

3. Install two rows of steel slotted channel with a minimum of four attachment points for each device. Gang multiple devices mounted at same location on common mounting channel where possible.
4. Where suitable mounting substrate is not available or properly located, provide support frame of steel slotted channel anchored to floor and ceiling structure.

E. Do not support disconnect switches or enclosed circuit breakers by raceway system.

F. Install disconnect switch, enclosed circuit breaker and toggle-switch disconnect with centerline of operating handle 54 inches above finished floor or work platform where possible. Adjust mounting height as required for field conditions maintaining NFPA 70 (NEC) accessibility, clearance and operation requirements.

G. Tighten electrical connectors and terminals according to equipment manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

H. Install proper fuses in fusible switches.

3.3 IDENTIFICATION

A. Provide engraved plastic nameplates per Section 260553 "Identification for Electrical Systems". Attach nameplate to exterior of enclosure of surface-mounted switches and enclosed circuit breakers using small stainless steel screws or rivets. Do not use self-adhesive backing as sole fastening means.

B. Switch or enclosed circuit breaker nameplate shall include: Equipment Designation for connected equipment, circuit voltage and phase, branch circuit designation (panelboard name and circuit number).

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems".

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors".

3.5 FIELD QUALITY CONTROL

A. Inspect for physical damage, proper alignment, anchorage and grounding.

B. Check phase-to-phase and phase-to-ground insulation resistance levels prior to energizing equipment.

C. Check for electrical continuity of circuits and short-circuits prior to energizing.

3.6 ADJUSTING

A. Adjust fronts, covers, hinges, doors and locks for proper alignment and operation. Adjust doors and locks for smooth operation.

3.7 CLEANING & TOUCH-UP

A. Clean interiors and exteriors. Remove paint splatters and other spills. Completely remove dirt and debris from enclosure interior.

B. Touch-up chips, scratches or marred finishes to match original finish using manufacturer-supplied paint kit.

END OF SECTION

SECTION 265119 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior Lighting Luminaires
2. Exterior Building-Mounted Luminaires
3. Exit Signs
4. Emergency Lighting Units

B. RELATED WORK

1. Section 262726 “Wiring Devices”.

1.2 DEFINITIONS

A. CCT: Correlated Color Temperature.

B. CRI: Color Rendering Index.

C. Decorative, Deco.: Luminaire has been selected for its appearance, finishes, shape, dimensions, etc., as well as, performance characteristics.

D. Lighting Fixture or Fixture: Luminaire per definition below. Lighting Fixture, Fixture and Luminaire shall convey the same meaning.

E. IP: International Protection or Ingress Protection Rating.

F. LED: Light-Emitting Diode.

G. Lumen: Measured illumination output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, electrical and electronic components, housing, mounting hardware and brackets.

1.3 DESCRIPTION OF THE WORK

A. Provide and connect luminaires as scheduled and indicated on the Drawings and Specifications.

B. Luminaires shall be provided complete with necessary accessories for proper installation in or on the building elements indicated.

C. Luminaire catalog numbers indicated on the Drawings are for basic luminaire types. Additional features, accessories and options herein specified or required for proper installation shall be provided.

D. Luminaire installation shall include final aiming, focusing and adjustments of luminaires as directed by the Professional and as required for illumination of the intended area or surface.

1.4 REFERENCED STANDARDS

A. C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products.

C. IES LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources.

D. NECA/IESNA 500 - Recommended Practice for Installing Indoor Commercial Lighting Systems.

E. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems.

F. NECA/IESNA 502 - Recommended Practice for Installing Industrial Lighting Systems.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility.

H. UL 57 - Electrical Luminaires.

I. UL 496 - Lampholders.

J. UL 773 - Plug-in Photocontrols for Use with Area Lighting.

K. UL 924 - Emergency Lighting and Power Equipment.

L. UL 1598 - Luminaires

M. UL 8750 - Safety Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.5 QUALITY ASSURANCE

A. Luminaires provided shall have local manufacturer’s sales representation. Local shall mean for the purpose of this requirement located within the boundaries of the State in which the project is located or an immediate adjacent State. Sales representation shall mean a person(s) or company contracted or owned by the lighting manufacturer to provide sales, technical and warranty services in the associated territory. An electrical distributor or lighting distributor does not constitute sales representation.

