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Keyed _____

09 -

SM No. CBWO7145430011

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

09
Construction of Brookhaven Project Office Building, Equipment Shed & Site Improvements, known as State Project Nos. BWO-7145-43(001), BWO-7146-43 (001), & LWO-7067-43(002) / 503007301, 302, & 303 in Lincoln County.

Project Completion: 07/17/2020

(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

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
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PROJECT: BWO-7145-43(001)/503007301 - Lincoln
BWO-7146-43(001)/503007302 - Lincoln
LWO-7067-43(002)/503007303 - Lincoln

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

10/30/2018 01:23 PM

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 901 - ADVERTISEMENT

Electronic bids will be received by the Mississippi Transportation Commission at 10:00 o'clock A.M., Tuesday, November 27, 2018, from the Bid Express Service and shortly thereafter publicly read on the Sixth Floor for:

Construction of Brookhaven Project Office Building, Equipment Shed & Site Improvements, known as State Project Nos. BWO-7145-43(001), BWO-7146-43(001), & LWO-7067-43(002) / 503007301, 302, & 303 in Lincoln County.

The attention of bidders is directed to the predetermined minimum wage rate set by the U. S. Department of Labor under the Fair Labor Standards Act.

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

Plans and specifications are on file in the offices of the Mississippi Department of Transportation.

Contractors may request permission to bid online at http://shopmdot.ms.gov at no cost. Upon approval, Contractors shall be eligible to submit a bid using Bid Express at http://bidx.com. Specimen proposals may be viewed and downloaded online at no cost at http://mdot.ms.gov or purchased online at http://shopmdot.ms.gov at a cost of Ten Dollars ($10.00) per proposal plus a small convenience fee. Cash or checks will not be accepted as payment.

Plans must be purchased online at <https://shopmdot.ms.gov>. Costs of plans will be on a per sheet basis plus a small convenience fee. If you have any questions, you can contact the MDOT Plans Print Shop at (601) 359-7460, or e-mail at plans@mdot.state.ms.us. Plans will be shipped upon receipt of payment. Cash or checks will not be accepted as payment.

Bid bond, signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent, with Power of Attorney attached, a Cashier's check or Certified Check for five (5%) percent of bid, payable to STATE OF MISSISSIPPI, must accompany each proposal.

The attention of bidders is directed to the provisions of Subsection 102.07 pertaining to irregular proposals and rejection of bids.

MELINDA L. MCGRATH
EXECUTIVE DIRECTOR

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1 **CODE: (IS)**

DATE: 03/01/2017

SUBJECT: Governing Specifications

The current (2017) Edition of the Standard Specifications for Road and Bridge Construction adopted by the Mississippi Transportation Commission is made a part hereof fully and completely as if it were attached hereto, except where superseded by special provisions, or amended by revisions of the Specifications contained within this proposal. Copies of the specification book may be purchased from the MDOT Construction Division, or online at shopmdot/default.aspx?StoreIndex=1.

A reference in any contract document to controlling requirements in another portion of the contract documents shall be understood to apply equally to any revision or amendment thereof included in the contract.

In the event the plans or proposal contain references to the 2004 Edition of the Standard Specifications for Road and Bridge Construction, it is to be understood that such references shall mean the comparable provisions of the 2017 Edition of the Standard Specifications.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 3 **CODE: (SP)**

DATE: 01/17/2017

SUBJECT: Final Clean-Up

Immediately prior to final inspection for release of maintenance, the Contractor shall pick up, load, transport and properly dispose of all litter from the entire highway right-of-way that is within the termini of the project.

Litter shall include, but not be limited to, solid wastes such a glass, paper products, tires, wood products, metal, synthetic materials and other miscellaneous debris.

Litter removal is considered incidental to other items of work and will not be measured for separate payment.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 5 **CODE: (SP)**

DATE: 03/16/2017

SUBJECT: Storm Water Discharge Associated with Construction Activity (≥ 1 and < 5 Acres)

Construction Storm Water General NPDES Permit MSR 15 to discharge storm water associated with construction activity is required. This project is granted permission to discharge treated storm water into State waters. Copies of said permit and Storm Water Pollution Prevention Plan (SWPPP) are on file with the Department.

Prior to the execution of the contract, the successful bidder shall execute and deliver to the Executive Director an original signed copy of the completed Prime Contractor Certification (Form No. 1).

Failure of the bidder to execute and file the completed Prime Contractor Certification (Form No. 1) shall be just cause for the cancellation of the award.

The executed Prime Contractor Certification (Form No. 1) shall be prima facie evidence that the bidder has examined the permit, is satisfied as to the terms and conditions contained therein, and that the bidder has the primary responsibility for meeting all permit terms and conditions including, but not limited to, the inspection and reporting requirements of Part IV. For this project, the Contractor shall furnish, set up and read, as needed, an on-site rain gauge.

The Contractor must furnish the Project Engineer a completed copy of the Small Construction Notice of Intent (SCNOI) along with the Contractor's Erosion Control Plan.

The Contractor shall make inspections in accordance with condition No. S-4, Page 19, and shall furnish the Project Engineer with the results of each weekly inspection as soon as possible following the date of inspection. The weekly inspections must be documented monthly on the Inspection and Certification Form, a copy of which is provided. The Contractor's representative and the Project Engineer shall jointly review and discuss the results of the inspections so that corrective action can be taken. The Project Engineer shall retain copies of the inspection reports.

The Engineer will have the authority to suspend all work and/or withhold payments for failure of the Contractor to carry out provisions of MDEQ's Storm Water Construction General Permit, the erosion control plan, updates to the erosion control plan, and /or proper maintenance of the BMPs.

Securing a permit (s) for storm water discharge associated with the Contractor's activity on any other regulated area the Contractor occupies, shall be the responsibility of the Contractor.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 9 **CODE: (IS)**

DATE: 03/01/2017

SUBJECT: Federal Bridge Formula

Bidders are hereby advised that the latest revision of Federal Highway Administration Publication No. FHWA-HOP-06-105, **BRIDGE FORMULA WEIGHTS**, dated August 2006, is made a part of this contract when applicable.

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

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

Federal Highway Administration
400 7th Street, SW
Washington, DC 20590
(202) 366-2212

or

http://www.ops.fhwa.dot.gov/Freight/publications/brdg_frm_wghts/bridge_formula_all_rev.pdf

An on line **BRIDGE FORMULA WEIGHTS CALCULATOR** is available at

http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 30 **CODE: (SP)**

DATE: 01/17/2017

SUBJECT: Additional Governing Specifications for BWO/LWO Projects

Bidders are advised that if the language of the AIA Document A201 in Special Provision 907-242 is in conflict with the provisions in Section 100 of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction, the language in the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction shall govern.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 113 **CODE: (SP)**

DATE: 04/18/2017

SUBJECT: Tack Coat

Bidders are advised that in addition to the products listed on the Department's APL as referenced in Subsection 401.03.1.2 on page 256, the Contractor may use one of the following as a tack coat.

- CSS-1
- CSS-1h
- SS-1
- SS-1h

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 445 **CODE: (SP)**

DATE: 10/10/2017

SUBJECT: Mississippi Agent or Qualified Nonresident Agent

Bidders are hereby advised of the requirements of Subsections 102.08, 103.05.2, and 107.14.2.1 of the *2017 Standard Specifications for Road and Bridge Construction* as it refers to bonding agents. Proposal guaranties, bonds, and liability insurance policies must be signed by a **Mississippi Agent or Qualified Nonresident Agent.**

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 516 **CODE: (IS)**

DATE: 11/28/2017

SUBJECT: Errata and Modifications to the 2017 Standard Specifications

Page	Subsection	Change
16	102.06	In the seventh full paragraph, change "Engineer" to "Director."
33	105.05.1	In the sixth sentence, change "Contract Administration Engineer" to "Contract Administration Director."
34	105.05.2.1	In subparagraph 2, change "SWPPP, ECP" to "SWPPP and the ECP"
35	105.05.2.2	In subparagraphs 2, add " and" to the end of the sentence. In subparagraph 3, remove ", and" and add ".".
90	109.04.2	In the last paragraph of subparagraph (a), place a period "." at the end of the sentence.
93	109.04.2	In the last paragraph of subparagraph (g), place a period "." at the end of the sentence. Also, in the first paragraph of subparagraph (h), place a period "." at the end of the sentence.
97	109.07	Under ADJUSTMENT CODE, subparagraph (A1), change "HMA mixture" to "Asphalt mixtures."
98	109.11	In the third sentence, change "Engineer" to "Director."
219	308.04	In the last sentence of the last paragraph, change "Contractor's decision" to "Engineer's decision."
300	405.02.5.9	In the first sentence of the second paragraph, change "Hot Mix Asphalt" to "Asphalt Mixtures."
502	630.01.1	In the first paragraph, change "AASHTO" to "AASHTO's LRFD".
636	646.05	Change "each" to "per each" for the pay item units of payment.
640	656.02.6.2	In item 7), change "down stream" to "downstream".
688	630.03.2	Change the subsection number from "630.03.2" to "680.03.2."

725	702.08.3	In the second sentence of the first paragraph, change "hot-mix" to "asphalt."
954	804.02.13.1.6	In the definition for "M" in the % Reduction formulas, change "paragraph 7.3" to "paragraph 5.3."

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 757 **CODE: (IS)**

DATE: 03/20/2018

SUBJECT: Additional Erosion Control Requirements

Bidders are hereby advised of the following requirements that relate to erosion control activities on the project.

THE MAXIMUM TOTAL ACREAGE THAT CAN BE DISTURBED, AT ONE TIME, ON THE PROJECT IS NINETEEN (19) ACRES. THE CONTRACTOR SHALL BE REQUIRED TO STABILIZE DISTURBED AREAS PRIOR TO OPENING UP ADDITIONAL SECTIONS OF THE PROJECT. STABILIZED SHALL BE WHEN THE DISTURBED AREA MEETS ONE OF THE FOLLOWING CRITERIA:

- **THE AREA HAS BEEN SEEDED, EITHER TEMPORARY OR PERMANENT, AND MULCHED ACCORDING TO THE SPECIFICATIONS,OR**
- **A CRUSHED STONE COURSE OR A LIFT OF ASPHALT PAVEMENT HAS BEEN PLACED, OR**
- **THE AREA HAS BEEN CHEMICALLY TREATED USING PORTLAND CEMENT OR LIME-FLY ASH, AND SEALED.**

DISTURBED AREAS INCLUDE THE ROADBED, SLOPES AND REMAINING AREA OUT TO THE ROW LINE.

Clearing and Grubbing: Prior to beginning any clearing and grubbing operations on the project, controls shall be in place to address areas such as drainage structures, wetlands, streams, steep slopes and any other sensitive areas in accordance with the approved Erosion Control Plan or as directed by the Engineer. Clearing and grubbing should be limited to the minimum area necessary to construct the project. Grubbing operations should be minimized in areas outside the construction limits and stumps should be cut off flush with the existing ground elevations. A buffer area of at least fifteen (15) feet or as shown in the Plans shall be in place adjacent to the right-of-way line. The buffer area can either be the existing vegetation that is left undisturbed or re-established by planting new vegetation if clearing and grubbing was required. As applicable, see the Riparian Buffer Erosion Control sheet(s) in the Plans for clearing and grubbing limits adjacent to stream banks.

Unclassified Excavation: Cut sections shall be graded in accordance with the typical sections and plan grades. Permanent erosion control BMP's should be placed as soon as possible after the cut material has been moved. Fill sections that are completed shall have permanent erosion control BMP's placed. Fill sections that are not completed shall be either permanently or temporarily seeded until additional material is made available to complete these sections. All unclassified excavation on the project is be required to be moved prior to incorporating any borrow excavation. The Contractor may have to stockpile unclassified excavation in order to comply with the nineteen (19) acre requirement. No additional compensation will be made for stockpiling operations.

Disturbed areas that remain inactive for a period of more than fourteen (14) days shall be temporary grassed and mulched. Temporary grassing and mulching shall only be paid one time for a given area.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1192 **CODE: (SP)**

DATE: **10/03/2018**

SUBJECT: **Contract Time**

PROJECT: **BWO-1745-43(001) / 503007301, BWO-7146-43(001) / 503007302 & LWO-7067-43(002) / 503007303 – Lincoln County**

The calendar date for completion of work to be performed by the Contractor for this project shall be **July 17, 2020** which date or extended date as provided in Subsection 108.06 shall be the end of contract time. It is anticipated that the Notice of Award will be issued no later than **December 11, 2018** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **March 14, 2019**.

Should the Contractor request a Notice to Proceed earlier than **March 14, 2019** and it is agreeable with the Department for an early Notice to Proceed, the requested date will become the new Notice to Proceed date.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1206 **CODE: (SP)**

DATE: 10/16/2018

SUBJECT: MASH Compliant Devices

Bidders are hereby advised that the Standard Specifications may require certain traffic control and permanent safety hardware devices to meet the requirements of the Manual for Assessing Safety Hardware (MASH). However, devices meeting the requirements of NCHRP Report 350 will be allowed until the mandatory effective date for MASH compliance. The following table shows the effective dates for MASH compliant devices.

Device	Effective Date for MASH Compliance
W-beam barriers, cast-in-place concrete barriers	December 31, 2017
W-beam terminals - non-flared	June 30, 2018
Crash cushions	December 31, 2018
Cable barriers, cable barrier terminals, bridge rails, transitions, all other longitudinal barriers including portable barriers installed permanently, W-beam terminals - flared, all other terminals, sign supports, all other breakaway hardware	December 31, 2019

Temporary work zone devices, including portable barriers manufactured after December 31, 2019, must have been successfully tested to the 2016 Edition of MASH. Such devices manufactured on or before this date and successfully tested to NCHRP Report 350 or the 2009 Edition of MASH may continue to be used throughout their normal service lives.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-102-2 **CODE: (IS)**

DATE: 11/22/2017

SUBJECT: Bidding Requirements and Conditions

Section 102, Bidding Requirements and Conditions, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-102.01--Prequalification of Bidders. Delete the last sentence of the third paragraph of Subsection 102.01 on page 13, and substitute the following.

The Bidder's Certificate of Responsibility number must be on file with the Department's Contract Administration Division prior to request for permission to bid.

907-102.02--Contents of Proposal Forms. Delete the fourth paragraph in Subsection 102.02 on page 13, and substitute the following.

Prospective bidders must complete an online request for permission to be eligible to bid a project. Upon approval, the bidder will be authorized to submit a bid electronically using Bid Express at http://bidx.com.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-103-2 **CODE: (SP)**

DATE: 06/22/2017

SUBJECT: Award and Execution of Contract

Section 103, Award and Execution of Contract, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-103.01--Consideration of Proposal. Delete the second and third paragraphs of Subsection 103.01 on page 19, and substitute the following.

907-103.01.1--For Projects Constructed Without Federal Funds. Resident Contractors actually domiciled in Mississippi are to be granted preference over nonresidents in awarding of Contracts financed 100% with State funds.

In consideration of proposals that are equal to or in excess of $50,000 and financed 100% with State funds, a nonresident bidder domiciled in a state having laws granting preference to local Contractors will be considered for such contracts on the same basis as the nonresident bidder's state awards contracts to Mississippi Contractors bidding under similar circumstances. When a nonresident Contractor submits a bid equal to or in excess of $50,000 on a contract financed 100% with State funds, a copy of the current laws from the state of domicile and an explanation thereof pertaining to treatment of nonresident Contractors shall be attached. If no preferential treatment is provided for Contractors in the state of domicile and contracts are awarded to the lowest responsible bidder, a statement to this effect shall be attached. Should the attachment not accompany the bid when submitted, the Contractor shall have 10 days following the opening of the bids to furnish the required information to the Contract Administration Director for attachment to the bid. Failure to provide the attachment within 10 days will result in the nonresident Contractor’s bid being rejected and not considered for award. As used herein, the term "resident Contractor" includes a nonresident person, firm or corporation that has been qualified to do business in this State and has maintained a permanent full-time office in the State of Mississippi for two years prior to the submission of the bid, and the subsidiaries and affiliates of such a person, firm or corporation.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-107-2 **CODE: (SP)**

DATE: **01/31/2018**

SUBJECT: **Contractor's Erosion Control Plan**

Section 107, Legal Relations and Responsibility to Public, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-107.22--Environmental Protection.

907-107.22.1--Contractor's Erosion Control Plan (ECP). After the first sentence of the first paragraph of Subsection 107.22.1 on page 63, add the following.

The ECP shall be submitted electronically to the Project Engineer who will forward it to the appropriate MDOT Divisions.

Delete the example Narrative in Subsection 107.22.1 on page 65, and substitute the following.

EXAMPLE
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
Storm Water Pollution Prevention Plan (SWPPP)
Narrative

General Permit Coverage No: MSR_____
Project Number: _____
County: _____
Route: _____

SITE INFORMATION

This project consists of grading and installing drainage structures necessary to construct approximately 6 miles of parallel lanes on SR 31 between the Hinds County Line and the Rankin County Line.

SEDIMENT AND EROSION CONTROLS

a) Vegetative Controls: Clearing and grubbing areas will be minimized to comply with the buffer zones (minimum of 15 feet along the ROW lines and 5 feet along creeks) as per the contract documents. A combination of temporary and permanent grassing will be used to protect slopes as construction progresses. **Should a disturbed area be left undisturbed for 14 days or more, placement of temporary BMPs (seeding & mulching, silt fences, basins, ditch checks, slope drains, etc.) or permanent erosion control measures (seeding & mulching, riprap, paved ditch, flumes, etc.) will be initiated by the next working day after the land disturbing activities have stopped.**

b) Structural Controls: Gravel construction entrance/exit will be installed near Stations 145+50, 159+50, 164+50 & 172+50. Riprap ditch checks will be constructed at Stations 144+50, 151+75, 162+00 & 166+25. The Concrete washout area will be at Stations 140+25, 152+00 & 168+50.

c) Housekeeping Practices: Structural BMPs will be cleaned out when sediment reaches 1/3 to 1/2 of the height of the BMP. Maintenance and repair of equipment will be performed off-site, material wash out will occur either off-site or within designated wash out areas.

d) Post-Construction Control Measures: As construction is completed, permanent vegetative growth will be established on disturbed soils to improve soil stability and provide a buffer zone for loose material. Paved ditches and flumes will be placed as specified in the ECP to reduce erosion in concentrated flow areas and rip rap will be placed as specified to dissipate flow energy and reduce flow velocity.

IMPLEMENTATION SEQUENCE

Perimeter controls will be installed first. Clearing and grubbing will be performed in 19-acre sections beginning at the BOP and temporary grassing will be installed as needed. Temporary erosion control BMPs will be installed at the drainage structures prior/during construction of the drainage structures. Grading activities will commence at the BOP and proceed towards the EOP, fill slopes will be permanently grassed in stages for fill heights that exceed 5 feet. Base materials will be installed on completed grading sections with the paving to follow.

MAINTENANCE PLAN

All erosion and sediment control practices will be checked for stability and operation following every rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed. Sediment basins will be cleaned out when the level of sediment reaches 2.0 feet below the top of the riser. Sediment will be removed from the front/upstream end of the BMPs when it becomes about 1/3 to 1/2 height of BMP.

_____ _____
Prime Contractor's Signature Date

_____ _____
Printed Name Title

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-242-7 **CODE: (SP)**

DATE: 10/04/2018

SUBJECT: Project Office and Open Equipment Shed

PROJECT: BWO-7145-43(001). BWO-7146-43(001), & LWO-7067-43(002) / 503007301, 302, & 303 -- Lincoln County

Section 907-242, Project Office and Open Equipment Shed, is hereby added to and made part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-242--PROJECT OFFICE AND OPEN EQUIPMENT SHED

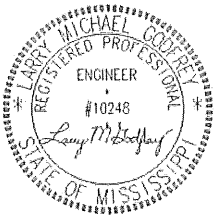
The specification format for this item of work is different than normal. The Contractor shall perform the construction of the Brookhaven Project Office Building, Open Equipment Shed, and Site Work in accordance with the requirements set forth as follows. All other items of work shall be performed in accordance with the 2017 Mississippi Standard Specification.

DOCUMENT 00 01 07 SEAL PAGE

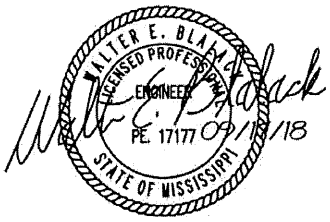
Architectural
Joseph R. Perkins, Architect
MDOT-ASU
201 N. West Street
Jackson, MS 39201 (601) 359-7292

Civil Engineer
Thomas Bradley Engels
Stantec Consulting
200 North Congress Street, Suite 600
Jackson, MS 39201

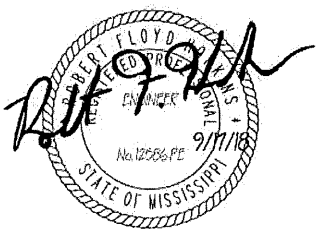
Structural Engineer
Larry Michael Godfrey
P.O. Box 889
Florence, MS 39073



Plumbing / Mechanical
Walter E. Blalack
SSR, Inc.
2650 Thousand Oaks Blvd.
Memphis, TN 38118



Electrical Engineer
Robert F. Hopkins
SSR, Inc.
2650 Thousand Oaks Blvd.
Memphis, TN 38118



DOCUMENT 00 01 10 TABLE OF CONTENTS

PROJECT: BROOKHAVEN PROJECT OFFICE & OPEN EQUIPMENT SHED IN BROOKHAVEN, LINCOLN COUNTY, MISSISSIPPI

PROJECT NUMBER: BWO-7145-43(001) 503007
BWO-7146-43(001) 503007
LWO-7067-43(002) 503007

DATE: 09-17-18

DESCRIPTION A: This Work shall consist of minor site work and all construction work necessary in constructing a Project Office Building for District Seven in Brookhaven, Lincoln County, Mississippi, Project No. BWO-7145-43(001) 503007, in accordance with these Specifications and conforming to the Drawings.

DESCRIPTION B: This Work shall consist of minor site work and all construction work necessary in constructing an Open Equipment Shed for the Project Office for District Seven in Brookhaven, Lincoln County, Mississippi, Project No. BWO-7146-43(001) 503007 in accordance with these Specifications and conforming to the Drawings.

The Site Improvements portion of this Work shall consist of site work outside and adjacent to the Work described for construction of the buildings for District Seven in Brookhaven, Lincoln County, Mississippi, Project No. LWO-7067-43(002) 503007. See Civil Drawings and Special Provisions for extent of this portion of the Work.

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	TITLE SHEET
T-102	2	INDEX OF DRAWINGS
T-103	3	CODE INFORMATION AND LEGENDS
SQ-1	4	SUMMARY OF QUANTITIES
SQ-2	5	SUMMARY OF QUANTITIES
CIVIL		
C-1	6	EXISTING CONDITIONS PLAN
C-2	7	REMOVAL PLAN
C-3	8	SITE PLAN
C-4	9	SITE LAYOUT PLAN
C-5	10	PAVING PLAN
C-6	11	GRADING AND DRAINAGE PLAN
C-7	12	EROSION CONTROL PLAN
C-8	13	PAVEMENT MARKINGS AND PERMANENT SIGNS
C-9	14	FENCING DETAILS
C-10	15	FENCING PER PLANS, TEMPORARY
C-11	16	CANTILEVER GATE DETAIL
C-12	17	CONSTRUCTION PHASING – PHASE 1
C-13	18	CONSTRUCTION PHASING – PHASE 2
C-14	19	MISCELLANEOUS DETAILS
VS-1	20	VEGEATION SCHEDULE
L-1	21	LANDSCAPE PLAN
OT-1	22	OFFICE TRAILER PLAN
STRUCTURAL		
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S1.1	24	FOUNDATION PLAN
S1.2	25	ROOF FRAMING PLAN
S1.3	26	WALL FRAMING ELEVATIONS
S2.1	27	BUILDING SECTIONS
S3.1	28	FOUNDATION DETAILS
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A101-A	29	FLOOR PLAN
A102-A	30	REFLECTED CEILING PLAN
A103-A	31	INTERIOR FINISH SCHEDULE
A104-A	32	FINISH FLOOR PLAN
A201-A	33	BUILDING ELEVATIONS
A202-A	34	BUILDING ELEVATIONS
A301-A	35	BUILDING SECTIONS
A302-A	36	WALL SECTIONS AND DETAILS

A401-A	37	INTERIOR ELEVATIONS
A402-A	38	INTERIOR ELEVATIONS
A403-A	39	INTERIOR ELEVATIONS
A404-A	40	MILLWORK DETAILS
A501-A	41	MISC. DETAILS AND PARTITION TYPES
A502-A	42	PLANTER AND RAMP DETAILS
A601-A	43	OPENING SCHEDULES
A602-A	44	OPENING DETAILS
A901-A	45	EXTERIOR VIEWS
A101-B	46	EQUIPMENT SHED SECTION AND PLAN
A201-B	47	EQUIPMENT SHED ELEVATION AND DETAILS

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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 TIME OF COMPLETION

A. The Bidder shall agree to commence work on a date specified in a written *NOTICE TO PROCEED* and fully complete the Project within the Contract Time indicated on the Proposal.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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.

1.17 MODIFICATION TO BID

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

1. Notification on Envelope: A modification may NOT be written on the outside of the sealed envelope containing the bid.
2. Facsimile: A facsimile (fax) will NOT be acceptable.

1.18 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.

1.19 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 newc 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.

1.20 PROTEST

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

1.21 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.

1.22 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. .

1.23 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.

1.24 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.

1.25 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 in duplicate.
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 under $50,000 and the statement "bid does not exceed $50,000" is on the outside of the sealed envelope.
( ) 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 there is a separate HVAC/Plumbing Sub-Contractor, so notate as mentioned herein.
* If Mechanical, Plumbing, and/or Electrical Subcontractor is performed by the General Contractor, be sure the General has COR for said discipline.
* If there is no Mechanical, Plumbing, and/or Electrical Sub-Contractor listed, then use of Sub-Contractor to perform such scope will not be permitted.

E. Subcontractors' COR Number

1. Certificate of Responsibility
( ) List certificate of responsibility Number for all listed Sub-Contractors over $50,000.
* If under $50,000 – so notate on the COR line "under $50,000" (or can still show COR Number)

1.26 BIDDER'S CONTACT LIST

A. Proposal and Contract Documents: If the Bidder has any questions pertaining to the following specific areas of the Documents, please direct them to the following individuals:

1.	Additional Proposals:	Kerry Harris – Contract Administration	(601) 359-7700
2.	Bid Forms:	Neal Dougherty – Contract Admin. Director	(601) 359-7730
3.	Specifications:	Shane Martin – Assist. Construction Engr.	(601) 359-7301
4.	Drawings:	Shane Martin – Assist. Construction Engr.	(601) 359-7301

5. Bidder's List & Specimen Proposals are available online at:
http://www.gomdot.com/Applications/BidSystem/Home.aspx

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 2014 Edition Section 102 – Bidding Requirements and Conditions, Subsection 907-102.06 – Preparation of Proposal (as amended).

1.06 CONTRACT TIME

A. Refer to Section 904 – Notice to Bidders (Contract Time) for completion of Contract. Construction Schedule: Refer to Mississippi Standard Specifications for Road and Bridge Construction 2017 Edition Section 108 – Prosecution and Progress (as amended).

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

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. Masonry Items
   b. Cellulose Thermal Insulation
   c. Metal Building System
   d. Thin-Set Tiling
   e. Plumbing Items
   f. Heating, Ventilating and Air Conditioning Items
   g. Security and Surveillance Items
   h. 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 31 32 GEOTECHNICAL DATA

1.01 GEOTECHNICAL DATA

A. This Document with its referenced attachments, Brookhaven Project Office Geotechnical Report 18-43-08, 503007/101000 PE, dated August 14, 2018 (31 pages) is part of the Procurement and Contracting Requirements for the Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents. Geotechnical Data may also be referred to in the Contract Documents as the “Geotechnical Report” or “Soils Engineering Report”.

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

C. In the event of a conflict between the Geotechnical Data and the Construction Documents, notify the Project Engineer in writing of conflict to determine course of action prior to proceeding.

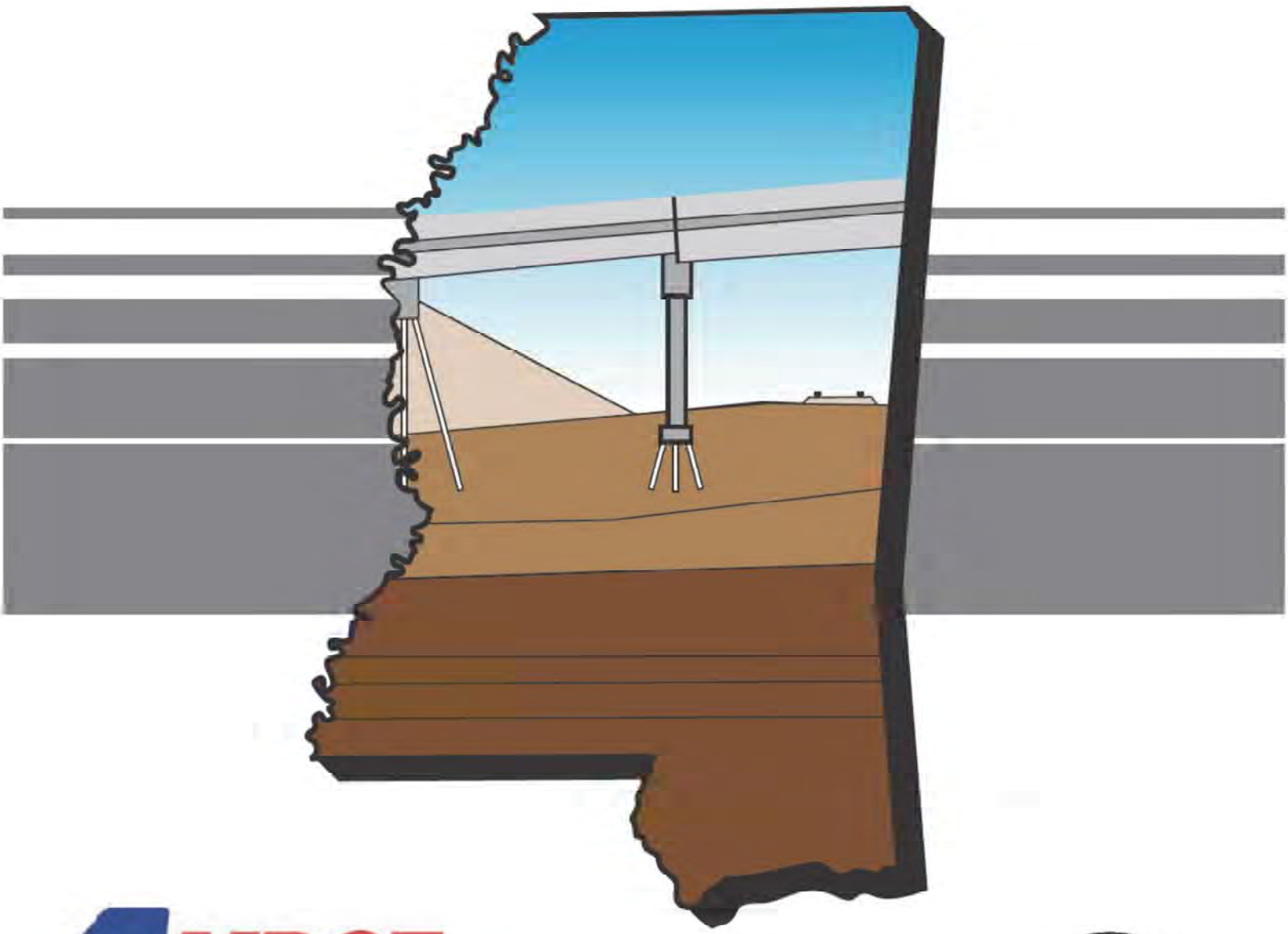
END OF DOCUMENT

GEOTECHNICAL INVESTIGATION

Federal Aid No.: BWO-7145-43(001) **Report No.: 18-43-08**

FMS Construction: 503007/301000

County: LINCOLN



Mississippi Department of Transportation
Materials Division
Geotechnical Branch

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: Manager, Architectural Services (75-20)
Mr. Seth Winchester

DATE: August 14, 2018

FROM: Geotechnical Engineer
R. Sean Ferguson

SUBJECT OR PROJECT NO: Brookhaven Project Office
Report 18-43-08
503007/101000 PE

COUNTY: LINCOLN

INFORMATION COPY TO:
Central File (via Owen)
District Engineer 7th District
District 7 (Wilkinson)
Construction Engineer
Materials Engineer
Project File
Lab File

This is the submission of the geotechnical investigation performed by this office on the soil and foundation conditions at the site of proposed building and pavements to be constructed at the Brookhaven Project Office in Lincoln County.

Please distribute to the design architects at your convenience.

If any additional information is needed or if any questions arise which require further review of site conditions or design assumptions either during the design or construction phase of the project or which require clarification please advise.

RSF

GENERAL

Eleven rotary wash soil borings were completed between February 28 and March 7, 2018 at the Brookhaven Project Office. Construction of the new project office building is planned at the location of the existing building. The soil borings ranged from 16 to 32 feet in depth and were completed as part of the geotechnical investigation to provide a general understanding of the subsurface conditions at the site and to provide guideline site preparation, foundation and pavement recommendations for the proposed building and parking lot.

The new building will consist of a single-story building with a footprint of approximately 9,700 square feet with continuous wall footings and limited isolated spread footings. Maximum anticipated column loads are about 28 kips with maximum wall loads of about 1.2 kips per foot. New asphalt-paved parking areas are planned along the north, south, and east sides of the proposed building.

SOIL AND GROUNDWATER CONDITIONS

Soil Borings

Borings B-5, B-6, B-9, and B-11 were generally located within the footprint of the new building, and borings B-1, B-2, B-3, B-4, B-7, B-8, and B-10 were drilled for the asphalt parking areas planned around the building.

The locations of the borings are shown on Figure 1. Soil boring logs which include a summary of the field and laboratory data are presented as Figures 2 through 12. Grain size distribution curves are included as Figures 13-23.

The upper ten feet of soils encountered within the building footprint generally consisted of medium dense to dense, slightly clayey, silty very fine to fine sands and firm clays and clayey silts. Very loose sands were encountered between elevations EL 426 and EL 419 in boring B-6.

Groundwater

Free water was not determined during drilling, although soil samples were observed to be moist between depths of 5 to 10 feet below existing ground surface.

Proper note should be taken that groundwater levels will vary: seasonally; with variations in local rainfall; with changes in the water levels of nearby streams, rivers, or lakes; and depending on the local ground surface topography or the presence of nearby leaking utilities.

Near-surface groundwater often causes problems where excavations are required. It is recommended that groundwater conditions be determined by the Contractor by excavated test pits at the time of construction to allow for development of mitigation plans prior to the initiation of actual excavations.

GEOTECHNICAL CONSIDERATIONS

The proposed building is relatively lightly loaded and will be founded on slabs-on-grade with continuous footings. Maximum spread footing loads are 28 kips per column and maximum wall loads are about 1.2 kips per linear foot based on dead plus live load. Existing topography of the site is such that minimal cuts are required and fills between 1 foot to about 4 feet will be required to achieve finished floor elevations. In order to construct the paved parking area east of the building, fills up to 16 or 17 feet will be required.

The following sections present guideline recommendations related to earthwork, foundation design and permanent surfacing for the project. It should be noted that these recommendations are based upon the information that was available to us at the time this report was prepared. If

during the review of this report, the design process, or during construction, questions arise that require clarification of items in this report we are glad to assist as needed.

GUIDELINE ENGINEERING RECOMMENDATIONS

EARTHWORK AND SITE PREPARATION

Surface Drainage

During construction, surface drainage should be improved to divert surface runoff away from the building area. The construction of temporary ditches, berms, or the use of swales or other surface water diversion devices should be considered in order to divert water away from and not across the site during construction. Upon completion of construction, the site should be graded to rapidly remove surface water away from the new building.

Stripping

Within the proposed building and paved parking lots we anticipate that stripping to a depth of at least one foot will be required to remove unsuitable soils and potential debris. Stripping should be carried to a depth where all organic containing soils have been removed. Soils containing these objectionable materials should not be used for backfill. Any topsoil encountered within construction limits should be stripped and could be stockpiled for landscaping purposes.

Proof Rolling

Depending on the time of year the earthwork construction is started, the subgrade soils could be unstable and may not support the proof-roll equipment. If the earthwork construction is to be performed in the wetter, winter months, or after long periods of rainfall, the proof-rolling recommended in this section should not be performed. We anticipate that during these periods the subgrade will be wet and unstable and may not support construction traffic.

In the dryer periods of the year proof-rolling is recommended to uncover any unstable areas that may be present within the building areas. After achieving finished subgrade elevation in cut areas and prior to placing fill in any areas that are currently below finished subgrade elevation, the exposed subgrade should be evaluated to confirm that all loose, yielding and unsuitable materials have been removed. During this evaluation, those areas which are at finished subgrade elevation or are to receive new fill should be proof rolled. The proof rolling should be performed with a loaded tandem-axle dump truck or similar pneumatic-tired equipment with a weight between 20 and 30 tons. Proof rolling will help reveal the presence of unstable materials that were not identified during our drilling program. We anticipate that loose unstable soils may be encountered.

Any areas, which yield or pump under the proof roll equipment should be properly mitigated. Mitigation might include processing to remove excess moisture, undercut and backfilling, stabilization with Portland cement, or stabilization with a biaxial Type II (or triaxial) structural geogrid placed in conjunction with granular compacted backfill. Should mitigation of wet and pumping soils be required, we request to be notified so that appropriate mitigation measures can be discussed.

Select Fill Materials, Placement and Compaction

Fill used to bring the site to grade should be either low plasticity Silty Clay (CL) or Clayey Silt (ML) fine-grained soils meeting the requirements for Class B9-10 borrow material (plasticity index, PI, between 10 and 25). The plasticity of the fill material will be verified by testing during fill placement. This material should meet all requirements of Section 703.21 of the Standard Specifications for borrow material. The near-surface on-site soils appear to be generally suitable for use as structural fill provided they are placed at the proper moisture content and meet

minimum density requirements. However, due to the quantities of fill material required it is expected that the majority of fill will be imported from off-site.

All materials excavated from the building area which are unsuitable for use as select fill material should be removed and disposed of off- site. Prior to placing fill, the native clayey silt subgrade soils should be lightly scarified and compacted to at least 98% of the standard Proctor maximum dry density at a moisture content between -2% of optimum to +3% of optimum within the upper 8 inches.

After subgrade preparation and observation have been completed, fill placement may begin. The fill should be placed and graded to provide a uniform thickness not exceeding 8-inch loose lifts per Section 203 of the Standard Specifications. The surface of each preceding, compacted lift should be scarified to ensure adequate bonding between lifts. Field density tests should be completed in each lift of the fill material to provide assurance that adequate and uniform densities are being obtained. At least one field density test should be performed by the Department or Department's representative for every 800 square feet of lift surface area (minimum one density test per lift regardless of lift surface area). During compaction, the moisture content of the soil should be maintained within plus 3% or minus 2% of the optimum moisture content as determined by the Standard Effort laboratory compaction test (AASHTO T 99). Each lift should be compacted to achieve a minimum of 98% of the Standard Effort maximum dry density with stability present. Stability is defined as the absence of pumping or rutting under the load of heavy construction equipment or a loaded dump truck.

Continuous Footings

Continuous footings supported on compacted fill may be designed for a maximum allowable bearing pressure of 2,900 pounds per square foot based on dead load plus design live load considerations. For lateral resistance against sliding, a friction coefficient of 0.40 may be used at the soil-foundation interface.

All interior footings should have a minimum width of 12 inches, and should bear entirely in compacted select fill material. Perimeter footings should have a minimum width of at least 14 inches and should bear at least 24 inches below adjacent surface grades. Footings should be formed by placing compacted select fill material to underslab grade elevation and then trenching the beams with a power trencher or similar equipment. This method adds support to the slab and helps it resist deflections by effectively reducing the potential expansion of the underlying soils. If soft or loose soils are encountered at the design bearing level, they should be undercut to stiff or dense soils and the excavation back-filled with concrete.

Foundation Construction

Footing excavations should be observed and approved with concrete placed as quickly as possible after to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond.

The foundation concrete should be placed during the same day the excavation is made. Slabs-on-grade should be stiffened utilizing interior continuous footings spaced not more than 30 feet on center in each direction. These interior footings should extend at least 18 inches below the bottom of the slab, and together with perimeter footings should be reinforced for both positive and negative bending. As mentioned previously, floor slabs should be steel-reinforced and can be designed based on a modulus of subgrade reaction (k_s) of 210 pci when bearing on properly compacted select fill material.

Uniform compaction of fill materials is critical to reduce total and differential settlement. If the site is prepared as recommended, total movements of the slab should not exceed 1 inch. It is recommended that a 15 mil polyolefin membrane be installed prior to placing slab concrete to

act as a vapor retarder. This material should be placed to provide continuous protection under the entire slab.

Isolated Spread Footings

Spread footings, if necessary to carry isolated column loads, should be properly dimensioned using a net allowable bearing capacity of 3,200 pounds per square foot for compacted fill materials and should bear at the depth required to adequately satisfy the design compression and uplift loading conditions. The uplift capacity of an individual spread footing should be taken as equal to the weight of the concrete in the footing and pedestal plus the weight of the backfill soils lying directly over the footing.

The weight of the concrete should be taken as 150 pounds per cubic foot and the weight of the backfill soils should be taken as 115 pounds per cubic foot provided that the soils are adequately compacted as per the Specifications.

When the weight of the backfill soils is added to the weight of the concrete footing and pedestal, and then divided by the uplift force, the resulting factor of safety against uplift for the footing should exceed 1.3. The final dimensions of the footing and footing reinforcement should satisfy both the requirements for the compressive and uplift capacities of the spread footing.

Differential Movements

Even when designed with adequate safety factors against bearing capacity failure, foundation and floor slab movements can occur. Settlements can result from immediate deflection upon load application and consolidation over extended periods of time in response to stress increase.

Both uplift and downward foundation movement can occur due to the swelling and shrinkage of plastic soils as the moisture content of the soils increase and decrease, respectively. With properly designed and constructed earthwork and foundations, the total movement of this structure could be on the order of about 1 inch with differential movements estimated to be about 1/2 inch.

PAVEMENTS

Driveway and Parking Areas

Driveway and parking areas will be constructed along the north, south, and east perimeter of the project office building. Concrete paving may be constructed to provide truck access to portions of the lot. Concrete paving should be used for the dumpster pad(s). Soil conditions at the location of these parking areas were investigated. Silty clays (CL) overlying dense to very dense sands were encountered in all of the borings completed within the portions of the lot accessible by vehicle.

The subgrade should be prepared according to the recommendations provided earlier in the report, and select fill material should be used to bring the area to subgrade elevation. However, prior to placement of pavement, the subgrades to be paved should be lime treated and compacted to at least 95% of maximum standard Proctor dry density. The top 6 inches of the pavement subgrade should be lime treated with 4 percent hydrated lime by dry weight of soil. The lime stabilized subgrade layer should be constructed according to Section 307 of the Standard Specifications. If the subgrade soils are prepared and select fill materials are placed according to Section 203 of the Standard Specifications, a design subgrade CBR value of 6 is appropriate for flexible pavement design.

Flexible Pavement Minimum Thickness

Based on the estimated traffic and subgrade conditions described above, flexible pavements in light-duty areas (automobile traffic only) should be constructed with a minimum of 3.5 inches of

asphaltic concrete (1.5-inch wearing course and 2-inch binder course) over 6 inches of compacted granular base course. Medium duty traffic areas supporting mixtures of automobiles and light trucks should be constructed with a minimum of 4.5 inches of asphaltic concrete (1.5-inch wearing course and 3-inch binder course) over 9 inches of compacted granular base course.