B. Luminaires shall be manufactured by companies regularly engaged in the manufacture of lighting equipment with appropriate manufacturing, sales and distribution facilities and staff.

C. Regulatory Requirements:

1. Comply with NFPA 70 (NEC).
2. Furnish products listed and labeled by UL as suitable for indicated use and installation conditions and environment.

1.6 SUBMITTALS

A. Refer to Section 26 05 00 “General Requirements for Electrical Systems” for additional requirements.

B. Manufacturer’s Representative: Provide with Product Data the name and contact information for local manufacturer’s representative for each submitted luminaire.

C. Product Data: For each type of product and each Luminaire type as scheduled.

1. Arrange in order of luminaire drawing designations. Luminaire drawing designation shall be indicated in minimum 12 point font on upper right-hand corner of each page.
2. Indicate by highlighting, encircling or other distinguishable method all luminaire specified or required features, accessories, finishes, etc.
3. Include data on features, accessories, and finishes.
4. Include physical description, color image, and dimensions of luminaires.
5. Specifically indicate luminaire lumen output, input wattage, CCT, CRI and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.

D. Shop Drawings: For nonstandard or custom luminaires or luminaires with custom lengths, widths or other custom manufacturing.

1. Detailed drawings including plans, elevations, sections, and mounting and attachment details.
2. Detailed drawings of nonstandard or custom luminaire assemblies indicating dimensions, weights, method of field assembly, components, features, finishes, and accessories.
3. Include diagrams for power, signal and control wiring.

E. Substituted Equipment: Approval of submitted substitute luminaires shall not eliminate the Contractor's responsibility to provide luminaires similar in performance and physical characteristics to the specified luminaires.

1. Substituted luminaires shall meet the performance and functional characteristics and the general appearance and dimensions (+/-10%) of the specified luminaires.
2. Luminaires identified on the drawings as "Decorative" have been selected by the Professional for their appearance as well as operational performance. Substituted luminaires shall be compatible to specified equipment in appearance and operational performance. Substituted decorative luminaires may be rejected due to appearance or finish only at the sole discretion of the Professional.
3. Where substituted luminaires are proposed, the Professional shall have the right to require the submission of photometric calculations of any area or areas by the luminaire manufacturer using parameters and design illumination levels provided by the Professional and an industry recognized lighting calculation computer program. Successful performance to design illumination levels shall be a condition of luminaire approval.
4. For all substituted luminaires or equipment, the Contractor shall clearly indicate on the shop drawings or product data sheets a deviation statement indicating all variations in dimensions, function, operation, installation, connection, etc. of the proposed substitution luminaires or equipment. Failure to provide this information shall be interpreted to mean that the proposed substituted luminaires or equipment is identical to the specified equipment in all respects.

1.7 DELIVERY, STORAGE & HANDLING

A. Manufacturer shall protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping. Contractor shall maintain factory protective covering on luminaires until just before installation.

B. Store in a clean, dry location per manufacturer's recommendations.

1.8 WARRANTY

A. Warranty: Manufacturer and Contractor agree to repair or replace luminaires or components of luminaires that fail in materials, components or workmanship within the specified warranty period. Warranty repair or replacement of luminaires or components shall include all labor, material and shipping costs.

B. Warranty Period: 5 years from project date of Substantial Completion.

C. When a luminaire is replaced under warranty due to failure, the replacement luminaire shall carry the same specified warranty period and the start date for this warranty period shall be the date of installation of the replacement luminaire.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The luminaires indicated in the Lighting Luminaire Schedule on the Drawings by brief descriptions, manufacturers and catalog numbers are the Basis of Design luminaires. Equal luminaires by other reputable manufacturers may be proposed by the Contractor for consideration and approval by the Professional.