In areas where 4 or 5-axle delivery trucks will travel (heavy duty pavement), flexible pavements should be constructed with a minimum of 6 inches of asphaltic concrete (1.5-inch wearing course, 1.5-inch asphalt binder, and 3-inch bituminous base) over 9 inches of compacted granular base course.

Flexible Pavement Materials

The asphaltic concrete wearing and binder courses should meet the requirements of the 2017 MDOT Standard Specifications for Road and Bridge Construction. Granular base course should consist of MDOT size 610 or 825B crushed limestone. Alternate materials may be acceptable as approved by the Engineer.

Rigid Pavement Construction Considerations

Rigid pavements should be designed and constructed in accordance with the following guideline recommendations. Rigid pavements should be used where heavy trucks or equipment will traffic regularly. This should include the area around the loading dock.

Thickness

Rigid pavements for the medium duty pavement (automobiles, 2-axle, and 3-axle delivery trucks) should have a minimum thickness of 6.5 inches. Rigid pavements that will be required to support multiple passes of trucks having 5 or more axles are classified as heavy duty pavement and should have a minimum thickness of 8.0 inches. The rigid pavement thickness design should include a minimum 9-inch thick granular base over the prepared subgrade. Granular base course should consist of a 610 crushed limestone. The granular base should be placed in loose lifts not exceeding 8 inches in thickness and compacted to at least 100% of the Standard maximum dry density.

Concrete Strength and Mix Design

The concrete used for the pavement should consist of a pavement mix with a minimum 28-day compressive strength of 4,500 psi or a minimum 28 day flexural strength of 625 psi. The mix design should be proportioned to provide adequate durability with adequate workability for efficient placement, finishing and texturing.

Contraction Joints and Construction Joints

Rigid pavements should be constructed with transverse contraction joints spaced not more than 13 feet on center. Contraction joints should also be located in the longitudinal direction with spacing of not greater than 13 feet. These contraction joints should be either grooved (tooled) or saw cut. The timing of grooving or saw cutting is critical to the prevention of shrinkage cracks in the pavement. Begin saw cutting within 4 to 6 hours after concrete placement or as soon as the concrete allows when using an early-entry saw. The depth of the contraction joint should be at least ¼ of the slab thickness. Aggregate interlock joints will be sufficient reinforcement of the contraction joints.

Construction joints provide the interface between areas of concrete placed at different times. Construction joints should be installed at the intended location of contraction joints in order to prevent odd-sized slabs. Construction joints should consist of butt joints, thickened edge butt joints, or keyed joints. Keyed joint should only be used in pavements that have a thickness of 6

inches or greater. Keyed joints can be either slip-formed or formed. If keyed joints are used, it is important that the keyways have proper dimensions to avoid creating weak joints. The key could consist of either a trapezoidal key or a half-round key. For either of these designs the total height of the key should not exceed 20% of the slab thickness (0.2d) and the center of the key should be located in the center of the slab. Metal forms with improper keyway dimensions or "leave-in-place" keyed shapes should not be used. Thickened edges for thickened edge butt joints should begin 3 feet from the joint with the pavement thickness at the joint increased to at least 20% of the original pavement thickness or 2 inches, whichever is greater.

Isolation (Expansion) Joints

Concrete pavement slabs should be separated from permanent structures or fixed objects (buildings, light standard foundations, drop inlets, etc.) using isolation or expansion joints. Expansion joints are not recommended for routine use as regularly spaced joints as they are difficult to construct, difficult to maintain, and are subject to the development of pavement distress and premature failure. Isolation joints are full-depth vertical joints usually filled with a compressible material. Where subject to traffic and wheel loadings we recommend that the isolation joints be constructed with the free edge thickened by at least 20% of the original pavement thickness or 2 inches, whichever is greater.

Joint Reinforcement, Design and Location

The use of dowels is not recommended in pavements that are 7 inches or less in thickness. Tie bars should be used to tie only the first longitudinal joint from the pavement edge in order to keep the outside slab from separating from the pavement. Tie bars are not required in interior joints of parking lots or other wide paved areas. Tie bars should be used on the centerline longitudinal joints of entrance driveways and access roads if there are no curbs. Tie bars should consist of ½-inch by 24-inch deformed bars spaced 30 inches on center.

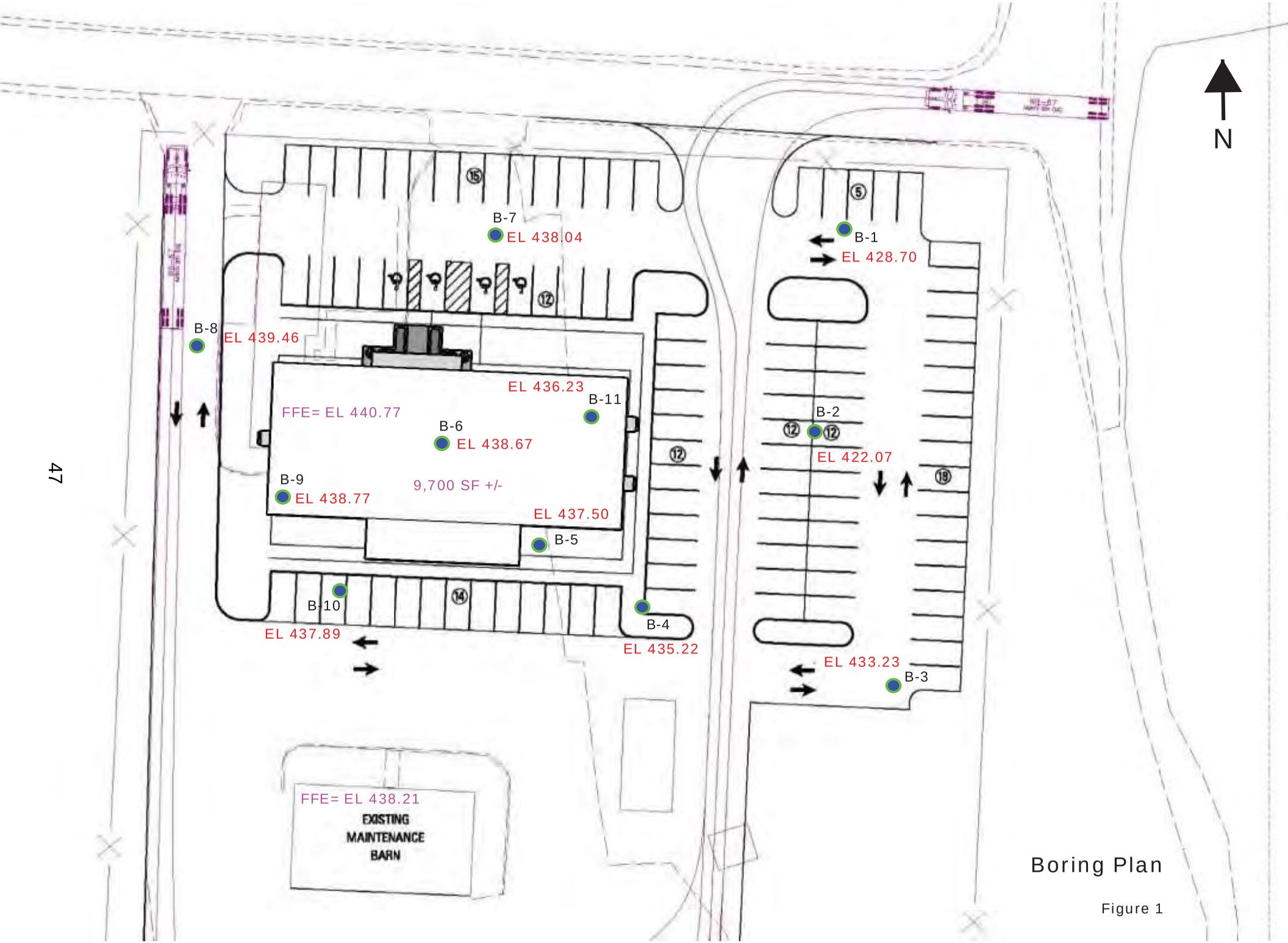
The design, location, and construction of pavement joints should be in accordance with the recommendations of ACI 330R-01. Care should be taken to provide additional joints and possibly wire reinforcement in odd-shaped slabs in order to prevent random cracking.

Dumpster Pad

The pad should be large enough to hold the largest expected container with approximately 3 to 5 feet of extra space on each side. Additionally, the pad should contain an approach apron on the loading side of the pad that is large enough to accommodate half the length of the anticipated collection vehicle. Additional apron area should be provided if the waste vehicles will be making turning movements in the vicinity of the pad. The pad for garbage dumpsters should be designed as a structural slab for the anticipated loading conditions. A typical design for small to medium containers would consist of an 8-inch thick concrete slab with a mat of reinforcing steel. Reinforcement should consist of No. 4 bars spaced at 12 inches on center in both directions having a minimum cover of 2 inches. Tooled contraction joints should be provided at intervals that will provide a slab size that does not exceed 20 feet by 20 feet. Expansion joints should not be placed in these pads unless they are required where the container pad directly abuts a building or other fixed structure.

CLOSING

We would request that our office have an opportunity to review the project Architect's final design documents and plan sheets to insure that the recommendations presented herein have been incorporated into the construction bid plans prior to advertisement.



Boring Plan

Figure 1

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 1	**FMS P.E. No.:** 503007/101000	**REPORT NO.:**18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5464856°	**LONGITUDE:** W90.4640743°	**COMPLETION DATE:** 2/28/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Demarcus Jobe		**SURFACE ELEVATION:** 428.7'

COHESION (ksf): ☐UU; ○UNC; ☒DS (1.5, 3.0, 4.5, 6.0)

PL Mo sture Cont. (%) LL (20, 40, 60, 80)

FINES CONTENT (%) ▲ (20, 40, 60, 80)

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0.0 / 427.5	T		Stiff Clay (CH)		4.0	110
2.5 / 425.0	T		@4' Dense, Orange, Brown, Maroon Sandy C ayey S t		4.5	
5.0 / 422.5	T				4.0	
7.5 / 420.0	T					
10.0 / 417.5	T		@10' Med um Dense, Rust F ne to Med um Sand (SP)		2.0	
12.5 / 415.0	S		@14' Dense, Brown F ne to Med um Sand w th Some F ne Grave , Wet	45		
15.0 / 412.5	S		@16' Dense, Brown F ne Sand w th Some F ne Grave , Wet	46		
17.5			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

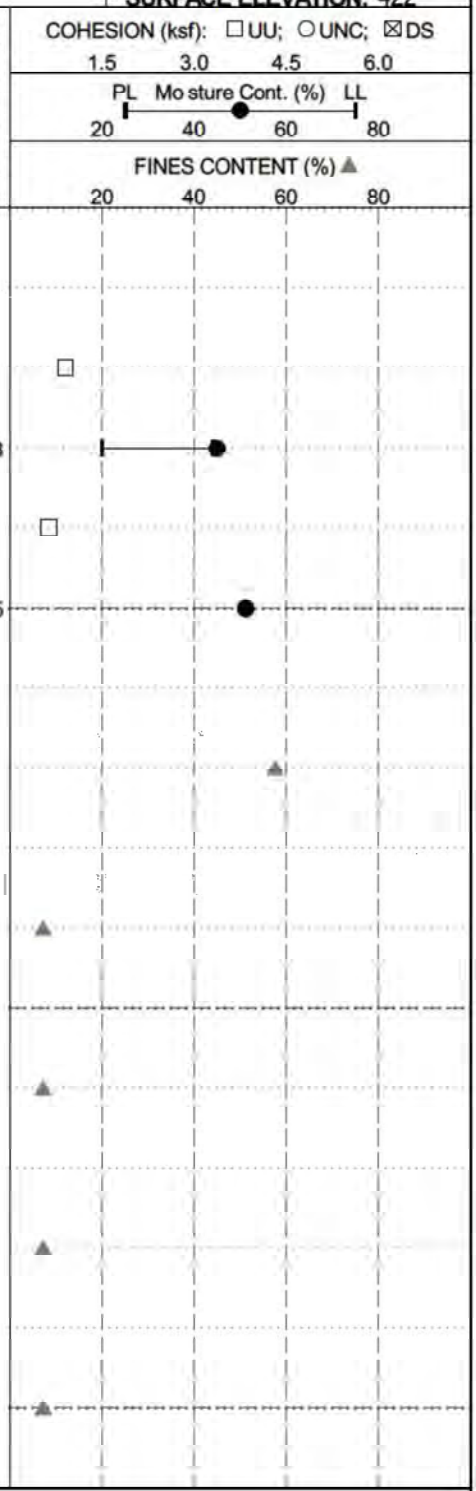
FIGURE 2

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 2	**FMS P.E. No.:** 503007/101000	**REPORT NO.:**18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5462074°	**LONGITUDE:** W90.4640928°	**COMPLETION DATE:** 2/28/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Demarcus Jobe		**SURFACE ELEVATION:** 422'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0.0						
420.0 / 2.5	T				1.5	108
			@4' Firm Brown Silty Clay (CL)			
417.5 / 5.0	T				2.0	105
			@6' Med. Dense, Brown sh Gray Sandy C ayey S t			
415.0 / 7.5	T				2.0	
	S			45		
412.5 / 10.0			@10' Dense, Rust F ne to Coarse Sand w th F ne Grave			
	S			86		
410.0 / 12.5	S			84		
407.5 / 15.0	S		@16' Dense, Rust F ne to Med um Sand w th F ne to Coarse Grave	72		
405.0 / 17.5			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.



S Split Spoon Shelby ube C Rock Core P Pitcher □ UU Cohesion ○ UNC Cohesion ⊠ DS Cohesion ● Moisture Content (%)

FIGURE 3

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 3	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5459516°	**LONGITUDE:** W90.4639917°	**COMPLETION DATE:** 3/1/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Demarcus Jobe		**SURFACE ELEVATION:** 433 2'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0 0 / 432.5						
2 5 / 430.0	T				2.0	
	S		@4' Very Dense, Rust, Brown F ne to Med um S ty Sand (SM) w th F ne Grave	81		
5 0 / 427.5	S		@6' Very Dense, Red, Brown F ne to Med um S ty Sand w th F ne Grave	46		
7 5 / 425.0	S			31		
10 0 / 422.5	T		@10' Med um Dense, Maroon, Brown F ne to Med um S ty Sand		1.5	
12 5 / 420.0	T				1.5	
15 0 / 417.5	S		@16' Dense, Maroon, Brown F ne to Med um S ty Sand, Mo st	46		
17 5			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): ☐ UU; ○ UNC; ☒ DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 4

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 4	**FMS P.E. No.:** 503007/101000	**REPORT NO.:**18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5460247°	**LONGITUDE:** W90.4643204°	**COMPLETION DATE:** 3/5/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Demarcus Jobe		**SURFACE ELEVATION:** 435.2'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0.0 / 435.0						
2.5 / 432.5	T				3.0	
	T		@4' Dense, Rust, Brown S t			
5.0 / 430.0						
	S		@6' Firm, Brown C ayey S t w th Some Grave , Mo st	23		
7.5 / 427.5						
	T		@8' Firm, Brown Silty Clay (CL) w th Some Sand, Mo st			
10.0 / 425.0	T		@10' F rm, Brown C ay w th F ne Sand Layers			118
12.5 / 422.5	S					
	S		@14' Sand Layer @14' Very Dense, Orange, Brown Sand	100+		
15.0 / 420.0						
17.5 / 417.5			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): ☐UU; ○UNC; ☒DS
1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL
20 40 60 80

FINES CONTENT (%) ▲
20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 5

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 5	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5460944°	**LONGITUDE:** W90.4644783°	**COMPLETION DATE:** 3/5/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 32'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 437 4'

COHESION (ksf): ☐ UU; ○ UNC; ☒ DS — 1.5, 3.0, 4.5, 6.0

PL — Mo sture Cont. (%) — LL: 20, 40, 60, 80

FINES CONTENT (%) ▲: 20, 40, 60, 80

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) / RQD (%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0 / 435	S			WOH		
	T		@4' Loose Grave , Sand, C ay (Fill Material?)			
5 / 430	T		@6' Soft C ay (CL) w th Grave			
	T		@8' Very Dense Orange F ne Sand w th C ay Layers		3.0	
10 / 425	S		@10' Loose, Orange, Red Sand w th C ay ayers	WOH		
	T					112
	T		@14' Very St ff Orange C ay (CL) w th F ne Sand		4.0	
15 / 420						
20 / 415	S		@20' Very Dense Orange, Brown F ne Sand	100+		
25 / 410	S		@25' Med. Dense Wh te Med um Sand	11		
			@30' Med Dense Orange Med um Sand w th Some Grave			
30 / 405	S			23		

TOTAL DEPTH OF BORING 32.0'

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 6

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 6	**FMS P.E. No.:** 503007/101000	**REPORT NO.:**18-43-08
COUNTY: L nco n	**LATITUDE:** N31.546193°	**LONGITUDE:** W90.464568°	**COMPLETION DATE:** 3/5/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 32'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 438 6'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0 / 438						
	T		@2' St ff Brown C ay (CH)		2.5	
435	T		@4' Firm Brown Silty C ay (CL) w th Grave		0.5	108
5	S		@6' Stiff Tan L ght Brown C ay and F ne Grave w th Layers of F ne Sand	26		
430	S		@8' St ff Wh te Red C ayey S t w th F ne Sand and F ne Grave	58		
10	S			87		
	S			WOH		
425	T		@14' Loose Brown F ne to Med um Sand w th F ne Grave	WOH		
15	S			WOH		
420	S		@18' Loose Wh te P nk F ne to Med um Sand w th F ne Grave	WOH		
20						
415						
25	S		@25' Dense Brown F ne Grave	68		
410			@30' Lost Recovery			
30	S					
405			TOTAL DEPTH OF BORING 32.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): ☐UU; ○UNC; ☒DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 7

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 7	**FMS P.E. No.:** 503007/101000	**REPORT NO.:**18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5464268°	**LONGITUDE:** W90.4645084°	**COMPLETION DATE:** 3/6/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 438.0'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0.0 / 437.5						
	T		@2' Very St ff B ack C ay (CL)		3.0	106
2.5 / 435.0						
	T		@4' Very Stiff B ack, Brown, Rust C ay w th Sand and Some Grave		4.0	
5.0 / 432.5						
	T		@6' Very Dense Brown, Rust F ne to Med um Sandy C ayey S t		3.0	
7.5 / 430.0						
	T		@8' Very Dense, Brown, Tan, Cream, F ne to Med um Sandy C ayey S t		4.0	
10.0 / 427.5						
	T		@10' Very Dense, Rust w th P nk Specks, F ne Sandy C ayey S t		4.0	
12.5 / 425.0						
	T		@14' F rm Brown, P nk C ay w th Sand Layers			
15.0 / 422.5						110
17.5			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): □UU; ○UNC; ⊠DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher □ UU Cohesion ○ UNC Cohesion ⊠ DS Cohesion ● Moisture Content (%)

FIGURE 8

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 8	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5463006°	**LONGITUDE:** W90.4649186°	**COMPLETION DATE:** 3/6/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 32'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 439 4'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0						
	T		@2' St ff, Orange, Brown C ay (CH) w th Some Sand Layers		2.5	109
435 5	T		@4' F rm Orange, Brown C ay (CH)		1.0	107
	T				3.5	
	T		@8' St ff, Orange, C ayey S t		2.5	
430 10	T				3.0	112
	S		@12' Loose, Wh te, Orange, C ayey S t w th Some Sand Layers	WOH		
425 15	S		@14' Very Dense, Brown, Orange, F ne to Med um Sand	100+		
420 20	S		@20' Dense, Wh te to L ght Brown, F ne to Med um Sand	25		
415 25	S		@25' Very Dense, Brown, F ne to Med um Sand w th F ne Grave	62		
410 30	S		@30' Very Dense, Brown, F ne to Med um Sand w th F ne Grave	78		
405			TOTAL DEPTH OF BORING 32.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): □ UU; ○ UNC; ☒ DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher □ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 9

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 9	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5461438°	**LONGITUDE:** W90.4648043°	**COMPLETION DATE:** 3/6/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 32'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 438 7'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) / RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0 /						
/	T		@2' St ff Brown C ay (CH)		2.5	110
435 /	T				4.0	
5 /	T		@6' Hard Brown C ay		4.0	
/	T				3.0	
430 /	T				2.5	
10 /	T		@12' Very St ff, Brown, Tan C ay w th Some Sand Layer ng		3.0	
/	T				3.5	
425 /						
15 /						
/						
420 /						
20 /	S		@20' Med um Dense, Wh te, F ne to Med um Sand	25		
/						
415 /						
25 /	S		@25' Med um Dense, Orange, F ne to Med um Sand	53		
/						
410 /						
30 /	S		@30' Med um Dense, Orange, F ne to Med um Sand w th Some F ne Grave	16		
/			TOTAL DEPTH OF BORING 32.0'			
405 /			NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.			