B. All LED luminaires shall be listed on the Qualified Products List (QPL) of the DesignLights Consortium.

C. LED Chip Manufacturers: Cree, Nichia, Philips Lumileds, Samsung.

2.2 LUMINAIRE FABRICATION & MANUFACTURE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 (NEC) by a qualified testing agency and marked for intended location and application.

B. Factory Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel but not see from normal viewing angles on finished sides of luminaire.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by a nationally recognized testing laboratory.

E. Construction

1. Constructed of joints made by means of welded, brazed, screwed or bolted construction.
2. Housings shall be so constructed that all electrical components are accessible and replaceable without removing luminaires from their mountings.
3. Miter cuts shall be accurate. Joints shall be smooth, flush and without burrs.
4. Joints and bends shall be smooth, free of burrs and sharp corners and edges.
5. Form and support to prevent warping and sagging.
6. Steel:

    a. ASTM A 36/A 36M for carbon structural steel.
    b. ASTM A 568/A 568M for sheet steel.

7. Stainless Steel: Manufacturer’s standard grade, ASTM A 240/A 240M

8. Galvanized Steel: ASTM A 653/A 653M.
9. Aluminum: ASTM B 209.

F. Lenses, Reflectors and Diffusers

1. All lenses or louvers shall be removable but held in place so that normal motion will not cause them to open or drop out.
2. Optical lenses shall be free from spherical and chromatic aberrations.
3. Acrylic lenses shall be 100 percent virgin acrylic material.
4. Minimum troffer lense thickness shall be 0.125 inch unless indicated otherwise.
5. Alzak reflectors and louvers shall be low-iridescent.
6. Luminaires with adjustable aiming or beam angle shall contain reliable angle locking devices.

G. Finishes

1. Provide luminaires with finish as indicated on the Drawings. Verify final finish with the Professional prior to releasing for fabrication.
2. Substitute luminaires shall have available at no additional costs all standard finishes available for specified luminaires.
3. Ferrous parts and supports shall be rust proofed after fabrication and prior to final finish.

H. Wiring

1. Luminaires shall be completely factory wired.
2. Internal wiring shall contain no splices.
3. Connections shall be made with insulated “wire nut” type mechanical connectors.
4. Recessed luminaires installed in inaccessible ceilings shall be UL listed for through wiring with a junction box accessible from the luminaire opening.

I. Supports

1. Rigid metallic pipe stems furnished by the luminaire manufacturer shall be utilized for the support of pendant-mounted luminaires unless indicated otherwise.
2. Stem hangers shall be equipped with aligner-type box covers or canopies so that stems hang vertically, irrespective of the angle of the surface they are mounted from.
3. Provide finish ring or canopy to conceal outlet box.
4. Yokes, brackets and supplementary supporting members needed to mount luminaires to suitable ceiling members or building structure shall be provided.

J. Framing

1. Verify type of ceiling construction prior to releasing luminaires for fabrication and delivery.
2. Provide mounting appurtenance, flanges, sloped ceiling adapters where required.
3. Provide mounting assembly, clips or mechanical lugs as required for support of luminaires.
4. Install recessed luminaires to prevent light leaks between ceiling trim of luminaires and finished ceiling.
5. Ceiling opening frames shall be manufactured of non-ferrous metal or be suitable rust proofed after fabrication.

2.3 EXTERIOR LUMINAIRE FABRICATION & MANUFACTURE

A. In addition to the requirements for herein specified for interior lighting luminaires, exterior lighting luminaires shall comply with the following:

1. Metal parts shall be free from burrs, sharp corners and edges and shall be manufactured of corrosion-resistant aluminum, die-cast aluminum, steel or other material as shown on the drawings or specified herein. Steel or other materials subject to corrosion or rust shall have proper corrosion-resistant and weather proof finish applied after fabrication. Plastic and other non-metallic parts shall have a high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
2. Housings shall be rigidly formed, weather- and light-tight enclosures. Doors and other access means shall be smooth operating, free from light leakage under operating conditions and arranged to permit relamping without the use of tools. Arrange doors, frames, lenses, diffusers and other pieces to prevent accidental falling during relamping and when secured in operating position.
3. All exposed hardware, screws and other fasteners shall be manufactured of stainless steel.
4. Luminaires intended to be installed on exterior uncovered surfaces shall be wet-location listed.
5. Enclosed exterior mounted luminaires shall be properly sealed to prevent insects from entering the luminaire housing.