COHESION (ksf): □UU; ○UNC; ⊠DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher □ UU Cohesion ○ UNC Cohesion ⊠ DS Cohesion ● Moisture Content (%)

FIGURE 10

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 10	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5460432°	**LONGITUDE:** W90.4647164°	**COMPLETION DATE:** 3/6/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 16'
BORING TYPE: Rotary Wash	**LOGGED BY:** Gera d Entrek n		**SURFACE ELEVATION:** 437 8'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0.0 / 437.5						
	T		@2' F rm Brown C ay (CL)		2.0	104
2.5 / 435.0						
	T				3.5	
5.0 / 432.5						
	T		@6' Very St ff Brown C ay (CL)		4.0	
7.5 / 430.0						
	T				3.5	
10.0 / 427.5			@10' St ff Brown C ayey S t (ML)			
	T				3.5	
			@12' Very Dense, P nk, Brown. F ne to Med um Sand w th F ne to Coarse Grave			
12.5 / 425.0	S			100+		
			@14' Very Dense, P nk, Cream, Brown, F ne to Med um Sand			
15.0 / 422.5	S			100+		
17.5 / 420.0			TOTAL DEPTH OF BORING 16.0'			

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

COHESION (ksf): ☐ UU; ○ UNC; ☒ DS — 1.5 3.0 4.5 6.0

PL Mo sture Cont. (%) LL — 20 40 60 80

FINES CONTENT (%) ▲ — 20 40 60 80

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 11

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SITE NO.: 18-43-1022	**HOLE NO.:** 11	**FMS P.E. No.:** 503007/101000	**REPORT NO.:** 18-43-08
COUNTY: L nco n	**LATITUDE:** N31.5462301°	**LONGITUDE:** W90.4644095°	**COMPLETION DATE:** 3/7/2018
LOCATION: Brookhaven Project Off ce Bu d ng			**WATER TABLE ELEV:** N/A
STATION:	**OFFSET:**		**COMPLETION DEPTH:** 32'
BORING TYPE: Rotary Wash	**LOGGED BY:** Demarcus Jobe		**SURFACE ELEVATION:** 436.2'

DEPTH, ft. / ELEVATION, ft.	SAMPLES	GRAPHIC LOG	MATERIAL DESCRIPTION (USCS)	SPT (N_{60}) / RQD(%)	PKT PEN. (tsf)	DRY UNIT WT (pcf)
0 / 435	T				0.5	
	T		@4' Soft, Brown, F ne Sandy C ay (CL) w th Med um Grave		1.0	
5 / 430	T		@6' F rm Brown S ty C ay		2.5	
	T		@8' St ff, Brown, F ne to Med um Sandy C ayey S t w th Some Grave		4.5	
10 / 425	T		@10' Hard, Var gated, Brown, Maroon, Gray C ay (CH)		4.5	109
	T				4.5	
15 / 420	S			24		
			@16' Dense Brown, Clayey Sand w th F ne to Med um Grave			
20 / 415	S		@20' Med um Dense, Gray, Maroon F ne Sand, Wet	13		
25 / 410	S		@25' Very Dense, Brown F ne to Med um Sand w th F ne Grave	77		
30 / 405	S		@30' Very Dense, Brown, F ne to Med um C ayey Sand, Wet	78		

COHESION (ksf): ☐ UU; ○ UNC; ☒ DS — 1.5, 3.0, 4.5, 6.0

PL — Mo sture Cont. (%) — LL: 20, 40, 60, 80

FINES CONTENT (%) ▲: 20, 40, 60, 80

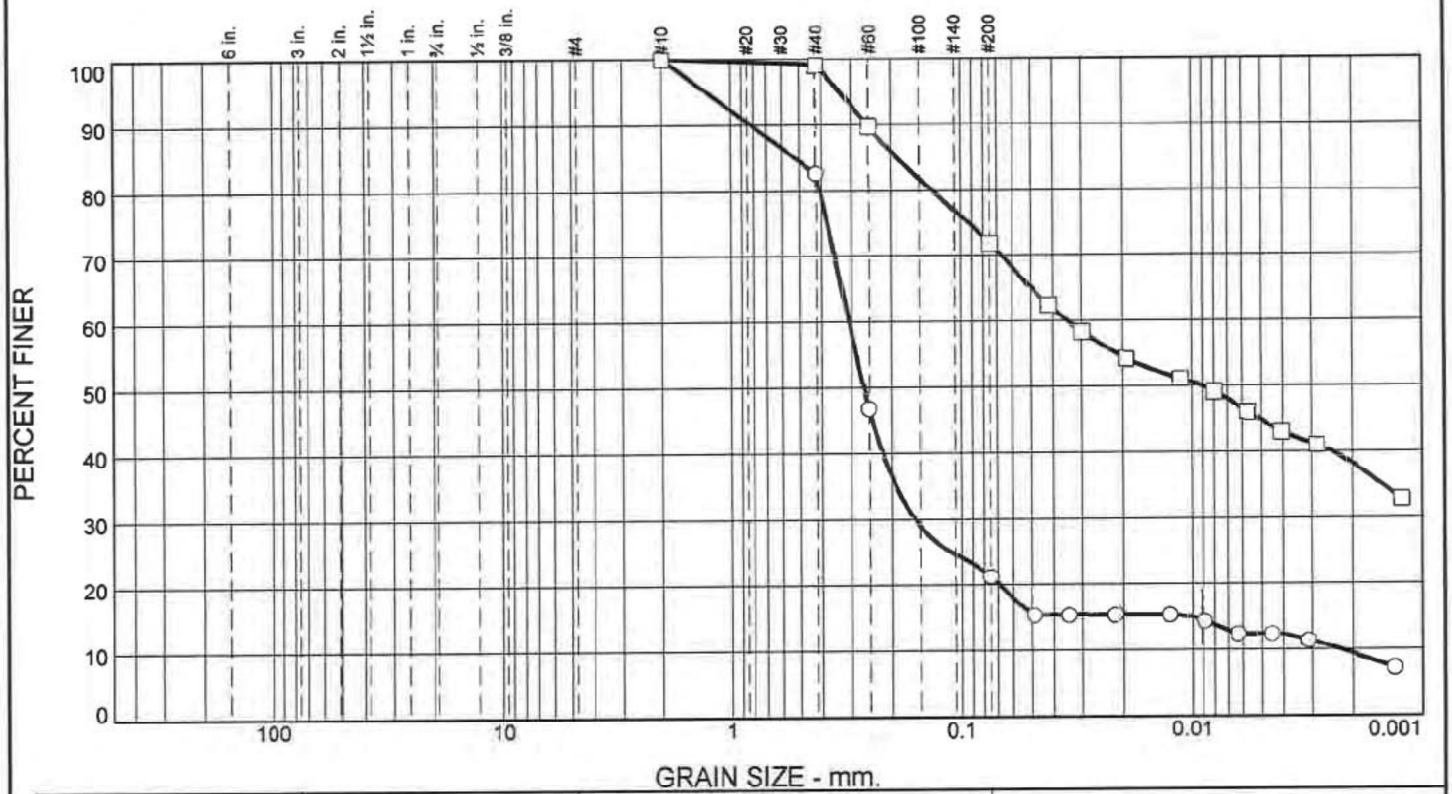
TOTAL DEPTH OF BORING 32.0'

NOTE: A HYDRAULIC AUTOMATIC TRIP HAMMER WAS USED TO DETERMINE SPT N VALUES. THE N VALUES SHOWN REPRESENT N_{60} VALUES.

S Split Spoon Shelby ube C Rock Core P Pitcher ☐ UU Cohesion ○ UNC Cohesion ☒ DS Cohesion ● Moisture Content (%)

FIGURE 12

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	17.3	61.5	8.8	12.4
□	0.0	0.0	0.0	0.0	0.9	27.3	27.0	44.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5214	0.3055	0.2632	0.1583	0.0102	0.0023	36.32	135.28
□			0.1866	0.0347	0.0090					

	Material Description	USCS	AASHTO
○			
□			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole1 **Depth:** 8-16 **Sample Number:** H1 S4-7

□ **Source of Sample:** Hole1 **Depth:** 6-8 **Sample Number:** H1 S3

Remarks:

○H1 S4-7 D8-16

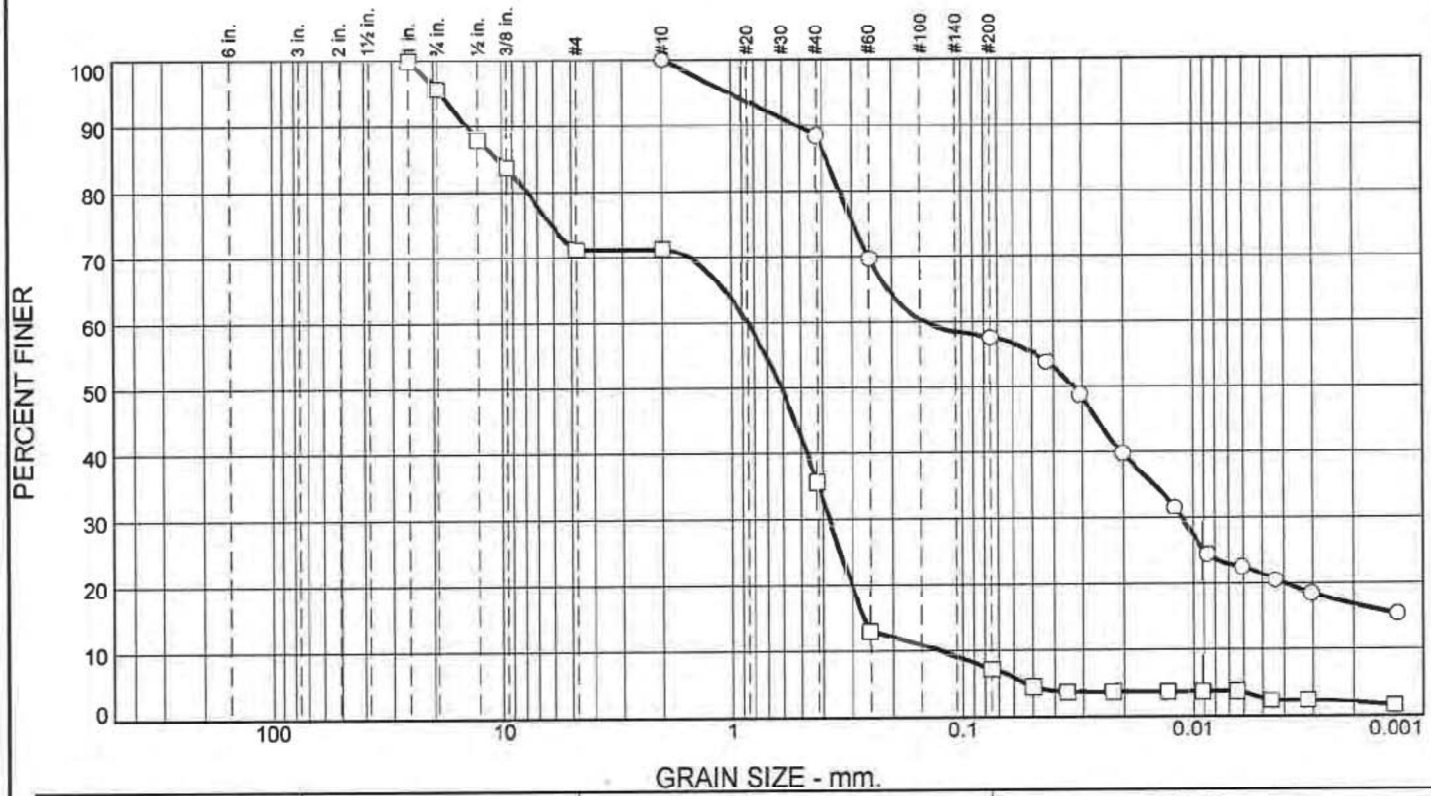
□H1 S3 D6-8

Mississippi Department of Transportation

Jackson, Mississippi

Figure 13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	11.5	30.8	36.2	21.5
□	0.0	4.4	24.3	0.0	35.6	28.5	4.5	2.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3832	0.1431	0.0328	0.0111				
□			10.2503	0.8479	0.6080	0.3756	0.2653	0.1245	1.34	6.81

	Material Description	USCS	AASHTO
○			
□			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole2 **Depth:** 6-8 **Sample Number:** H2 S3

□ **Source of Sample:** Hole2 **Depth:** 8-16 **Sample Number:** H2 S4-7

Remarks:

○H2 S3 D6-8

□H2 S4-7 D8-16

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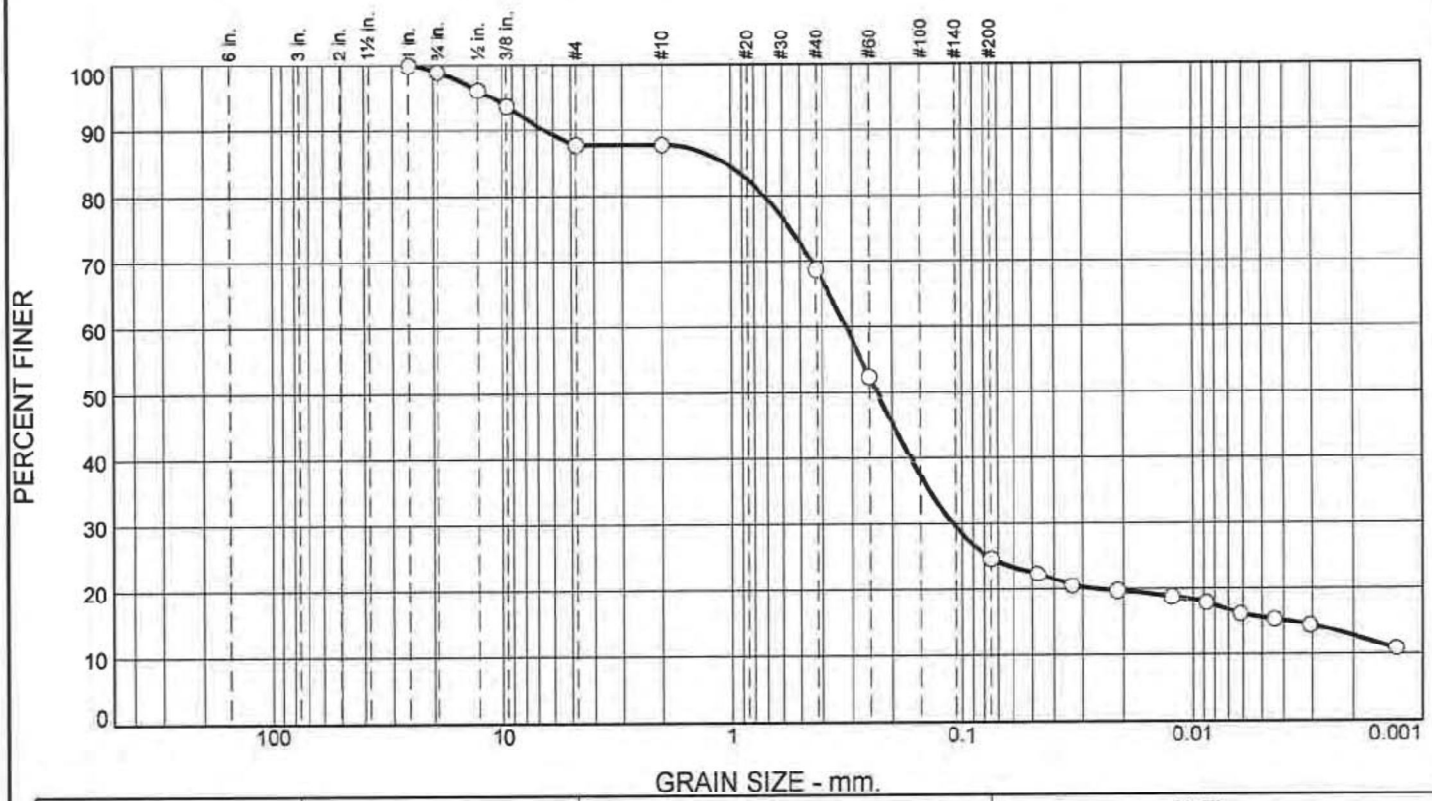
Figure 14

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.1	11.1	0.0	19.0	44.2	9.1	15.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.0676	0.3162	0.2312	0.1088	0.0038			

Material Description	USCS	AASHTO
○		

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole3 **Depth:** 2-16 **Sample Number:** H3 S1-7

Remarks:

○H3 S1-7 D2-16

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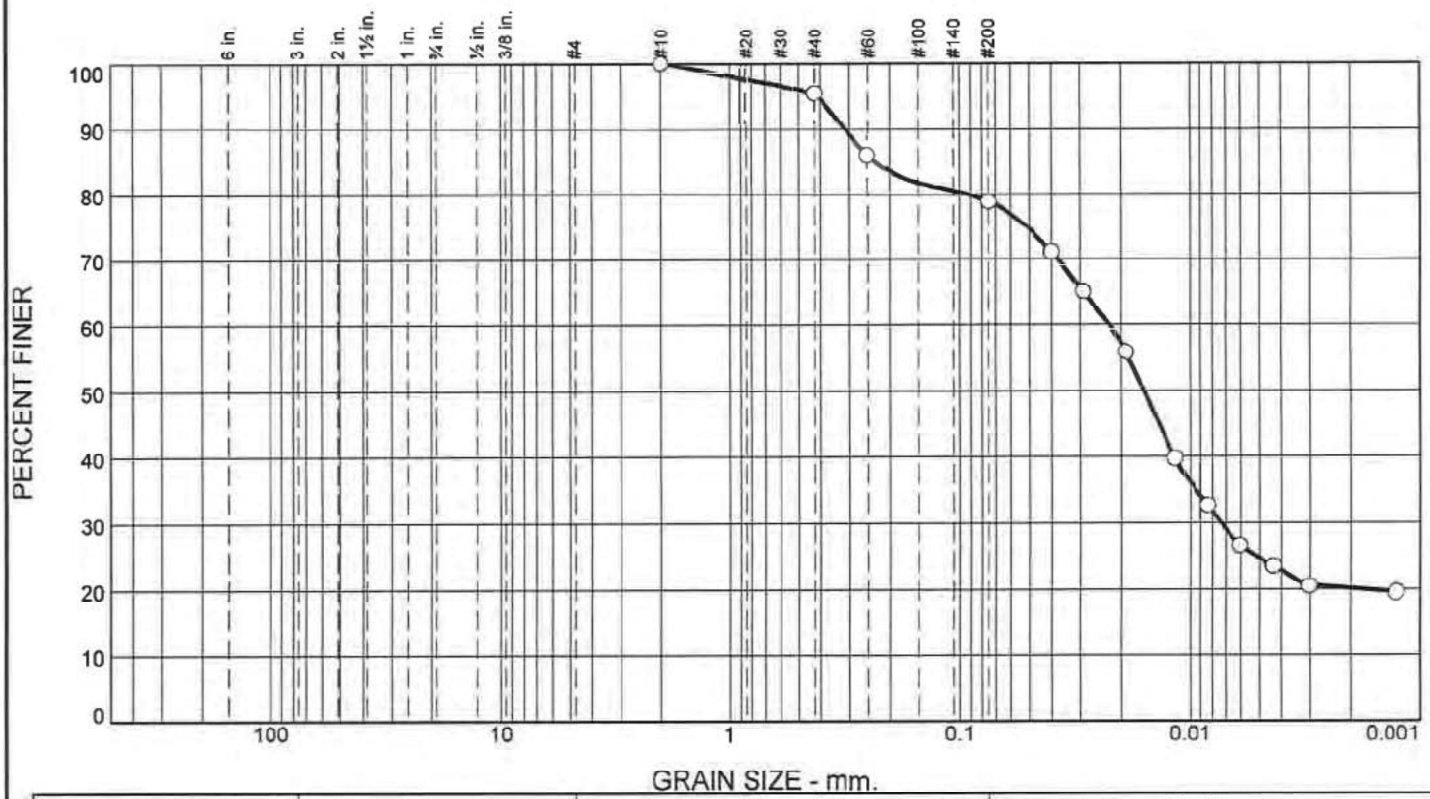
Figure 15

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.5	16.7	54.1	24.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2308	0.0224	0.0158	0.0074				

	Material Description	USCS	AASHTO
○			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole4 **Depth:** 8-10 **Sample Number:** H4 S4

Remarks:

○H4 S4 D8-10

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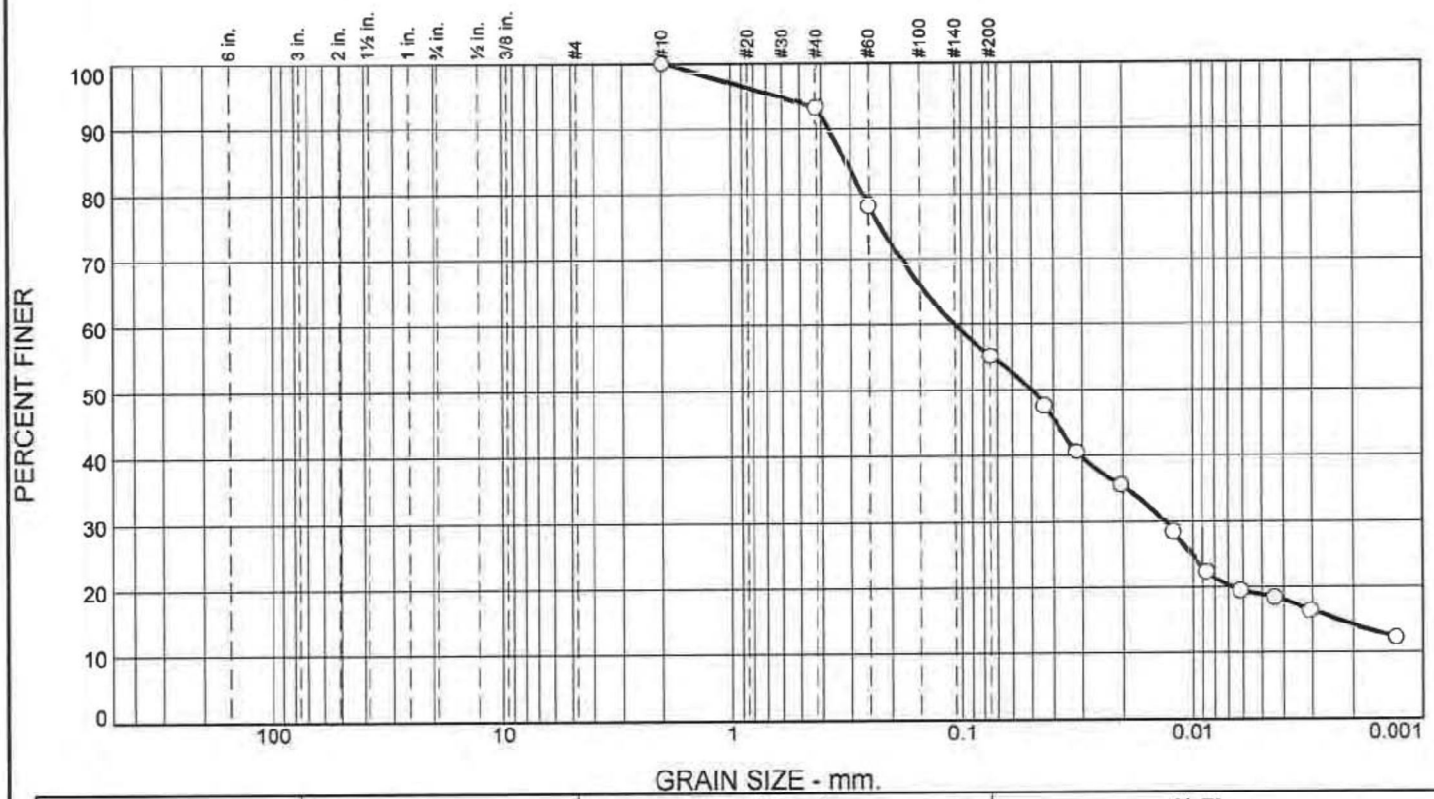
Figure 16

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	6.7	38.1	36.3	18.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3134	0.1067	0.0497	0.0131	0.0023			

	Material Description	USCS	AASHTO
○			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole5 **Depth:** 14-16 **Sample Number:** H5 S7

Remarks:

○H5 S7 D14-16

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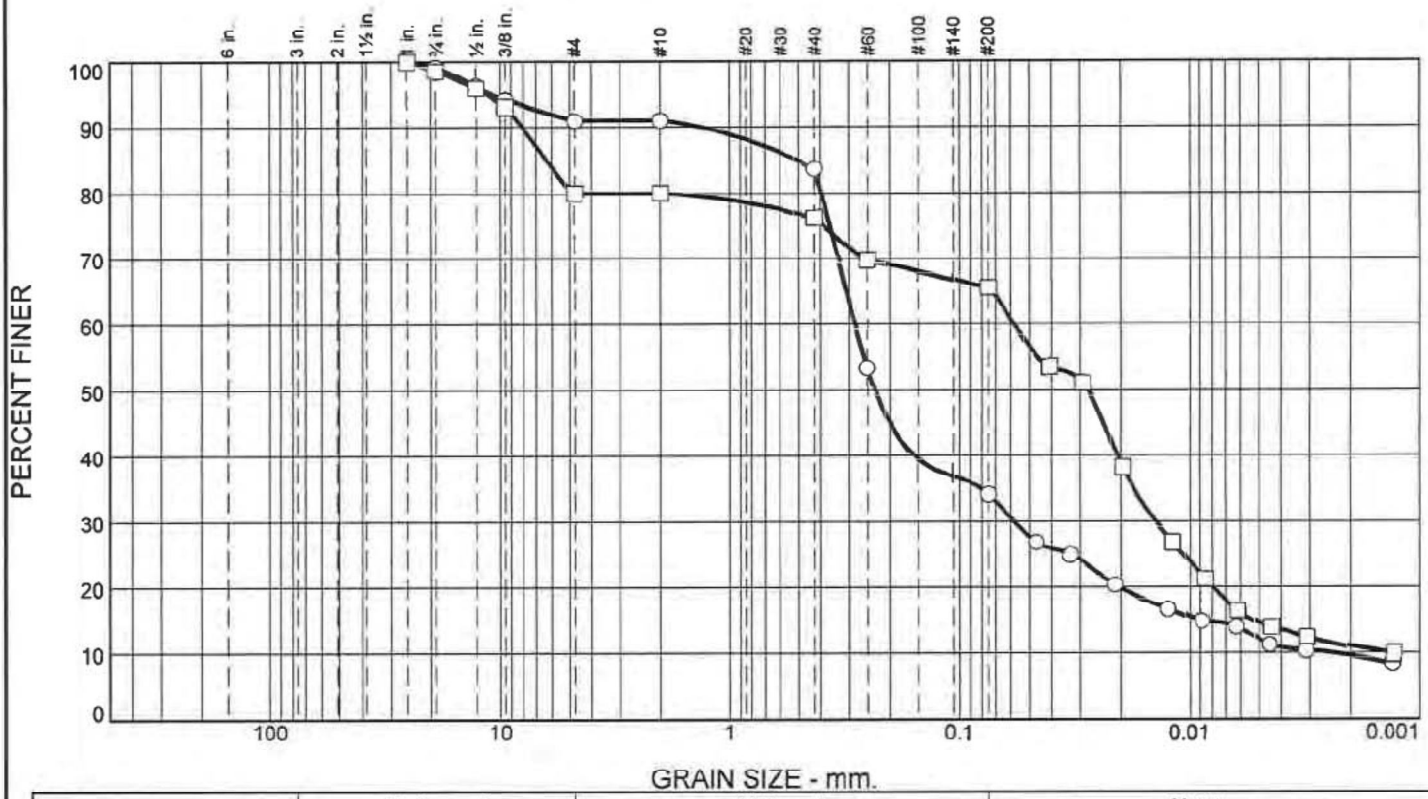
Jackson, Mississippi

Figure 17

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.9	8.1	0.0	7.3	49.6	21.9	12.2
□	0.0	1.4	18.6	0.0	3.8	10.7	50.8	14.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5081	0.2827	0.2309	0.0581	0.0090	0.0024	5.00	118.31
□			6.3249	0.0581	0.0277	0.0141	0.0052	0.0013	2.61	44.32

	Material Description	USCS	AASHTO
○			
□			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole6 **Depth:** 12-20 **Sample Number:** H6 S6-9

□ **Source of Sample:** Hole6 **Depth:** 6-12 **Sample Number:** H6 S3-5

Remarks:

○H6 S6-9 D12-20

□H6 S3-5 D6-12

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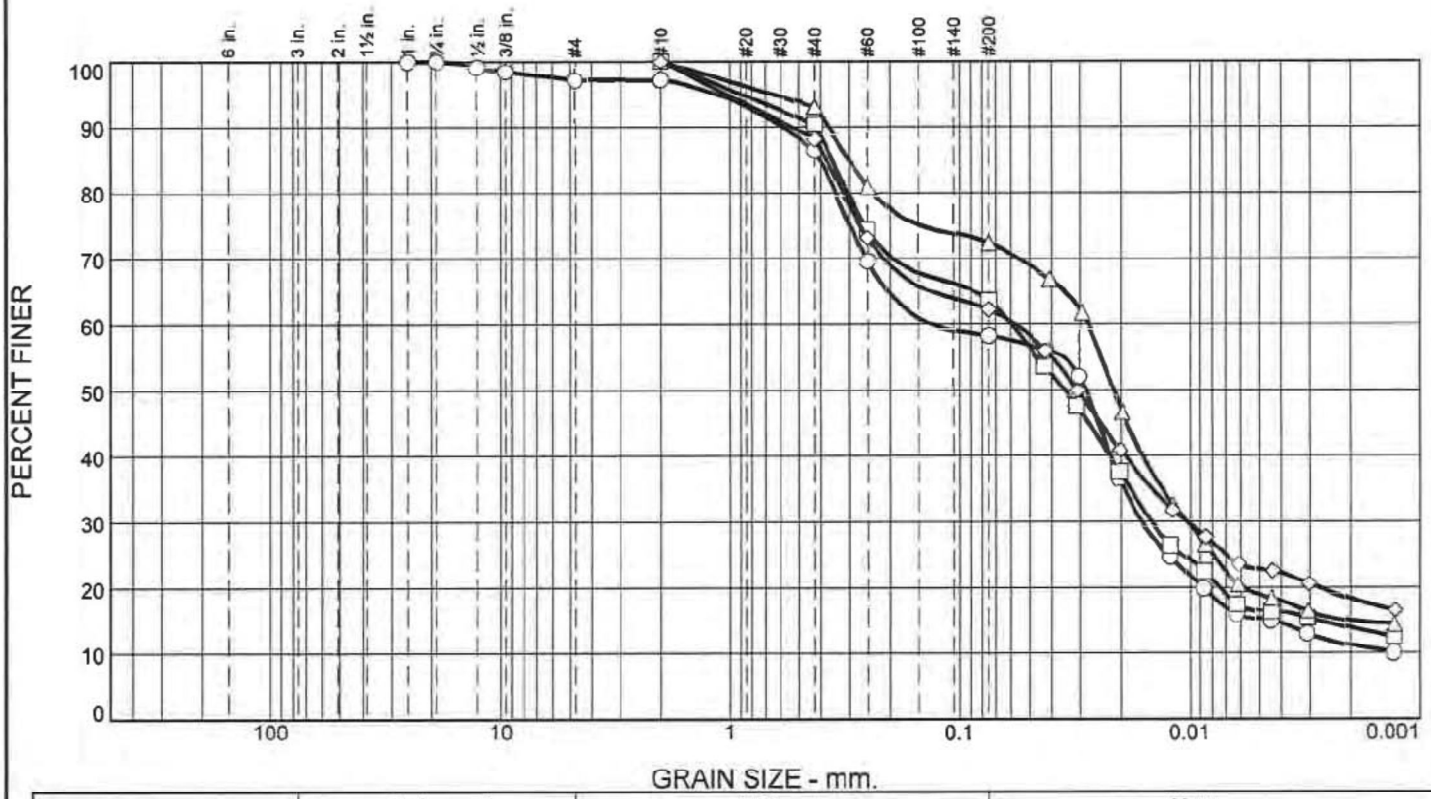
Jackson, Mississippi

Figure 18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.8	0.0	10.7	28.3	42.9	15.3
□	0.0	0.0	0.0	0.0	9.7	26.8	47.0	16.5
△	0.0	0.0	0.0	0.0	6.9	20.8	53.3	19.0
◇	0.0	0.0	0.0	0.0	11.9	25.9	39.3	22.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4036	0.1330	0.0282	0.0162	0.0044			
□			0.3562	0.0597	0.0350	0.0147	0.0027			
△			0.3009	0.0277	0.0214	0.0104	0.0020			
◇			0.3791	0.0574	0.0308	0.0104				

	Material Description	USCS	AASHTO
○			
□			
△			
◇			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole7 **Depth:** 6-8 **Sample Number:** H7 S3

□ **Source of Sample:** Hole7 **Depth:** 8-10 **Sample Number:** H7 S4

△ **Source of Sample:** Hole7 **Depth:** 10-12 **Sample Number:** H7 S5

◇ **Source of Sample:** Hole7 **Depth:** 4-6 **Sample Number:** H7 S2

Remarks:

○H7 S3 D6-8

□H7 S4 D8-10

△H7 S5 D10-12

◇H7 S2 D4-6

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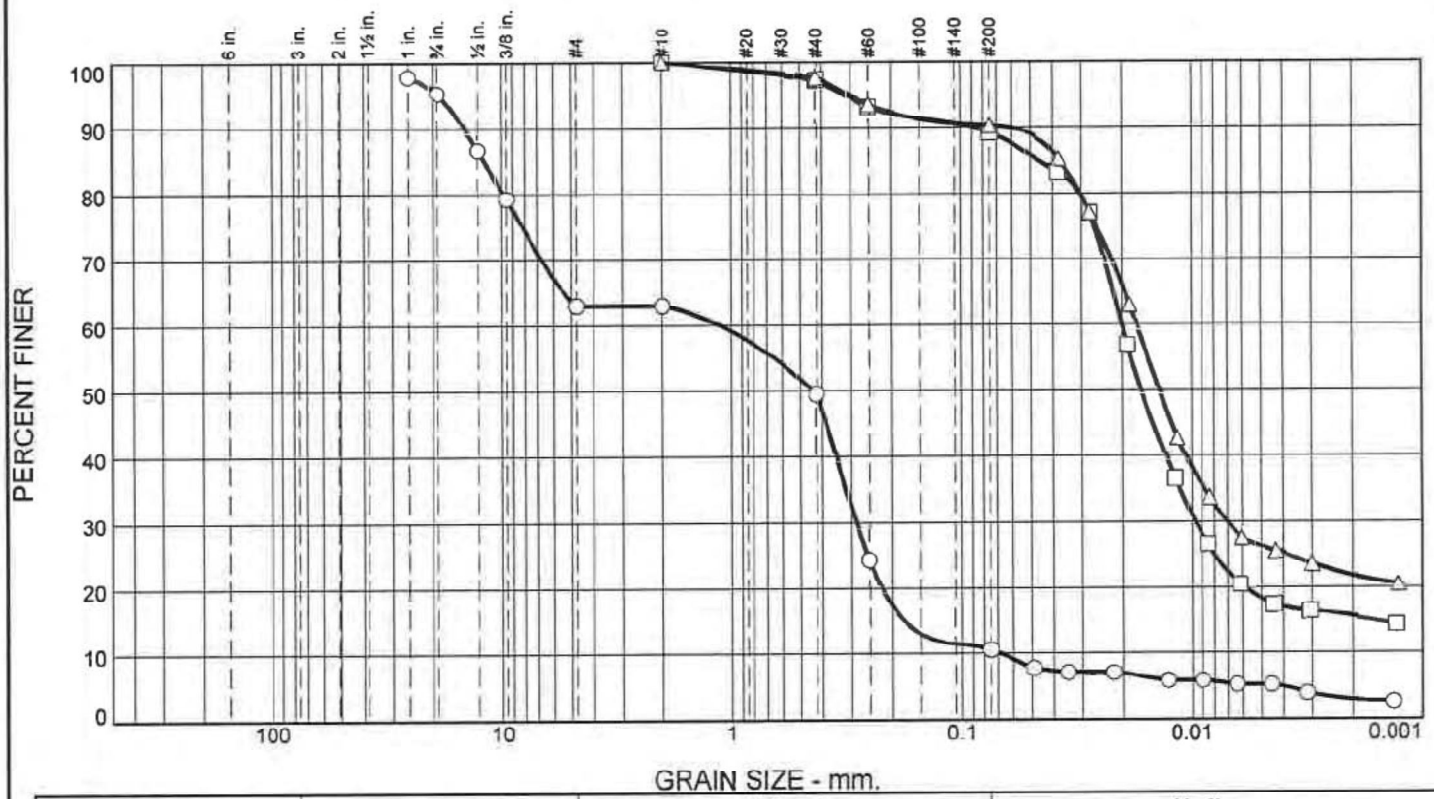
Figure 19

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○			32.3	0.0	13.4	39.0	5.3	5.3
□	0.0	0.0	0.0	0.0	2.7	8.1	70.8	18.4
△	0.0	0.0	0.0	0.0	2.3	7.5	63.9	26.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.8545	1.1257	0.4367	0.2841	0.1757	0.0681	1.05	16.53
□			0.0458	0.0200	0.0165	0.0096	0.0016			
△			0.0371	0.0172	0.0138	0.0070				

	Material Description	USCS	AASHTO
○			
□			
△			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole8 **Depth:** 14-32 **Sample Number:** H8 S7-10

□ **Source of Sample:** Hole8 **Depth:** 6-8 **Sample Number:** H8 S3

△ **Source of Sample:** Hole8 **Depth:** 10-12 **Sample Number:** H8 S5

Remarks:

○H8 S7-10 D14-32

□H8 S3 D6-8

△H8 S5 D10-12

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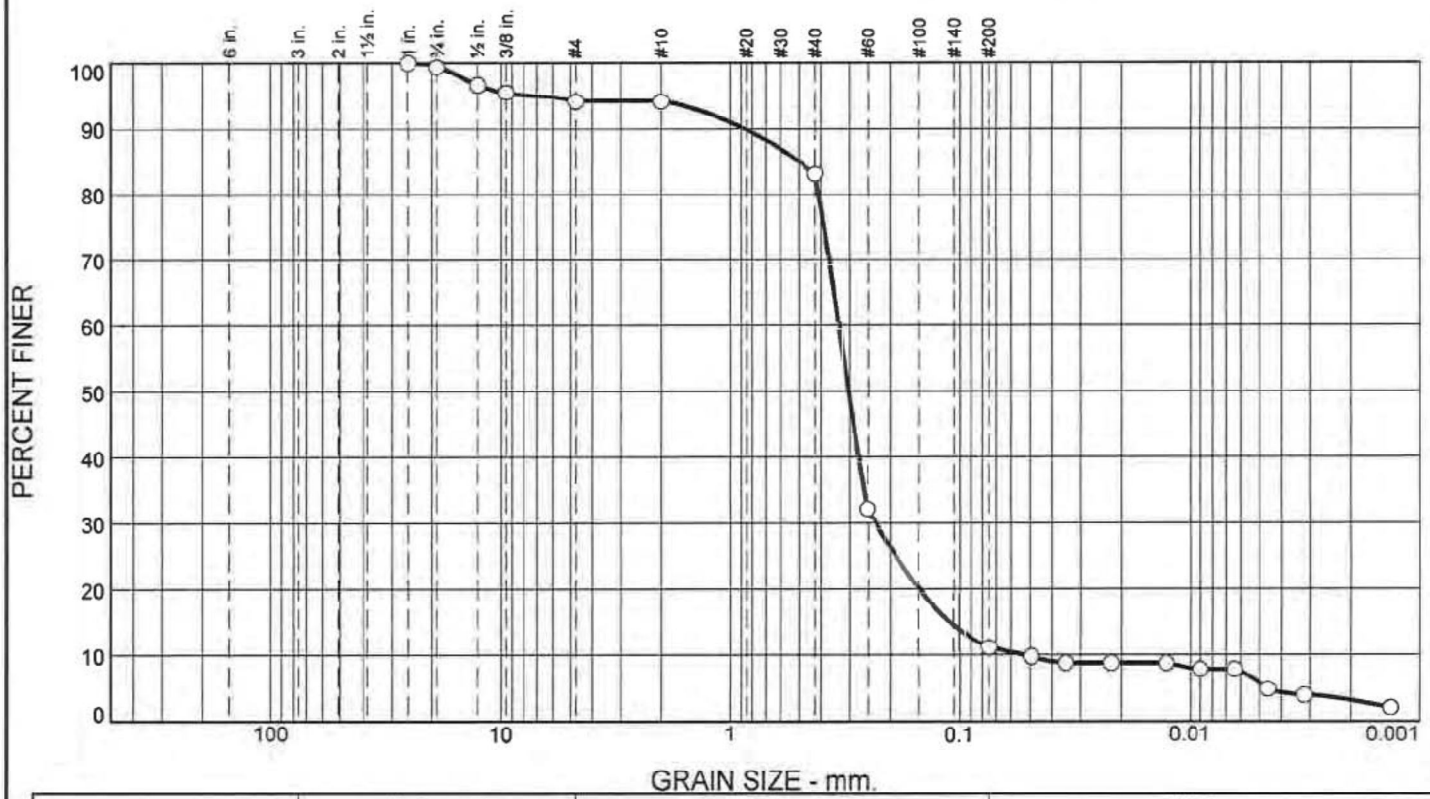
Figure 20

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.7	5.2	0.0	10.9	72.1	5.3	5.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4994	0.3336	0.3028	0.2307	0.1095	0.0533	2.99	6.26

	Material Description	USCS	AASHTO
○			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole9 **Depth:** 20-32 **Sample Number:** H9 S8-10

Remarks:

○H9 S8-10 D20-32

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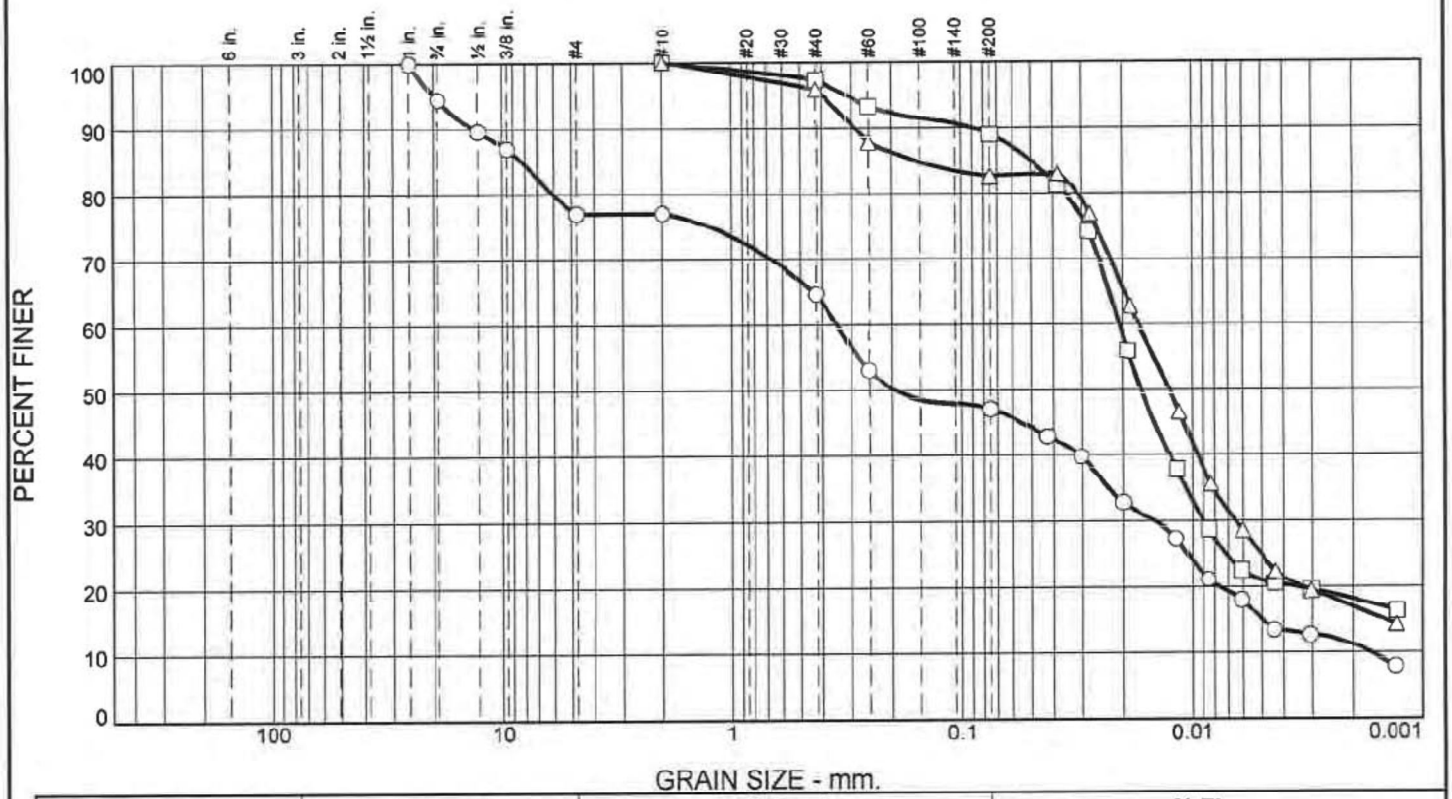
Jackson, Mississippi