2.4 DRIVERS

A. Provide and connect driver(s) in all luminaires as required to operate luminaire per operation indicated on the drawings or herein specified and fully compatible with the connected lighting control device.

B. Regulatory Requirements:

1. Comply with NFPA 70 (NEC).
2. Furnish products listed and labeled by UL as suitable for indicated use and installation conditions and environment.

C. Description: Electronic solid-state, AC-DC rectifying power supply with dimming control circuitry, surge suppression and inrush current and total harmonic distortion limiting components and circuitry.

D. Driver Specifications:

1. Limited Inrush Current: Meet or exceed NEMA 410.
2. Total Harmonic Distortion (THD): Less than 20 percent and meet ANSI C82.11 maximum allowable THD at full output.
3. Input Voltage: 120VAC or 277VAC with +/- 10 percent variations with no visible change in lighting output or quality.
4. Surge Withstand: Up to 1000V surge without impairment of performance as defined by ANSI C62.41 Category A.
5. Power Factor: > 90 percent.
5. Dimming Range: 100 percent to 1 percent unless indicated otherwise, step-free, flicker-free over entire dimming range.
6. Dimming Control: 4-wire, 0 - 10VDC voltage controlled unless indicated otherwise.
7. Fully compatible with the connected LED circuitry.
8. Fully compatible with the installed luminaire housing for cooling and temperature limitations.

2.5 EXIT SIGNS

A. Comply with UL 924, NFPA 70 (NEC), NFPA 101; for sign colors, visibility, luminance and lettering size, comply with authorities having jurisdiction.

B. LED Type, single or double face as indicated on the Drawings.

C. Unless indicated otherwise, exit signs shall be die-cast aluminum construction with brushed-aluminum faceplate(s), black housing, stenciled red lettering, directional chevrons as indicated or required.

D. Mounting: Universal for ceiling, wall or end mounting.

E. Connection: 120/277 Volt compatible.

F. Self-Powered Exit Signs (Battery Type): Sealed, maintenance-free nickel-cadmium battery back-up with minimum 90 minutes of operation; automatic battery recharge under normal power; test switch and status indicator.

2.6 EMERGENCY LIGHTING UNITS

A. Comply with UL 924, NFPA 70 (NEC), NFPA 101.

B. Comply with NEMA LE 4 for recessed luminaires.

C. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire housing and compatible with luminaire driver.

1. Emergency Connection: Operate luminaire continuously at a minimum output of 1100 lumens or maximum output of luminaire upon loss of normal power. Provide and connect separate un-switched circuit leg to battery-inverter unit for charging and voltage sensing from the lighting branch circuit serving the general lighting in the associated space.
2. Operation: Unit automatically switches power to battery operation upon sensing power supply circuit voltage drop to 80 percent of nominal voltage or below. Unit automatically disconnects from battery when voltage approaches deep-discharge level. Battery is automatically recharged and floated on charger upon return of normal power.
3. Luminaire Control: Luminaire's normal-lighting "on", "off" and "dimming" control shall be per control device(s) indicated on the Drawings and shall have separate switch-leg circuit(s) provided independent of battery-inverter unit charging/ sensing circuit.
4. Test Push-Button and Indicator Light: Visible and accessible without entering ceiling space.

    a. Push-Button: Push-to-test type, located in luminaire housing where possible or adjacent flush-mount handy box, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: Red LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type. Capacity to operate luminaire at specified lumen output for a minimum of 90 minutes.
6. Charger: Fully automatic, solid-state, constant current type with sealed power transfer relay.

D. External Type: Self-contained, modular, battery-inverter unit, integral dual adjustable LED lamps, thermoplastic housing.

1. Emergency Connection: Operate luminaire continuously at a minimum output of 1100 lumens upon loss of normal power. Provide and connect an un-switched circuit to battery-inverter unit for charging and voltage sensing from the lighting branch circuit serving the general lighting in the associated space.
2. Operation: Unit automatically switches power to battery operation upon sensing power supply circuit voltage drop to 80 percent of nominal voltage or below. Unit automatically disconnects from battery when voltage approaches deep-discharge level. Battery is automatically recharged and floated on charger upon return of normal power.
3. Test Push-Button and Indicator Light: Visible and accessible without entering ceiling space.

    a. Push-Button: Push-to-test type, located in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: Red LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type. Capacity to operate emergency unit for a minimum of 90 minutes.
5. Charger: Fully automatic, solid-state, constant current type with sealed power transfer relay.
6. Mounting: Listed for wall or ceiling mounting as indicated.
7. Emergency lighting units installed outdoors shall be wet-location listed.

2.7 FACTORY TESTING

A. LED luminaires shall be factory tested in accordance with IESNA-LM-79.

B. All LED light sources' lumen maintenance shall be factory tested in accordance with IESNA-LM-80.

PART 3 - EXECUTION

3.1 COORDINATION

A. The lighting luminaire locations shown on the electrical Drawings are approximate and representative. Contractor shall refer to and coordinate with the Architectural reflected ceiling plans and elevation drawings and details for exact lighting luminaire mounting heights and locations and for other elements which may effect luminaire mounting and/or operation.

B. Verify luminaire compatibility with indicated ceiling type in room/space in which luminaire is to be installed. Refer to Architectural reflected ceiling plans and details. Provide luminaires and mounting accessories required for ceiling type.

C. Coordinate rough-in location and outlet box size and type with luminaire manufacturer's installation instructions and shop drawings.

3.2 EXAMINATION

A. Examine luminaires, packaging, etc. for damage, signs of mishandling or abuse. Verify proper operation of luminaires with signs of mishandling prior to installation.

3.3 INSTALLATION

A. Provide and connect luminaires as indicated and scheduled on the Drawings.

B. Comply with NECA 1.

C. General Requirements:

1. Install luminaires level, plumb and square with ceiling and walls with bottom edge above finished floor as indicated on the Drawings unless field directed otherwise.
2. Install decorative luminaires, reflector cones, baffles, aperture plates, lenses, trims and decorative elements of recessed luminaires after completion of ceiling tile, plastering, painting and general clean-up has been completed. Where luminaire location or construction does not permit sequential installation, provide protection for all visible surfaces from construction processes.
3. Do not scale electrical drawings for locations of luminaires. Refer to architectural reflected ceiling plans, elevation drawings and details for luminaire locations.
4. Where indicated on the Drawings, the exact location of luminaires shall be field verified with the Professional prior to rough-in and installation.
5. Mount luminaires so as to maintain full range of motion and full operation of moving parts, doors, etc.
6. Coordinate stem, rod, chain or aircraft cable hanger lengths with job conditions to achieve indicated or field directed mounting heights and locations.

D. Supports:

1. Sized and rated for supported luminaire's weight.
2. Able to maintain luminaires position after cleaning and routine maintenance.
3. Provide support of luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Comply with manufacturer's written instructions and luminaires UL listing.
2. Secure to outlet box.
3. Attached to ceiling structural members using appropriate brackets or attachments.
4. Trim ring or flange flush with finished surface.

E. Wall-Mounted Luminaire Support:

1. Comply with manufacturer's written instructions and luminaires UL listing.
2. Secure to outlet box.
3. Where fixture size or weight requires additional support, secure to structural members using appropriate attachments.

F. Suspended Luminaire Support:

1. Comply with manufacturer's written instructions and luminaires UL listing.
2. Manufacturer recommended stem, aircraft cable or threaded rod as scheduled.
3. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

4. Stem-Mounted, Single-Unit Luminaires: Luminaires in excess of 24 inches in length or diameter, suspend with twin stem hangers. Support with approved outlet box and accessories that hold stem vertically and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
5. Continuous Rows of Luminiares: Use tubing or stem for wiring at one point and stem for suspension for each unit length of luminaire chassis including on at each end. Align luminaires so that they are perfectly straight with respect to each other and building elements.
6. Do not use ceiling grid as support for suspended or pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaire Support:

1. Comply with manufacturer's written instructions and luminaires UL listing.
2. Secure to any required outlet box.
3. Secure luminaire to ceiling grid using manufacturer recommend components.
4. Provide additional ceiling grid support wires to structure at luminaire locations at a minimum of 2 locations, spaced near opposite corners of luminaire for luminaires with overall weight in excess of 50-pounds and for luminaires installed in existing ceilings whose weight support limits are not known.