Figure 21

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	5.5	17.4	0.0	12.4	17.6	32.0	15.1
□	0.0	0.0	0.0	0.0	2.6	8.5	67.8	21.1
△	0.0	0.0	0.0	0.0	4.1	13.4	57.6	24.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			8.2620	0.3459	0.1938	0.0146	0.0050	0.0017	0.37	207.53
□			0.0500	0.0206	0.0166	0.0090				
△			0.1605	0.0171	0.0125	0.0065	0.0014			

	Material Description	USCS	AASHTO
○			
□			
△			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source of Sample:** Hole10 **Depth:** 10-16 **Sample Number:** H10 S5-7

□ **Source of Sample:** Hole10 **Depth:** 4-6 **Sample Number:** H10 S2

△ **Source of Sample:** Hole10 **Depth:** 8-10 **Sample Number:** H10 S4

Remarks:

○H10 S5-7 D10-16

□H10 S2 D4-6

△H10 S4 D8-10

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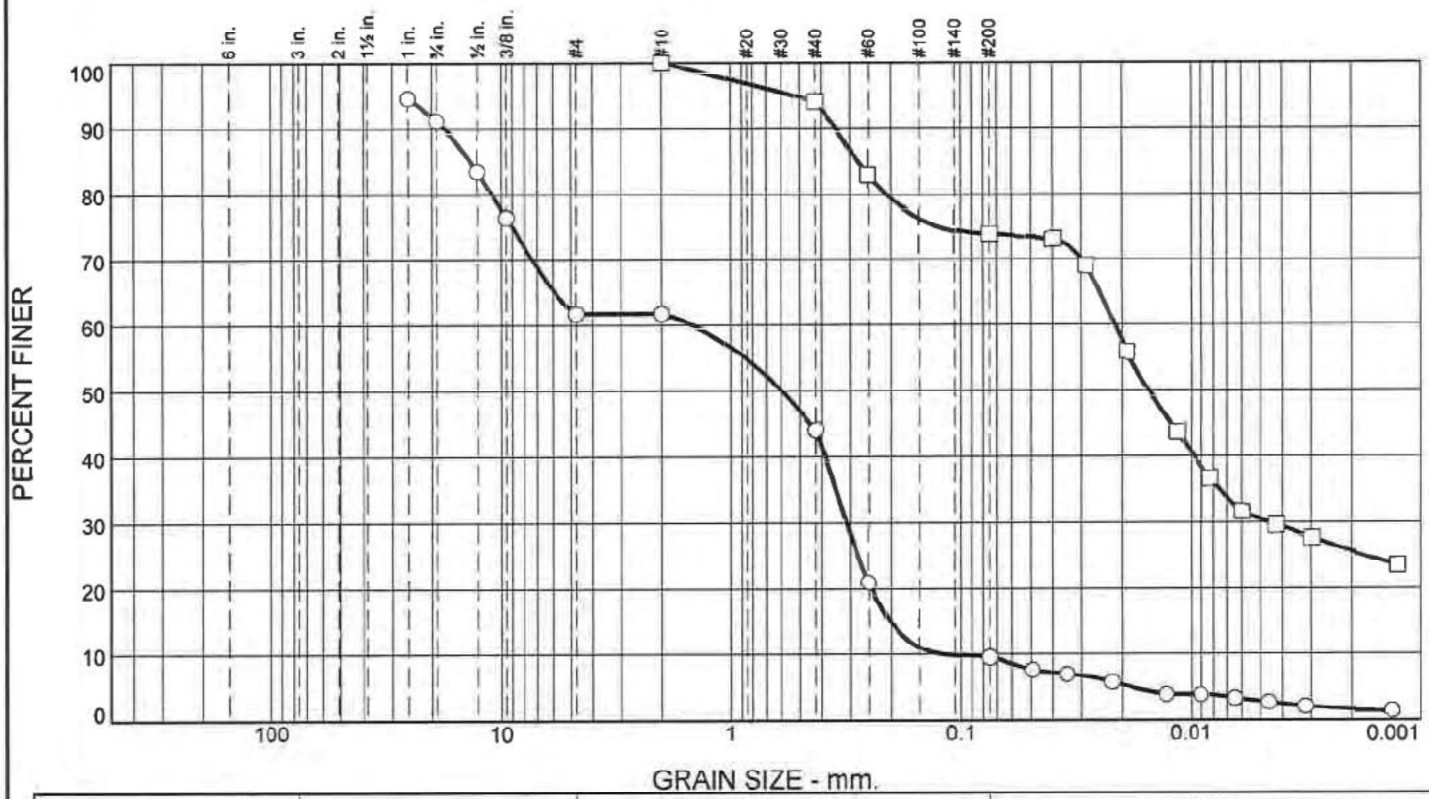
Figure 22

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○			29.5	0.0	17.5	34.7	6.7	2.8
□	0.0	0.0	0.0	0.0	5.9	20.2	43.5	30.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			13.5667	1.4649	0.5988	0.3103	0.2011	0.1212	0.54	12.08
□			0.2763	0.0215	0.0153	0.0046				

	Material Description	USCS	AASHTO
○			
□			

Project No. 503007/ **Client:** MDOT

Project: 18-43-1022 LINCOLN CO.

○ **Source:** HOLE11 **Depth:** 14-32 **Sample No.:** H11 S7-10

□ **Source of Sample:** HOLE11 **Depth:** 8-10 **Sample Number:** H11 S4

Remarks:

○H11 S7-10 D14-32

□H11 S4 D8-10

Mississippi Department of Transportation

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Figure 23

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)
BROOKHAVEN PROJECT OFFICE & OPEN EQUIPMENT SHED IN BROOKHAVEN, LINCOLN COUNTY, MISSISSIPPI

BWO-7145-43(001) 503007
BWO-7146-43(001) 503007
LWO-7067-43(002) 503007

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 preformed 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 Contractor Insurance Option Number 1: Bodily Injury & Property Damage (Combined Single Limit)	$500,000.00	Per Occurrence
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.

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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 to construct the Brookhaven Project Office Building and Open Equipment Shed in Brookhaven, Lincoln County, Mississippi. Separate Lump Sums as described in these Specifications and Drawings are to be given for each of the following separate descriptions:

1. Pay Item 907-242-A006 Construction of Project Office Building.
2. Pay Item 907-242-A006 Construction of Open Equipment Shed
3. Other Pay Items on Drawings Site Improvements.

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

C. Contractor's Duties:

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

9. Sub-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.
10. Coordination: The Contractor is responsible for the coordination of the total Project. All subcontractors will cooperate with the Contractor so as to facilitate the general progress of the Work. Each trade shall afford all other trades every reasonable opportunity for the installation of their Work. Refer to Section 01 31 00– Project Management & Coordination.

1.02 CONTRACTOR'S USE OF PREMISES

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

1. Law
2. Ordinances
3. Permits
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 CONSTRUCTION SEQUENCE

A. Submit an updated copy of Contractor's construction schedule (01 32 00) showing the sequence, commencement and completion dates, and move-in dates of Owner's personnel for all phases of the Work.

1.04 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.

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

B. 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. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. 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.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.06 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 in the existing building 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.

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

1.07 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 DEFINITIONS

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

1.03 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. Certificates and qualification data, where applicable or requested.
   g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. 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.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. 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.
m. 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.

1.04 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

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:

1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. 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 Supplementary Conditions 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, one by Civil Consultant, Structural Consultant, Mechanical / Electrical Consultants, one sent to Contract Administration for use in reviewing requests for Permission to Sub-Contract (CAD-720 Form), one sent to the Project Engineer, and 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:

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

E. Preparing Schedule of Unit Material Values:

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

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

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:

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

B. Preparation of Application:

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

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

D. Substantiating Data:

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

1.05 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 for the construction in District Seven. The Work includes Project Office Building and Open Equipment Shed in Brookhaven, Lincoln County, Mississippi. The Contract Sum shall be full compensation for all site work, for furnishing all materials, and all other Work and effort of whatever nature in the construction of the buildings, installation of underground and other equipment, and final clean-up of the area. It shall also be complete compensation for all equipment, tools, labor, and incidentals necessary to complete the Work.

B. Payment will be made under:

1.	Description A: MDOT Project No. BWO-7145-43(001) 503007 Project Office Building In Brookhaven, Lincoln County	lump sum
2.	Description B MDOT Project No. BWO-7146-43(001) 503007 Open Equipment Shed in Brookhaven, Lincoln County	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. Scope: 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: Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.02 DEFINITIONS

A. RFI: Request from Project Engineer, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.03 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.

1.04 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.

1.05 COORDINATION AND PROJECT CONDITIONS

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

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

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

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

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

1.06 SUBCONTRACTOR'S DUTIES

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

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

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

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

1.07 REQUESTS FOR INFORMATION (RFIs)

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.

1.08 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, MDOT Architect**,** and Owner's Commissioning Authority 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. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

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

D. 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.

E. 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.

2.02 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 3 - EXECUTION

3.01 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.

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

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.

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

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. Name of photographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date photograph was taken.
   f. Description of vantage point, indicating location, direction (by compass point), and elevation of construction.
   g. Unique sequential identifier keyed to accompanying key plan.

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.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

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

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Project Engineer / MDOT Architect.

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

D. Project Engineer /MDOT Architect -Directed 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. Refer to Section 01 25 00 – Substitution Procedures and Section 01 60 00 – Product Requirements, for requirements concerning products that will be acceptable on this Project.

C. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
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 submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require MDOT Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require MDOT Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.03 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.

1.04 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.
    a. 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, as follows. 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 Architect.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.
        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

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 and address of Architect.
      6) Name of Contractor.
      7) Name of firm or entity that prepared submittal.
      8) Names of subcontractor, manufacturer, and supplier.
      9) Category and type of submittal.
      10) Submittal purpose and description.
      11) Specification Section number and title.
      12) Specification paragraph number or drawing designation and generic name for each of multiple items.
      13) Drawing number and detail references, as appropriate.
      14) Transmittal number**,** numbered consecutively.
      15) Submittal and transmittal distribution record.
      16) Remarks.
      17) Signature of transmitter.
      18) 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 following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.

d. Name of Contractor.
e. Name of firm or entity that prepared submittal.
f. Names of subcontractor, manufacturer, and supplier.
g. Category and type of submittal.
h. Submittal purpose and description.
i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number**,** numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Remarks.

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, Commissioning Authority’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 ten paper (required for all submittals over 11 by 17 inches in size) copies of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return four copies, 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 documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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 ten paper copies of each submittal with additional number of copies, if required, by Contractor for distribution. MDOT Architect will return four 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. Include the following information in tabular form:

1. Submit product schedule in the following format:
   a. PDF Electronic pdf file for sheets less than 11 by 17 inches.
   b. Four paper copies (for sheets larger than 11 by 17 inches) of product schedule or list unless otherwise indicated. Architect will return two copies.

G. Coordination Drawings Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

H. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

I. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures.

J. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

K. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

L. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

M. 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.

N. 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.

O. 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.

P. 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.

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

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

S. 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.

T. 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.

U. 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.

V. Schedule of Tests and Inspections: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

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

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

Y. 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.

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

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. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. 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.

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

E. 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.

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

G. 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 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, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

C. MDOT will provide the following inspections, sampling and testing at no cost to the Contractor:

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

D. The Contractor shall provide and pay for all other required inspection, sampling and testing.

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. 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.
2. 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 and Commissioning Authority'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 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: 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.

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)
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.
CFSEI	Cold-Formed Steel Engineers Institute; www.cfsei.org.
CGA	Compressed Gas Association; www.cganet.com.
CIMA	Cellulose Insulation Manufacturers Association; www.cellulose.org.
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).
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.
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.
PDI	Plumbing & Drainage Institute; www.pdionline.org.
RFCI	Resilient Floor Covering Institute; www.rfci.com
SDI	Steel Door Institute; www.steeldoor.org.
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
SPIB	Southern Pine Inspection Bureau; www.spib.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.

C. 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.

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.

D. 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.

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.

E. 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.

CFR	Code of Federal Regulations;

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 45 23 TESTING AND INSPECTION SERVICES - CONTRACTOR

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Laboratory selection and payment.
2. Laboratory duties.
3. Contractor's responsibilities.

B. Related Requirements:

1. Individual specifications sections contain specific tests and inspections to be preformed.
2. Section 01 45 29 – Testing Laboratory Services – MDOT.

1.02 REFERENCES

A. ASTM International (ASTM):

1. D3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.
2. E329 - Standard Specification for Agencies Engaged in Construction Inspection and / or Testing.
3. E543 - Standard Specification for Agencies Performing Nondestructive Testing.

1.03 QUALITY ASSURANCE

A. Employment of Testing Laboratory shall in no way relieve Contractor of his obligations to perform work in accordance with Contract Documents.

B. Contractor shall employ and pay for services of an independent testing laboratory to perform specified testing and inspection.

C. Refer to the Conditions of the Contract for provisions related to special inspections and testing.

D. Qualifications of Laboratory:

1. Meet requirements of ASTM D3666, E329, and E543.
2. Authorized to operate in State of Mississippi

1.04 LABORATORY DUTIES

A. Cooperate with Project Engineer, Architect and Contractor; provide qualified personnel after due notice.

B. Perform specified inspections, sampling, and testing of materials and methods of construction.

1. Comply with specified standards.
2. Ascertain compliance or noncompliance of materials with requirements of Contract Documents.

C. Promptly notify Project Engineer, MDOT Architect, Architect and Contractor of observed irregularities or deficiencies of Work or products.

D. Promptly submit written report of each test and inspection; submit electronically in Adobe PDF format to Project Engineer, Architect, MDOT Architect and Contractor.

E. Each report to include:

1. Date issued.
2. Project title and number.
3. Testing Laboratory name, address, and telephone number.
4. Name of Inspector and signature of individual in charge.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in project.
10. Type of inspection or test.
11. Results of tests and compliance or noncompliance with Contract Documents.
12. Interpretation of test results when requested by Project Engineer, MDOT Architect, Architect or Contractor.

F. Perform additional tests when required by Project Engineer, MDOT Architect, Architect or Contractor.

G. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of work.
3. Perform duties of Contractor.

1.05 CONTRACTOR’S RESPONSIBILITIES

A. Cooperate with Laboratory personnel, provide access to Work, and to manufacturer's operations.

B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.

C. Furnish copies of product test reports as required.

D. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For safe storage and curing of test samples.

E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

F. Make arrangements with Laboratory and pay for additional samples and tests required for Contractor's convenience.

G. When tests or inspections cannot be performed after such notice, reimburse Owner for Laboratory personnel and travel expenses incurred due to Contractor's negligence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 45 29 TESTING AND INSPECTION SERVICES - MDOT

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: The Contractor shall use testing laboratory services of the Mississippi Department of Transportation for all testing required in this Section. These services will be provided to the Contractor by the MDOT at no charge. Use of said services shall in no way relieve the Contractor of his obligation to perform Work in accordance with the Contract. Refer to Section 01 45 23 Testing and Inspection Services – Contractor for additional testing and inspection services required to be provided by the Contractor

B. Inspection, Sampling and Testing are required for:

1. Section 31 23 12, Excavation, Fill and Grading.
2. Section 03 20 00, Concrete Reinforcing.
3. Section03 30 00, Cast-In-Place Concrete.

1.02 LABORATORY'S DUTIES

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

B. Prepare reports of inspections and tests including:

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

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

1.03 CONTRACTOR'S RESPONSIBILITIES

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

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

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

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

1.04 MATERIAL CERTIFICATIONS AND CERTIFIED TEST REPORTS

A. All certifications shall meet the following requirements:

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection 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, MDOT Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service: Provide water and sewer service with account placed in Owner's Name. . Water 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: Provide electric power service with account placed in Owner's Name. Electric power 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 is 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.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary 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 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. Sanitary Facilities: 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.

E. 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.

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

G. 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.

H. 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.

I. 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. 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.

C. Project Signs: Unauthorized signs are not permitted.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

E. 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.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

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

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

I. 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.

J. 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 Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial 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 weathertight 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, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

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. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. 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.
3. Section 07 84 00 "Firestopping" for patching penetrations in fire-rated construction.

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. 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.

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

C. 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.

D. 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.

E. 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.

F. 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 Final 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 Final 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 Substantial 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. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
2. Section 31 23 11 "Excavation, Fill and Grading for Building" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

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. 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.

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, and waste reduction work plan.

B. Waste Reduction Work Plan: List each type of waste and whether it will be recycled, or disposed of in landfill or incinerator.

1. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
2. 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 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.

3.04 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 and Commissioning Authority will return one copy with comments.

1. Correct or revise each manual to comply with MDOT Architect's and Commissioning Authority's comments. Submit two copies of each corrected manual within 15 days of receipt of MDOT Architect's and Commissioning Authority'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. Name and contact information for Architect.
7. Name and contact information for Commissioning Authority.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. 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.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training 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.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. 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. The Government's facility staff (as well as occupants and service Subcontractors as needed), shall receive orientation and training on features, systems and equipment in this facility requisite with the complexity and criticality of the system and the Government needs.

1.02 EQUIPMENT-SPECIFIC REQUIREMENTS

A. Additional training requirements may be found in specific equipment specification sections.

PART 2 - PRODUCTS

2.01 VIDEO RECORDING

A. The Subcontractor shall video record selected trainings, including audio, according to the following schedule:

1. HVAC and Controls: 16 hours
2. Plumbing: 4 hours
3. Electrical: 4 hours
4. Life Safety: 2 hours

B. Which portions of which training sessions are video recorded shall be at the discretion of the Commissioning Authority and Government.

C. An introduction shall be made at the beginning of each recording, identifying what equipment is being illustrated, where it is located and who the trainer is.

D. Recording shall be accomplished with a tripod when possible and performed in an expert manner so that the issues discussed are clearly illustrated and instructions clearly audible. A high quality camera shall be used and additional light provided if ambient light is insufficient.

E. Media shall be clearly labeled with the equipment, date, trainer and segment duration.

F. Recording shall be in video tape format.

1. For larger equipment, not more than one training session shall be put on a single tape. Not more than three pieces of equipment shall be on any single tape, even if the tape is not filled. Small camera sized tapes are acceptable as the final submittal, if a standard VHS adapter tape is provided.

G. Provide an additional copy in digital recording format.

1. The digital recording shall be bookmarked for each training session with an index/table of contents provided and recorded on the CD/DVD. The bookmarks will clearly indicate which equipment is being presented and the format will allow search and go-to functions for rapidly locating training segments.

H. An original and one copy of the recordings shall be submitted to the Government.

PART 3 - EXECUTION

3.01 GENERAL RESPONSIBILITIES

A. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed on all equipment per the Specifications.

B. The Commissioning Authority will be responsible for coordinating and approving the content and adequacy of the training of Government personnel for commissioned equipment.

1. The Commissioning Authority will develop an overall recommended training summary after meeting with the Government and appropriate facility staff to determine needs and areas of emphasis for this project.
2. The Commissioning Authority will develop criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The Commissioning Authority recommends approval of the training to the Government Construction Administrator.
3. At one of the training sessions, the Commissioning Authority will present a brief presentation discussing the use of the Systems Manual and the blank functional test forms for re-commissioning equipment.

C. Training shall consist of, as needed and at the discretion of the Government and Commissioning Authority, the installing technician, installing Subcontractor and the appropriate trade or manufacturer's representative on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment as installed in this project are required. More than one party will be required to execute the training on primary equipment.

D. The controls Subcontractor shall attend and present at sessions in addition to the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

E. The mechanical and electrical design engineer and Architect, or the Commissioning Authority, may attend the first training session for each of the main or special systems and assemblies and present the overall system design. This presentation will include a review of all systems using the simplified system schematics (one-line drawings).

F. Unless otherwise required or approved, the training shall be given during regular business hours during a regular work week.

3.02 TRAINING AGENDAS

A. For each piece of equipment or system a written training agenda will be provided by the respective Subcontractor. The generic agenda has been provided for typical equipment at the end of this Section. A similar, but more in-depth agenda will be provided prior to training, for the controls system. The agenda shall cover the following elements:

1. Equipment (included in training).
2. Intended audience.
3. Location of training.
4. Objectives.

5. Subjects covered (description, duration of discussion, special methods, etc.).
6. Duration of training on each subject.
7. Instructor for each subject.
8. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.).
9. Instructor and qualifications.

3.03 TRAINING PROCESS AND CONTENT

A. The Training Process Shall:

1. As appropriate, normally start with classroom-type sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
2. During any demonstration, should the system fail to perform in accordance with the requirements of the operation and maintenance (O&M) manuals or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
3. Follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

B. Training Shall Include the Following:

1. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
2. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover, as applicable, and any emergency procedures.
3. The mechanical Subcontractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
4. Discussion of relevant health and safety issues and concerns.
5. Discussion of warranties and guarantees.
6. Common troubleshooting and maintenance issues, problems and solutions.
7. Explanatory information included in the O&M manuals and the location of all related plans and manuals in the facility.
8. Discussion of any peculiarities of equipment installation or operation.
9. The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1 is recommended, as applicable.
10. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
11. Training shall occur after functional testing and piping and equipment labeling are complete unless approved otherwise by the Government Project Manager.

3.04 DURATION OF TRAINING

A. The subcontractor shall provide training on each piece of equipment according to the following schedule. The subcontractor shall provide training and orientation for other equipment installed on the project not listed here.