H. Comply with Section 260519 "Low-Voltage Electrical Power Conductors" for wiring connections.

3.4 FIELD QUALITY CONTROL

A. Perform visual inspection of all luminaires to insure they are free from damage, properly mounted and secured.

B. Perform function test of proper operation of all lighting luminaires and their associated controls.

C. Test all emergency lighting units for proper operation. Verify emergency lighting illumination levels in associated spaces comply with applicable codes. Verify by testing and observation that emergency lighting units (ELU) perform as follows:

a. ELU charges the battery when the associated lighting branch circuit is energized. The charging indicating light is illuminated.
b. ELU automatically switches lighting source to battery operation upon loss of power on the associated lighting branch circuit.
c. ELU un-switched charging circuit is not disrupted when associated or adjacent luminaire general lighting is switched off by the connected lighting control devices.
d. When associated or adjacent luminaire is switched off by the connected lighting control devices and power is available on the associated lighting branch circuit, the ELU does not transfer the lighting source to battery operation.

3.5 ADJUSTING & CLEANING

A. Luminaires with adjustable aiming or adjustable mounting brackets shall be aimed, focused, etc. for proper illumination of intended surface, area, etc. as directed by the Professional.

1. When required for proper adjustment, Contractor shall provide necessary labor to adjust luminaires after dark.

B. Aim adjustable lamps on emergency lighting units for code-required illumination of egress paths, exits, stairways, exit discharges, rooms, areas, spaces, etc.

C. Clean luminaires and associated trims, lenses, etc. of handling marks, dust and dirt.

D. Replace damaged luminaires and components with new.

E. Adjust mounting and attachment of recessed luminaires so that there are no light leaks at the ceiling line from any visible part or joint from any possible viewing angle.

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 any 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.

I (We) acknowledge that this proposal will be found irregular and/or non-responsive unless a certified check, cashier's check, or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law) is submitted electronically with the proposal or is delivered to the Contract Administration Engineer prior to the bid opening time specified in the advertisement.

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.

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) shall submit electronically with our proposal or deliver prior to the bid opening time 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.

SECTION 905 -- PROPOSAL (CONTINUED)

I (We) hereby certify by digital signature and electronic submission via Bid Express of the Section 905 proposal below, that all certifications, disclosures and affidavits incorporated herein are deemed to be duly executed in the aggregate, fully enforceable and binding upon delivery of the bid proposal. I (We) further acknowledge that this certification shall not extend to the bid bond or alternate security which must be separately executed for the benefit of the Commission. This signature does not cure deficiencies in any required certifications, disclosures and/or affidavits. I (We) also acknowledge the right of the Commission to require full and final execution on any certification, disclosure or affidavit contained in the proposal at the Commission's election upon award. Failure to so execute at the Commission's request within the time allowed in the Standard Specifications for execution of all contract documents will result in forfeiture of the bid bond or alternate security.

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.

Building Improvements at the Clinton Maintenance Area Headquarters Office Building, HVAC Upgrades, known as State Project No. BWO-5222-25(003) / 502891301210 in Hinds County.

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
			Roadway Items		
0010	1510-A001		1	Lump Sum	Renovate HVAC Upgrade

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.

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) agree to complete each contract on or before its specified completion date.

* *

COMBINATION BID PROPOSAL

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 Combination A has been selected, your Combination Bid is complete.

(b) If Combination B has been selected, then complete the following page.

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

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 Combination C has been selected, then initial and complete ONE of the following.

_____ 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.

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 September 8, 2011.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

(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 September 8, 2011.

Contractor _____

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION

I,_____,
(Name of person signing bid)

individually, and in my capacity as_____ of
(Title of person signing bid)

_____
(Name of Firm, partnership, or Corporation)

do hereby certify under 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-5222-25(003)/ 502891301210**

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.

Do exceptions exist and are made a part thereof? Yes / No

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 is true and correct.

(1/2016 S)

SECTION 902

CONTRACT FOR _____
LOCATED IN THE COUNTY(IES) OF _____

STATE OF MISSISSIPPI
COUNTY OF HINDS

This Contract is entered into by and between the Mississippi Transportation Commission (the "Commission") and the undersigned contractor (the "Contractor"), as follows:

As consideration for this Contract, the Commission agrees to pay the Contractor the amount(s) set out in the Proposal attached hereto. Said payment will be made in the manner and at the time(s) specified in the Specifications and/or Special Provisions, if any. In exchange for said consideration, the Contractor hereby agrees to accept the prices stated in the Proposal as full compensation for the furnishing of all labor, materials and equipment, and the execution of the scope of work identified for this referenced Project as contemplated in this Contract, and as more fully outlined in the Contract Documents (the "Work"). The Contract Documents consist of the Advertisement, the Notice to Bidders, the Proposal, the Specifications, the Special Provisions, and the approved Plans, all of which are hereby made a part of this Contract and incorporated herein by reference.

The Contractor shall be responsible for all loss or damage arising out of, or in any way in connection with the Work, or from any unforeseen obstructions or difficulties that may be encountered in the prosecution of the Work, and for all risks of every description connected with the Work, with the exception of any items specifically excluded in the Contract Documents. The Contractor shall fully and faithfully complete the Work in a good and workmanlike manner, according to the Contract Documents and any Supplemental Agreements thereto.

The Contractor further agrees that the Work shall be done under the direct supervision of, and to the complete satisfaction of, the Executive Director of the Mississippi Department of Transportation, or his authorized representative(s), and, when federal funds are involved, subject to the inspection and approval of the Federal Highway Administration, or its agents, and/or the agents of any other state or federal agency whose funds are involved. Further, the Work shall be done in accordance with any applicable state and federal laws, and any such rules and regulations issued by the Commission and/or any relevant Federal Agency.

The Contractor agrees that all labor as outlined in the Contract Documents may be secured from a list furnished by the Manager of the Win Job Center nearest the project location, or any successor thereto.

It is agreed and understood that each and every provision of law and clause required by law to be inserted into this Contract shall be deemed to be inserted herein, and this Contract shall be read and enforced as though it were included herein. If through mere mistake or otherwise, any such provision is not inserted, then upon the application of either party hereto, the Contract shall be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of the Contract Documents, and fully understands the meaning of same, and hereby acknowledges that he will comply with all terms, covenants and agreements therein.

Witness our signatures, this the _____ day of _____, 20___.

_____
Contractor

By: _____
Title: _____

_____
Signed and sealed in the presence of: (name and address of witness)

_____
_____

MISSISSIPPI TRANSPORTATION COMMISSION

_____
Executive Director

_____
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ____ day of _____, _____, Minute Book No._____, Page No. _____.

SECTION 903
PERFORMANCE BOND

PERFORMANCE BOND FOR THE FOLLOWING CONTRACT:
Project No.: _____

For the construction of: _____

Contract date: _____ Contract amount: _____

FOR OWNER: MISSISSIPPI TRANSPORTATION COMMISSION, 401 N. WEST STREET, JACKSON, MISSISSIPPI 39201.

CONTRACTOR (full legal name, contact person, phone number and address):
_____
_____
_____
_____

SURETY (legal name, phone number, principal place of business and address ***for notice purposes***):
_____
_____
_____

Second Surety (if applicable):
_____
_____
_____

The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns, to the Owner for the performance of the Contract, which is incorporated herein by reference, and subject to the following terms:

1. If the Contractor fully and faithfully performs the Contract, the Surety and the Contractor shall have no obligation under this Bond.

2. The Surety's obligation under this Bond shall arise after:
   (a) the Owner first provides notice to the Contractor and the Surety that termination is imminent, pursuant to the current edition of the Mississippi Standard Specifications for Road and Bridge Construction, which is a part of the Contract; and
   (b) the Owner declares a Contractor Default, terminates the Contract, and notifies the Surety.