Training Schedule	**Hours**
Mechanical Support Systems	
Air Handling Units	2
Variable frequency drives	2
Chillers	2
Boilers	2
Controls	8
Restroom exhaust system	0.5
Misc. exhaust fans	0.5

Plumbing	
Domestic water system	1
Domestic water heating system (heaters, circulation pumps, mixing valves)	2
Sump pumps	1
Fire protection	2
Emergency eyewashes and safety showers	1

Electrical	
Wiring devices (switches and outlets)	0.5
Lighting controls	1
Variable frequency drives	2
Transformers	1
Switchgear	1
Ground fault and secondary grounding	1
Fire alarm	2

3.05 SPECIAL RESPONSIBILITIES

A. HVAC Controls: The SUBCONTRACTOR shall have the following special training responsibilities relative to the HVAC control systems:

1. For the primary HVAC equipment, the controls Subcontractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
2. The standard operating manual for the system and any special training manuals shall be provided for and retained by each trainee. In addition, the system technical manual shall be demonstrated during training. Manuals shall include detailed description of the subject matter for each session. The manuals shall cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays. Manuals will be approved by the Commissioning Authority.
3. The trainings will be tailored to the needs and skill-level of the trainees and be oriented to the specific system installed in this project.
4. The trainers shall be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) shall be used. The Government shall approve the instructor prior to scheduling the training.
5. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated.
6. There shall be three training sessions:
   a. Training I - Control System: The first training shall be 4 hours in length. This training may be held on-site. Upon completion, each trainee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system. The number of trainees for Training I shall be 8, conducted in two separate sessions of 4 hours each. The Controls Subcontractor shall provide 3 laptops for the training duration plus the permanent work station, all with network connections and the controls operating system installed and functioning for this building in the training room for use by the trainees.
   b. Training II - Building Systems: The second session shall be held on-site for a period of 4 hours of actual hands-on training after the completion of system commissioning. The number of trainees for Training II shall be 3, conducted in two separate sessions of 2 hours each. The Controls Subcontractor shall provide 3 laptops for the training duration plus the permanent work station, all with network connections and the controls operating system installed and functioning for this building in the training room for use by the trainees. The session shall include instruction on:
      1) A review of the as-built drawings and O&M manuals, a walk-through of the facility to identify control panels and device locations.
      2) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

3) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
4) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
5) Every screen shall be completely discussed, allowing time for questions.
6) Use of keypad or plug-in laptop computer at the zone level.
7) Use of remote access to the system via phone lines or networks.
8) Setting up and changing an air terminal unit controller.
9) Graphics generation.
10) Point database entry and modifications.
11) Understanding FMCS field panel operating programming (when applicable).

c. Training III - Deferred On-Site: The third training will be conducted on-site 6 months after occupancy and consist of eight (8) hours of training in one session. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the systems.

TRAINING AGENDA and Sign-Off

Project:_____ Date:_____

Equipment / System:_____ Hours Required:_____

Spec Section:

1. Audience and General Scope
[Government and/or Commissioning Authority to fill out the following box.]

Intended audience type (enter number of staff): __facility manager, __facility engineer, __facility technician, __project manager, __tenant, __other:_____

General objectives and scope of training: (check only one)

___ A. Provide only an overview of the purpose and operation of this equipment, including required interactions of trainees with the equipment.

___ B. Provide an overview plus technical information of the purpose, operation and maintenance at an intermediate level, expecting that serious malfunctions will be addressed by factory reps.

___ C. Provide an overview plus technical information (purpose, operation, troubleshooting and maintenance) at a very detailed level, expecting that almost all operation, service and repair will be provided by the trainees.

2. Instructors [Trainer fills out this section: ___prior to training & submits to CA, ___after training.]

ID	Trainer	Company	Position
1)	_____	_____	
2)	_____	_____	
3)	_____	_____	

3. Agenda

__The responsible Subcontractors have their trainers fill out this section prior to conducting training and submit to the commissioning authority for approval, OR

__The Government and commissioning authority fill out this section prior to training and submit to Subcontractor for their use, OR

__This section is left blank until the training and the trainer fills it in as a record of what was covered in the training.

Training Date: _____

Agenda of general subjects covered

Duration	Instructor	Completed
(All subjects will be covered)		(√ when completed)

OVERVIEW

- Reason for system selection, layout and general purpose, unique features, general interactions with other systems, special O&M issues

_____ _____ _____

CONTROLS

- Integral controls (packaged): programming, troubleshooting, alarms

_____ _____ _____

- Review of control drawings (have copies for attendees) __A, __B

_____ _____ _____

- Building automation controls (BAS): programming, troubleshooting, alarms, manual operation, interface with integral controls) __A, __B

_____ _____ _____

A: This training to be done during equipment training. B: This training to be done during central BAS training.

OPERATION (describe and <u>demonstrate)</u>

_____ _____ _____

- Startup, loading, normal operation, unloading, shutdown, unoccupied operation, seasonal changeover, manual operation, etc., as applicable
- Interactions with other systems, operation during power outage and fire
- Relevant health and safety issues concerns and special safety features
- Energy conserving operation and strategies (if applicable)

TROUBLESHOOTING

_____ _____ _____

- Common troubleshooting issues and methods, control system warnings and error messages, including using the control system for diagnostics

MAINTENANCE

_____ _____ _____

- Service, maintenance, and preventative maintenance (sources, spare parts inventory, special tools, etc.)
- For associated piping and ducting, describe layout, location of isolation valves, zone dampers for handling leaks and repairs, etc.
- Any special issues to maintain warranty
- Special requirements of tenants for this equipment's function

QUESTION AND ANSWER PERIOD

_____ _____ _____

<u>Other subjects covered:</u>

_____

_____ _____ _____

Total duration of training (hrs) ----------> ☐

Video-taping. __Training shall be video recorded with audio, __digitally, __taped, __by Subcontractor, __by others, with copies provided to Government.

Training methods that will be included (clarify as needed): (Trainer checks all that apply)

__√__ Use of the O&M manuals, illustrating where the verbal training information is found in writing

__√__ Each attendee will be provided: 1) the control drawing schematic and sequence of operations;

2) a copy of this agenda.

__√__ Site demonstration of equipment operation

___Written handouts

___Manufacturer training manuals

___Classroom lecture

___Video presentation

4. Record of Training

Date(s) of Training: _____ Hours Spent: _____

Trainers:

_____

Attendees

Printed Name	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

END OF SECTION

SECTION 01 91 00 COMMISSIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. General provisions and mechanical and electrical systems are specified in Divisions 01, 07, 08, 22, 23, and 26. Other divisions may be required to participate in the commissioning process.

B. These Division(s) covers the commissioning of mechanical, electrical, building envelope, plumbing, pipe sprinkler, openings, and masonry systems

C. Commissioning is the systematic process of ensuring that all building mechanical and electrical systems perform interactively according to the Owner's project requirements and the operational requirements specified in other Divisions. The Commissioning Authority shall inspect the installation and coordinate equipment start-up, system performance, testing, adjusting and balancing, control system calibration, construction and system documentation, and Owner training.

D. Specific requirements of the commissioning process and responsibilities, duties, and obligations of the Commissioning Authority are described in this Section. To accomplish these duties, the Commissioning Authority shall coordinate his activities with other entities.

1.02 REFERENCES

A. ASHRAE Guideline 0-2005, The Commissioning Process.

B. ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process.

C. Building Commissioning Association Ductwork Construction Checklist.

D. NIBS 3-2006 “Exterior Enclosure Technical Requirements for the Commissioning Process”.

1.03 DEFINITIONS

A. The following terms are used in this Section:

1. Acceptance phase - phase of construction after initial start-up and check-out when functional testing, operational training, and operating and maintenance documentation development and review occurs.

2. Basis of design - the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the Owner's project requirements. The basis of design describes the intent of the project and the systems, components, conditions, and methods chosen to meet the Owner's project requirements.
3. Commissioning Authority - an independent entity not otherwise associated with the Contractor. The Commissioning Authority directs and coordinates the day-to-day commissioning activities. The Commissioning Authority does not have a construction oversight role.
4. Commissioning plan - an overall plan that provides the structure, schedule, and coordination planning for the commissioning process.
5. Commissioning team - the group responsible for accomplishing the commissioning process.
6. Data logging -monitoring flows, currents, status, and pressures of equipment using stand-alone recording equipment, separate from the control system. Additional monitoring may be provided through the capabilities of the control system.
7. Deferred functional tests - functional tests that are performed after the date of substantial completion due to partial occupancy, equipment and seasonal testing requirements, design, or other site conditions that do not allow meaningful testing of a system or piece of equipment during the normal commissioning sequence.
8. Owner's project requirements - a dynamic document prepared by the Owner that provides the explanation of the ideas, concepts and criteria that are considered to be critical to the Owner’s expectations. It is initially the outcome of the programming and conceptual design phases.
9. Factory testing - testing of equipment at the factory (or on-site) by factory personnel with an Owner’s representative present.
10. Functional tests - tests of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chilled water pump is tested interactively with the chiller functions to determine if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied modes, varying outside air temperatures, fire alarm modes, and power failure. The systems are run through the control system’s sequences of operation and components are verified to respond properly. The Commissioning Authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is performed by the Contractor. Functional tests are performed after prefunctional checklists and start-up is complete.
11. Indirect indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.
12. Manual tests - using hand-held instruments, immediate control system read-outs or direct observation to verify performance (as opposed to analyzing monitored data taken over time to make the “observation”).
13. Monitoring - the recording of parameters (flow, current, status, or pressure) of equipment operation using data loggers or the trending capabilities of control systems.

14. Over-written value – manually overriding a sensor value in the control system to determine the response of a system (e.g., changing the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation). Also see "Simulated Signal."
15. Owner-contracted tests - tests paid for by the Owner which the Commissioning Authority does not oversee. These tests are not repeated during functional testing if properly documented.
16. Phased commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
17. Pre-functional checklists - lists of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the Contractor to the Commissioning Authority. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gauges in place, sensors calibrated). However, some prefunctional checklist items may entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a 3-phase pump motor). The word prefunctional refers to testing to be accomplished prior to the formal functional testing of the installed equipment. Prefunctional checklists augment and are often combined with the manufacturer's start-up checklist. For most equipment, the Contractor will execute the checklists.
18. Retesting – testing due to the failure of a component or system due to part failure, incorrect installation, etc.
19. Sampling - functional testing of only a fraction of the total number of identical or near identical pieces of equipment.
20. Simulated condition – a condition that is artificially created for the purpose of testing the response of a system (e.g., applying a hair dryer to a space temperature sensor to determine the response of a variable volume terminal unit).
21. Simulated signal - disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and control system to simulate a sensor value.
22. Start-up - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.
23. Test, adjust, and balance - the process of measuring the actual flows of the air and hydronic systems, adjusting these flows to the values required by the construction documents, and documenting the results.
24. Trending -monitoring of equipment performance over a period of time, using data logging equipment or the building control system.

1.04 QUALITY ASSURANCE

A. Supervision, coordination, and documentation of the commissioning process shall be the direct responsibility of the Commissioning Authority, who shall work under the direct supervision of a licensed professional engineer or a certified member of the Building Commissioning Association, and have a minimum of 10 years experience in the design and/or construction of mechanical and electrical systems, or of automated building control systems. The Commissioning Authority shall become familiar with the Owner's project requirements and the basis of design documentation, and project documents, and shall assume responsibility for the overall system commissioning effort.

1.05 COORDINATION

A. The Commissioning Authority shall be hired by the Owner. The Commissioning Authority shall direct and coordinate the activities of the commissioning team.

B. The commissioning team shall consist of the Owner, Design Team, Commissioning Authority, Contractor, and associated subcontractors. The Contractor and Subcontractors shall appoint employees with the required experience and skill sets to work with the Commissioning Authority to demonstrate the required sequences of operation of the systems being commissioned.

C. Scheduling: the Commissioning Authority shall schedule the commissioning activities of the Project and shall coordinate this schedule with the Contractor.

1.06 COMMISSIONING PROCESS

A. The primary role of the Commissioning Authority shall be to develop and coordinate the execution of a commissioning plan; observe and document the installation, check-out, start-up, and testing of equipment and systems to establish that they are functioning in accordance with the requirements of the construction documents; and to assist in developing correct and complete documentation of the construction effort. The Commissioning Authority SHALL NOT be responsible for design concept, design criteria, compliance with codes, design, construction scheduling, cost estimating, construction management, or construction supervision. The Commissioning Authority may assist the Design Team with problem-solving, or the Contractor with the correction of non-conformance items or deficiencies. The Commissioning Authority is not responsible for providing tools required to start, check-out and perform functional tests of equipment and systems.

B. Design Phase: Ensure that the Project requirements are met and achieve the following specific objectives by date of substantial completion:

1. Review the contract documents for ability to commission, maintain, and service components and systems.
2. Provide comments and suggestion regarding ability to commission to the owner and the design team for incorporation into an addendum.

C. Construction phase: ensure that the Project requirements, as defined by the construction documents, are met, and achieve the following specific objectives:

1. Within 60 days of receipt of contract or purchase order: schedule, plan, and conduct a commissioning scoping meeting to review the commissioning process and the draft commissioning plan and schedule with the commissioning team. With the input of the commissioning team, revise the draft commissioning plan and develop the working commissioning schedule.
2. Coordinate and direct the commissioning activities in a logical, sequential, and efficient manner using centralized documentation, periodic communications, and consultations with the commissioning team. Schedule additional commissioning meetings to plan, scope, coordinate, schedule future activities, and resolve problems throughout construction. Commissioning meetings shall initially be scheduled monthly until prefunctional testing of equipment and systems begins, and weekly thereafter. Record and distribute the meeting minutes for commissioning meetings. Meetings may be held electronically by teleconferencing and reports will be distributed electronically via email.
3. Be responsible for the continuous updating, maintenance, revision, and coordination of the commissioning activities as construction progresses, coordinate the commissioning work, and, with the Contractor, ensure that commissioning activities are included in the master project schedule.
4. Review submittals applicable to systems being commissioned, including the Contractor’s proposed detailed start-up procedures, concurrent with the Engineer's reviews and provide comments to the Engineer and the Owner. The review shall be for compliance with commissioning needs, and to aid in the development of functional testing procedures and only secondarily to review for compliance with equipment specifications.
5. Request and review additional information as required to perform the assigned commissioning tasks, including review of operations and maintenance materials and Contractor start-up and check-out procedures. Incorporate into the documents checks for system maintainability and serviceability, and inspect for installation supporting, and not interfering with these requirements.
6. Develop specific functional test procedures and forms to document the proper operation, of each piece of equipment and system. Submit the proposed functional tests to the Architect for review and approval, and provide a copy of the proposed functional test procedures to the Contractor who shall review the proposed tests for feasibility, safety, and equipment warranty protection. Required performance testing may include control system trending, stand-alone data logger monitoring, and/or manual logging of system operation to demonstrate proper operation.
7. Functional test forms shall include (but not be limited to) the following information:
    a. Date
    b. Project name
    c. System and equipment or component name(s)
    d. Equipment location and identification number
    e. Unique test identification number and reference to unique prefunctional checklist and start-up documentation identification numbers for the piece of equipment
    f. Participating parties

g. A reference to the specification describing the specific sequence of operations or
h. Required pre-test field measurements
i. Specific step-by-step procedures to execute the test, in a clear, sequential, and repeatable format
j. Acceptance criteria of proper performance with provisions for clearly indicating whether or not proper performance of each part of the test was achieved
k. A section for comments
l. A signature and date block for the Commissioning Authority and participating parties

8. Review the Contractor's start-up and prefunctional testing reports and provide on-site observation of start-up and prefunctional testing as specified herein.
9. Review the proposed testing, adjusting, and balancing execution plan for completeness and requirements of the commissioning process and provide comments to the Contractor, Engineer, and Owner.
10. Perform site visits as required until prefunctional testing of equipment and systems begins, then as needed through the completion of the Project, to review component and system installations. Concurrently, schedule and conduct commissioning planning and coordination meetings to review the construction progress and to assist in resolving discrepancies or issues relating to the commissioning process. Include the owner's maintenance staff in as many meetings and inspections as possible.

E. Acceptance phase: demonstrate that the performance of the equipment and systems installed during the construction phase meets the requirements of the construction documents. Notify the Owner and Architect of deficiencies in results or procedures.

F. Commissioning activity shall achieve the following specific objectives:

1. Witness 10 percent of the HVAC piping testing and flushing procedures.
2. Witness 10 - 20 percent of the prefunctional test procedures for each type and/or size of equipment. If issues are discovered with the installation the installer shall correct the issues, and after the installer has re-inspected the systems, 25 percent of the systems shall be checked by the CxA. If 10 percent of the re-checked systems are discovered to have issues, all 100 percent of the systems will be re-inspected and the installing contractor shall bear the cost for the re-inspection.
3. After the Test, Adjust, and Balance has been completed, witness 10 - 25 percent of the functional test procedures for each type and/or size of equipment. If issues are discovered with the installation the installer shall correct the issues, and after the installer has re-inspected the systems, 25 percent of the systems shall be checked by the CxA. If 10 percent of the re-checked systems are discovered to have issues, all 100 percent of the systems will be re-inspected and the contractor shall bear the cost for the re-inspection.
4. Witness the testing and adjusting of any boilers by the factory representative.
5. Oversee the check-out, calibration, and functional testing of the control system and approve it for use for the testing, adjusting, and balancing effort before the test and balance procedures begin.

6. Oversee at least 10 percent of the test, adjust, and balance process by observing, at a minimum, the first test of each system type (e.g., air handling units, diffusers and grilles, terminal units, pumps), and spot testing a minimum of 10 percent of all TAB readings. Test subsequent equipment, sufficient to be confident that proper procedures were followed, and review of the Contractor's completed reports.
7. Coordinate, witness, and approve functional tests of equipment and systems performed by the Contractor. Review functional test reports and analyze any trend logs, data logger reports, and other monitoring data to evaluate equipment and system performance. Document the performance of the functional testing and provide a comparison to the required performance, as defined by the construction documents.
8. Coordinate retesting as necessary until satisfactory performance is demonstrated.
9. Maintain a master deficiency and resolution log and a separate testing record and provide written progress reports and test results with recommended corrective actions for observed deficiencies.
10. Compile and submit a commissioning report to the Owner and Architect documenting the results of the start-up, prefunctional testing, and functional testing.
11. Review the Contractor's proposed training of the Owner's operating personnel, and provide comments to the Architect and Owner.
12. Coordinate the Contractor-provided training sessions. Verify that the approved training has been properly completed.

G. Warranty period: assist the Owner in identifying defects in the installed equipment or system operation and in accomplishing the following specific objectives:

1. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
2. Verify that warranty items have been corrected properly.
3. Coordinate and supervise required seasonal or deferred testing and deficiency corrections, as specified or required by the commissioning plan.
4. Return to the site, approximately 10 months into the warranty period and review with the Owner the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Assist the Owner in reviewing the failure and repair records of equipment during the warranty period and in the evaluation of the Contractor's corrective actions. Identify areas that may come under warranty or under the original construction contract. Interview the Owner and identify problems or concerns regarding operating the building as originally intended and shall make suggestions for improvements. Assist the Owner in developing reports, documents, and requests for services to remedy outstanding problems.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Data logging equipment, monitoring devices, specialized equipment, and software not specified in other Divisions to be provided by the Contractor, and provided by the Commissioning Authority to monitor, confirm, or verify the Contractor's testing procedures shall remain the property of the Commissioning Authority.

B. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request.

1. Temperature sensors and digital thermometers shall have a certified calibration within the past 12 months and a resolution of plus or miss 0.1 degree F. Accuracy of temperature test equipment shall be at least twice that of the instrumentation being tested.
2. Humidity sensors shall have a certified calibration within the past 6 months and a resolution of plus or minus 1 percent. Accuracy of humidity test equipment shall be at least twice that of the instrumentation being tested.
3. Pressure sensors shall have a certified calibration within the 12 months and a resolution of 0.05 percent of sensor range. Accuracy of pressure test equipment shall be at least twice that of the instrumentation being tested.
4. Accuracy of other Commissioning Authority sensors shall be at least twice that of the installed sensors being tested.

PART 3 - EXECUTION

3.01 REPORTING

A. Provide regular reports to the Owner and members of the commissioning team as construction and commissioning progresses, keeping them apprised of commissioning progress and scheduling changes.

B. Provide periodic commissioning reports to the commissioning team beginning with the first site observations and continuing throughout the project duration. These reports shall include as a minimum the following:

1. List of upcoming commissioning activities, as noted on project schedule.
2. Copies of functional test requirements scheduled for the following 4 weeks.
3. A list of outstanding discrepancies and the party responsible for corrective action.

C. Provide a final commissioning report to the Owner. The final commissioning report shall contain at a minimum:

1. Copies of periodic commissioning reports.
2. Copies of prefunctional test reports.
3. Copies of functional test reports.
4. Copies of the training report.

D. Provide two copies of all reports to the following entities:

1. Owner
2. Program Manager
3. General Contractor
4. Any Subcontractor installing systems to be commissioned.

3.02 SYSTEMS TO BE COMMISSIONED

A. The following shall be commissioned if applicable:

1. HVAC Systems
2. Building Automation Systems
3. Building Envelope
4. Electrical Power Systems
5. Plumbing
6. Sprinkler System
7. Fire Alarm System

B. The following systems including all components and controls shall be commissioned in this project: in addition to those mentioned in 3.03.A. .