3. The Surety shall promptly and at the Surety's expense, take one of the following actions:
   (a) Arrange for the Contractor, with the consent of the Owner, to perform and complete the Contract; or
   (b) Undertake to perform and complete the Contract itself, through its agents or independent contractors.

4. If the Surety does not proceed as provided in Paragraph 3, within 20 calendar days as set forth in Section 108.08 of the current edition of the Mississippi Standard Specifications for Road and Bridge Construction, then the Surety shall be deemed to be in default on this Bond, and the Owner shall be entitled to enforce any remedy available to it under the Contract and applicable law.

5. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

(a) the responsibilities of the Contractor for correction of defective work and completion of the Contract;
(b) additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 3; and
(c) liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.

6. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.

7. The penal sum of the Bond shall be subject to increase or decrease based on any subsequent Supplemental Agreements and/or final contract quantities.

8. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address listed for notice purposes on the first page of this Bond.

CONTRACTOR AS PRINCIPAL
Company: _____

Signature: _____
Name: _____
Title: _____
Address: _____
_____

SURETY
Company: _____

Signature: _____ MS Insurance ID # _____
Name: _____
Title: _____
Address: _____
_____

SURETY (if applicable)
Company: _____

Signature: _____ MS Insurance ID # _____
Name: _____
Title: _____
Address: _____
_____

SECTION 903
PAYMENT BOND

PAYMENT BOND FOR THE FOLLOWING CONTRACT:
Project No.: _____

For the construction of: _____

Contract date: _____ Contract amount: _____

FOR OWNER: MISSISSIPPI TRANSPORTATION COMMISSION, 401 N. WEST STREET, JACKSON, MISSISSIPPI 39201.

CONTRACTOR (full legal name, contact person, phone number and address):
_____
_____
_____

SURETY (legal name, phone number, principal place of business and address ***for notice purposes***):
_____
_____
_____

Second Surety (if applicable):
_____
_____
_____

The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns, to the Owner for payment of labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference, subject to the following terms:

1. If the Contractor promptly makes payment of all sums due to any and all subcontractors, suppliers and/or laborers, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Contract, then the Surety and the Contractor shall have no obligation under this Bond.

2. The Owner shall provide notice to the Surety of any claims, demands, liens or suits against the Owner or the Owner's property that it receives from any person or entity ("Claimants") seeking payment for labor, materials or equipment furnished for use in the performance of the Contract.

3. Upon notice of any claims, demands, liens or suits provided by the Owner or Contractor or given to the Surety by a Claimant, the Surety shall promptly and at the Surety's expense, defend, indemnify and hold harmless the Owner against said claim, demand, lien or suit and shall take the following additional actions:
   (a) Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
   (b) Pay or arrange for payment of any undisputed amounts.

4. The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have no obligation under this Bond to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

5. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders and other obligations.

6. The penal sum of the Bond shall be subject to increase or decrease based on any subsequent Supplemental Agreements and/or final contract quantities.

CONTRACTOR AS PRINCIPAL
Company: _____

Signature: _____
Name: _____
Title: _____
Address: _____
_____

SURETY
Company: _____

Signature:_____ MS Insurance ID # _____
Name: _____
Title: _____
Address: _____
_____

SURETY (if applicable)
Company: _____

Signature:_____ MS Insurance ID # _____
Name: _____
Title: _____
Address: _____
_____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we_____
Contractor

_____
Address

_____
City, State ZIP

As principal, hereinafter called the Principal, and _____
Surety

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 **Building Improvements at the Clinton Maintenance Area Headquarters Office Building, HVAC Upgrades, known as State Project No. BWO-5222-25(003) / 502891301210 in Hinds County.**

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 _____, 20___

_____
(Principal) (Seal)

_____ By:_____
(Witness) (Name) (Title)

_____
(Surety) (Seal)

_____ By:_____
(Witness) (Attorney-in-Fact)

_____
(MS Agent)

_____
Mississippi Insurance ID Number