1. Mechanical Equipment and/or Systems:
   a. Air handlers
   b. Split system heat pumps
   c. Ductless split system heat pumps
   d. Finned water boilers
   e. Building pressurization
   f. Rotary screw chillers, air cooled packaged
   g. Fans
   h. Kitchen range hoods
   i. Make up air units
   j. Roof top air conditioning with gas heat and hot gas reheat w/ temp. & humidity control
   k. Pumps
   l. Variable speed drives
   m. Domestic water heating system
   n. Domestic water booster system
   o. Hydronic flow systems for building heating and cooling
   p. Electric unit heaters
   q. Building automation system
2. Electrical Equipment and/or Systems:
   a. Electrical distribution system
   b. Electrical switchboard
   c. Electrical switchgear
   d. Emergency power system
3. Specialty Equipment and/or Systems
   a. Fire and smoke alarm system including fireman’s control panel
   b. Fire protection system including fire pump

3.03 START-UP, PREFUNCTIONAL CHECKLISTS, AND INITIAL CHECK-OUT

A. Contractor shall be responsible for the initial check-out and prefunctional testing of installed equipment and systems. The Commissioning Authority shall monitor the activities of the parties responsible for executing the required start-up, and prefunctional testing, as identified in the commissioning plan. The Commissioning Authority shall review the Contractor-furnished documentation of the start-up, initial check-out, and prefunctional test procedures for equipment and systems to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Construction Contractor shall furnish Operation and Maintenance manuals, minus the as-built drawings and post occupancy controls software prior to the generation of the pre-functional testing documents.

B. Observe the first prefunctional test procedures for each type and size equipment to ensure that the approved procedures are being followed.

3.04 FUNCTIONAL TESTING

A. Functional testing of equipment or systems shall be conducted only after prefunctional testing and start-up has been satisfactorily completed. The Commissioning Agent (CxA) shall schedule functional tests with the Contractor, and shall direct, witness, and document the functional testing of equipment and systems to be commissioned. The Contractor shall be responsible for the execution of the functional tests and shall supply any test equipment required to prove the performance of the installed equipment.

B. The functional testing shall demonstrate that each item of equipment and each system are operating according to the requirements of the construction documents. Each item of equipment and system undergoing functional testing shall be operated through all modes of operation where there is a required system response. Verify each action required in the sequences of operation has been accomplished according to the requirements.

C. Functional testing shall proceed from components to subsystems to systems. When the proper performance of interacting individual systems has been achieved, the interface or coordinated responses between systems shall be tested.

D. The proper and accurate operation of the control system shall be proven by functional testing and approved by the Commissioning Authority before it may be used for testing, adjusting and balancing activities or to verify performance of other components or systems. If authorized by the Commissioning Authority, portions of the control system may be tested and approved for these uses before the functional testing of the entire system is completed.

E. Air and water balancing shall be completed and corrected as necessary before functional testing of air-related or water-related equipment or systems.

F. Test Methods:

1. Functional testing and verification shall be achieved by manual testing (direct manipulation of the equipment and observation of its response and performance) or by monitoring the performance using the control system's trend log capabilities or by stand-alone data loggers and analyzing the results. Functional test procedures shall specify which methods shall be used for each test. Determine which method is most appropriate for tests that do not have a method specified. The Commissioning Authority may substitute specified methods or require an additional method to be executed, other than that specified, if required to demonstrate the proper operation of the equipment or system being tested. Develop functional testing plans that define the allowable sampling procedures and that specify the procedures to be followed in the case of observed discrepancies or failures in the sample chosen for functional testing.
2. Sampling: multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy, as defined in the functional test procedures. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The following equipment serving individual suites may be sample tested: bathroom exhaust fans, VAV boxes, lighting controls.
3. If 10 percent of the identical pieces of equipment (size alone does not constitute a difference) fail to perform to the requirements of the construction documents (mechanically or substantively) due to manufacturing defects or application error not allowing it to meet its performance specification, identical units may be considered unacceptable by the Commissioning Authority. In such case, the Contractor shall provide the Commissioning Authority with the following:
   a. Within 1 week of notification from the Commissioning Authority, the Contractor or manufacturer's representative shall examine other identical units making a record of the findings. The findings shall be provided to the Commissioning Authority within 2 weeks of the original notice.
   b. Within 2 weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, and proposed solution, including full equipment submittals for corrective or replacement equipment, if appropriate. The proposed solutions shall meet the specified requirements of the original installation.
   c. The Commissioning Authority shall evaluate the proposed solution and submit his recommendation of approval or disapproval to the Owner and Architect.
   d. When approved, 2 examples of the proposed solution shall be installed by the Contractor and the Commissioning Authority shall schedule and conduct functional testing of the proposed solution. Upon completion of the functional testing of the proposed solution, the Commissioning Authority shall recommend the acceptance or disapproval of the proposed solution to the Owner. The Commissioning Authority shall provide a copy of his recommendations to the Architect.
   e. Upon acceptance of the proposed solution by the Owner, the Contractor shall replace or repair identical items and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within 2 weeks of approval of the proposed solution.

4. Ensure that each functional test is performed under conditions that simulate actual operating conditions as closely as is practically possible.
5. Simulation of operating conditions (not by an overwritten value) shall be allowed, at the Commissioning Authority's discretion, though timing the testing to experience actual conditions is encouraged wherever practical. Simulation of conditions shall be accomplished by subjecting the equipment to actual operating conditions by artificial means whenever possible.
6. Where actually achieving a simulated operating condition is impractical, as determined by the Commissioning Authority or identified in the functional test procedure, a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants shall be used instead of using the sensor to act as the signal generator via simulated conditions or overwritten values. Signal generators or simulators shall be provided by the Contractor.
7. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be different than it really is, shall be allowed when approved by the Commissioning Authority, but shall be used with caution and avoided when possible. Simulation of the operating condition is preferable.
8. Altering set points: rather than overwriting sensor values, and when simulating conditions is difficult, altering set points shall be used to test a sequence.
9. Indirect indicators: relying on indirect indicators for responses or performance shall be allowed only after the Commissioning Authority has visually and directly verified that the indirect readings represent actual conditions and responses over the range of the tested parameters.

G. During the functional testing process, recommend solutions to deficiencies found.

3.05 RETESTING OF EQUIPMENT AND/OR SYSTEMS

A. Prior to retesting of any functional performance test found to be deficient, submit the data indicating that the deficient items have been completed and/or corrected to the Commissioning Authority. After review of the submitted data, if the corrective measures are acceptable, the Commissioning Authority shall schedule and conduct a recheck. If during the retesting it becomes apparent that the deficient items have not been completed and/or corrected as indicated in the data provided by the Contractor, the retesting shall be stopped. Costs for the commissioning team to further supervise the retesting of a functional performance test shall be the responsibility of the Contractor.

3.06 DOCUMENTATION, NONCONFORMANCE, AND APPROVAL OF TESTS

A. Documentation: witness and document the results of functional tests using the specific procedural forms developed for that purpose. Deficiencies or nonconformance issues shall be noted and reported with the test results. Include the completed test forms in the final commissioning report.

B. As functional testing progresses and a deficiency is identified, discuss the issue and attempt to resolve the discrepancy with the Contractor.

1. When there is no dispute about the deficiency and the Contractor accepts responsibility for correcting it, document the deficiency and the Contractor's response and intentions and the testing shall proceed, if possible. Corrections of minor deficiencies identified may be made by the Contractor during the functional testing, at the discretion of the Commissioning Authority. In such cases the deficiency and resolution shall be documented on the functional test form. Every effort shall be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the commissioning effort. When the Commissioning Authority determines that the required corrective actions will delay the testing process, document the observed deficiency and the proposed corrective action on the functional test form.
2. When the identified deficiency is corrected, the Contractor shall sign the statement of correction at the bottom of the noncompliance form, certifying that the equipment is ready to be retested, and return the form to the Commissioning Authority. The Commissioning Authority shall schedule the retest of the equipment or system involved.
3. If there is a dispute about an identified deficiency, document the deficiency and the Contractor's response, and submit the noncompliance report to the Owner and Architect, with a copy furnished to the Contractor. Every attempt shall be made to resolve the dispute at the lowest management level possible. Other parties shall be brought into the discussions by the Commissioning Authority, as needed. Document the resolution process. When the dispute resolution has been decided, the appropriate party shall correct the deficiency, sign the statement of correction on the noncompliance form and return the form to the Commissioning Authority. The Commissioning Authority shall schedule the retest of the equipment or system involved. Final interpretive authority for any issue in dispute shall be the Architect. Final acceptance authority shall be the Owner.
4. Retain the original nonconformance forms until the end of the Project. The completed forms shall be delivered to the Owner as a part of the final commissioning report.

C. Approval: note each satisfactorily demonstrated function on the functional test form. Formal approval of the functional tests shall be made after review of the test reports by the Commissioning Authority and Owner. Recommend acceptance of each test to the Owner using a standard form. The Owner shall give final approval on each test using the same form, providing a signed copy to the Commissioning Authority and the Contractor.

3.07 DEFERRED TESTING

A. If any required prefunctional or functional test cannot be completed as scheduled, execution of checklists and functional testing may be delayed upon approval of the Architect and the Commissioning Authority. These deferred tests shall be conducted in the same manner as the seasonal tests as soon as possible.

B. Schedule and coordinate any required seasonal testing, tests delayed until weather or other conditions are suitable for the demonstration of the equipment or system's performance. Seasonal testing shall be executed, documented, and deficiencies corrected as specified herein for functional testing. Any adjustments or corrections to the operations and maintenance manuals and record documents required by the results of the testing shall be made before the seasonal testing process is considered complete. Schedule deferred testing with the Contractor, the Architect, and the Owner.

3.08 OPERATION AND MAINTENANCE MANUALS

A. Prior to the beginning of the training program for systems commissioned, review the draft operations and maintenance manuals, equipment documentation, and as-installed drawings for systems that were commissioned and to verify compliance with the specifications. Communicate deficiencies in the manuals to the Owner and Contractor. When identified deficiencies have been corrected, recommend approval and acceptance of the operations and maintenance manuals to the Owner. Also, review each equipment warranty and verify that requirements needed to keep the warranty valid are clearly identified.

B. Review the Contractor's draft operations and maintenance manuals to ensure they include single-line system diagrams on sheets matching the size required in the project specifications. These drawings shall include the chilled water system, domestic water system, heating system, supply, return and exhaust air systems, and Control systems. Drawings shall show major pieces of equipment.

C. Ensure that the Owner's project requirements and the basis of design are included in the first section of the operations and maintenance manuals. These narrative sections shall be updated to record status by the responsible parties.

D. Review all O & M manuals provided from the contractor to the owner as part of the project closeout for all components of commissioned systems.

E. At a minimum, the Operation and Maintenance Manuals shall contain:

1. Itemized Equipment List: Include maintenance schedule and detailed work description of each maintenance item.
2. Each item of Equipment and each System: Include description of unit or system and component parts.
3. Operating Procedures.
4. Maintenance Requirements.
5. Servicing and Lubricant schedule and a list of lubricants required.
6. Sequence of operation from BAS controls contractor: Include post occupancy software for all controls, BAS front end, and any software needed to operate or modify the BAS for daily operation.
7. Wiring diagrams and schematics for ALL systems, including life safety.
8. As-built control, speaker system, and fire alarm wiring diagrams.
9. O&M manuals shall be provided in 3-ring binders and on CD's in PDF version.

END OF SECTION

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes all concrete formwork and other related items necessary to complete project indicated by Contract Documents unless specifically excluded.

B. Related Sections:

1. Section 03 20 00 – Concrete Reinforcing.
2. Section 03 30 00 – Cast-in-Place Concrete.

1.02 PROJECT CONDITIONS

A. Examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wood Forms: 3/4 inch thick exterior grade plywood on studs and joists.

B. Form Ties: Standard snap ties, 1-1/2 inch break-back.

C. Form Oil: Oil must not affect bonding of finishes on exposed concrete. Approved non-staining type as follows:

1. Dayton Superior: Clean Strip™ J1EF
2. Nox-Crete Products Group: Nox-Crete Form Coating EB
3. SEI Form Release: Gcc-100.

PART 3 - EXECUTION

3.01 FORMWORK

A. Forms shall be properly aligned, adequately braced and mortar tight to produce concrete shapes required by Drawings.

1. Align forms so that the actual surface does not vary from true surface more than l/8 inch.
2. The surface shall be clean, undamaged, and free of offsets and irregularities at joints.
3. Adequately brace and frame to retain true shapes under vibration and placing strains without leaks, bowing, or deflection.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Studs, girts, and walls shall not be less than 2 by 4's, S4S, construction of standard grade Douglas fir, or equal, selected for straightness.

1. Walls shall consist of at least two 2 by 4's.
2. Studs shall not be spaced more than l6 inches, girts not more than 24 inches and ties not more than 27 inches, on center.

D. Lightly oil wood forms prior to placing reinforcing, and with oil not permitted on the reinforcing. Where oil form is used, remove excess before pouring concrete.

E. Unless indicated otherwise, chamfer exterior corners and edges of permanently exposed concrete.

F. Comply with recommendations of "Recommended Practice for Concrete Form work" ACI 347 unless indicated otherwise.

G. Construction joints in gradebeams shall have a horizontal shear key near the mid-depth of the member.

3.02 INSERTS AND FASTENING DEVICES FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, dowels, nailing strips, grounds and other fastening devices required for attachment of other Work

B. Locate partitions for other trades prior to pouring concrete in order that conduits, sleeves and inserts required by others will be installed in the proper locations.

C. Do not install sleeves in any concrete beams or piers except upon approval of the Project Engineer.

D. Do not install aluminum conduits in concrete.

3.03 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape. Refer to Section 07 26 00 – Vapor Retarders.

3.04 FORM REMOVAL

A. Grade beam forms may be removed 24 hours after a pour is completed.

B. Hardened room ceiling slab wood forms may be removed 7 days after pour, providing compressive strength has reached a minimum of 2500 psi based on job cast cylinders.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes all concrete reinforcing and the related items necessary to complete the Project indicated by the Contract Documents unless specifically excluded.

B. Related Sections:

1. Section 03 10 00 – Concrete Forming and Accessories.
2. Section 03 30 00 – Cast-in-Place Concrete.

1.02 SUBMITTALS

A. Submit reinforcing steel shop drawings and materials list prior to placement for MDOT Architect's approval.

1. Shop drawings shall include complete DIMENSIONED placing plans including control joint locations, order lists, bend diagrams, and DETAILS SHOWING DIMENSIONS WITH CLEARANCES.
2. Submittals not including this requirement will be considered as an incomplete submittal and will be returned to Contractor for re-submittal.

B. Furnish mill certificates for steel bar reinforcement, to the Project Engineer certifying that each shipment meets specifications. The fabricator will furnish certificates with bar lists to designate location of shipment and the time steel is delivered to the project.

1.03 QUALITY ASSURANCE

A. Reinforcing bars shall conform to ASTM A 615 "Deformed Billet-Steel Bars for Concrete", minimum yield strength of 60 ksi.

B. Mesh reinforcement shall conform to ASTM A 185 "Welded Steel Wire Fabric for Concrete Reinforcement".

C. Accessories shall conform to American Concrete Institute ACI 301 "Specifications for Structural Concrete for Buildings".

D. Placement shall be in accordance with approved shop drawings and ACI 318 "Standard Building Code Requirements for Reinforced Concrete".

E. Comply with ACI 315 "Manual of Standard Practice of Detailing Reinforced Concrete Structures".

1.04 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing bar steel and mesh shall be handled, shipped and stored in a manner that will prevent distortion or other damage.

B. Materials shall be stored in a manner to prevent excessive rusting and fouling with dirt, grease, or other bond-breaking coatings.

1.05 PROJECT CONDITIONS

A. Examine the substrate over which concrete forms are installed and advise the Project Engineer of conditions detrimental to the installation of concrete formwork. Do not proceed until unsatisfactory conditions have been corrected.

B. Coordinate placement of concrete reinforcing with installation of concrete formwork, vapor barriers, concrete inserts, conduit and all other items occurring in the area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Bar Reinforcement: Bar reinforcement shall conform to ASTM A 615, grade 60, of domestic manufacture. Bars shall be new; free from rust, scale, oil, or other coatings that will prevent bond.

B. Welded Steel Wire Fabric: Fabric shall conform to ASTM A 185, new, free from rust and other coatings that will prevent bond.

C. Accessories: Metal accessories as required shall support reinforcing bars and comply with ACI 315. Chairs and bolsters for use in exposed concrete shall have plastic coated or stainless steel legs or shall be plastic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fabricate and place reinforcement in accordance with the latest requirements of the American Concrete Institute and the approved shop drawings. Fabrication shall not proceed until MDOT Architect’s approval is obtained.

B. Reinforcing for one day's pour shall be completely placed and an inspection made by the Project Engineer / MDOT Architect prior to starting the pour.

C. Concrete Protection for Reinforcement: Minimum coverage shall be as follows unless shown otherwise on drawings:

1. Footings and gradebeams (bottom of steel) 3 inches clear
2. Slabs 1-1/2 inches clear top and 3/4 inch clear bottom
3. CMU Walls centered in wall

D. Steel Dowels for successive work shall be wired in correct position before placing concrete. The "sticking" of dowels after placing concrete will not be permitted.

E. Lap all bars 36 bar diameters at corners, splices and intersections.

F. Do not weld reinforcing steel unless specifically approved by the Project Engineer.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 07 26 00 - Vapor Retarders.
4. Section 09 90 00 – Painting and Coating.

1.02 SUBMITTALS

A. Submit concrete mix design, concrete compression test reports and product data and manufacturer's installation instructions for concrete curing compound.

1.03 TESTING LABORATORY SERVICES

A. The Owner will provide testing as specified in Section 01 45 29.

1.04 QUALITY ASSURANCE

A. Concrete work shall conform to all requirements of ACI 301, Specifications for Structural Concrete for Buildings and ACI 318 Building Code Requirements for Reinforced Concrete, latest editions, except as modified by supplemental requirements herein.

B. Mix Design: Concrete mix design proportioning shall be by a certified MDOT Class III technician and submitted to the Project Engineer prior to placing concrete. Mix proportions shall meet the requirements of the 804.02.10 Section of the MDOT's Standard Specifications, 2017 Edition, except concrete requiring a trowel finish shall not be air entrained and shall meet the compressive strength requirements for Class B concrete. Concrete shall be sampled according to ASTM C 172 and compression test cylinders made and cured according to ASTM C 31. Control of mixes is to be maintained at the Ready-Mix Plant and on the job site. Adjustments of the mix proportions shall meet the requirements of Section 804.02.10.4 of MDOT's Standard Specifications, 2017 Edition.

C. The Owner will mold and cure compression test cylinders (two cylinders per set) from concrete at the job site from the first placement of each mix design placed each day and additionally for each 100 cubic yards, or fraction thereof, of each mix design placed in a single day. In addition to sampling concrete in accordance with ASTM C 172, the Owner will follow the sampling requirements Paragraph 6.1.2 in the latest edition of the Department's *Concrete Field Manual*.

1. Cylinders will be tested in accordance with ASTM C 39. The Owner will mold one set of cylinders for ensuring the concrete meets the minimum 28-day acceptance requirements.
2. The Owner will mold three sets of cylinders for form removal in accordance with Subsection 907-804.03.15. See section 03200 for requirements of form removal.
3. In addition to determining the slump, temperature, and total air content of the concrete used for molding the test cylinders, the Owner will determine the yield of each mix design during the first placement of each mix design.
4. Copies of all test reports shall be furnished to the ready mixed concrete producer and as directed by the Project Engineer.

1.05 COORDINATION

A. Verify that all pipes under grade have been installed and tested before being covered. Check and verify materials and locations of inserts, anchors, and items required by other trades before pouring concrete. Concerned subcontractors shall be notified of date of pour in sufficient time to allow for completion of their work.

B. The Contractor shall notify the Project Engineer upon completing formwork and all reinforcing steel for the next intended pour, and shall not commence pouring operation until all forms and reinforcing steel are approved by the Project Engineer.

C. Project Engineer shall have free access to all materials used, and the required samples are to be furnished by the Contractor, as directed.

D. Inspection and written approval from the floor-covering subcontractor is required for slab finish receiving floor covering.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. All concrete, unless otherwise specifically approved in writing by the Project Engineer, shall be transit-mixed in accordance with ASTM C94. Control of concrete shall be under supervision of testing laboratory as described in Section 01 45 29.

B. All concrete, unless noted otherwise, shall be Class B.

C. Maximum slump for normal weight concrete shall be 4 inches. Sump may be increased to 8 inches with an approved water reducer.

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C-150, Type I.

B. Water: From an approved source.

C. Structural Concrete Aggregate: Coarse aggregate size number 57 or 67 shall be used and shall meet the requirements of MDOT Standard Specifications, 2017 Edition.

D. Admixtures: Admixtures shall be from the MDOT Approved List. Non-uniform addition of mixtures that result in erratic setting of the concrete will cause rejection of the concrete with subsequent removal from the structure at the concrete producer's expense.

2.03 RELATED MATERIALS

A. Preformed Expansion Joint Fillers: Provide pre-molded, asphalt impregnated board in widths and thickness required by conditions (1/2-inch minimum). Joint fillers shall conform to ASTM D994, D1751 or D1752.

B. Chemical Hardener (Sealer): Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent containing not less than 2 pounds of fluosilicates per gallon. Sealer shall not interfere with floor finish.

C. Curing Compound: Clear bond, manufactured by Guardian Chemical Co., Kure-N-Seal, manufactured by BASF / Sonneborn, Safe-Cure, manufactured by Dayton Superior Corp. or approved equal. Compound shall not interfere with bonding or floor finish.

D. Non-Shrink Grout: Shall be one part Portland cement to 2-1/2 parts of fine aggregate or Cement grout ASTM C 387 Dry Package mixtures similar and equal to Masterflow 713 Plus, manufactured by BASF / Master Builders; Five Star Grout, U.S. Grout Company or approved equal.

2.04 CONCRETE MIXES

A. Ready-Mixed Concrete: Ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C 94. Uniformly and accurately control proportions of material weight. Slump tolerances given in ASTM C 94 apply. Calcium chloride shall not be used.

B. Failure of concrete to meet the specified requirements may result in rejection with subsequent removal and replacement or re-testing (including coring, load test, etc.) at the supplier's expense.

1. Concrete exhibiting adverse reaction as a result of the presence of deleterious substances shall be removed and replaced or repaired in a manner completely satisfactory to the Project Engineer.
2. All cost of such corrective action, including all necessary testing, shall be borne by the concrete producer.

C. The Contractor may request adjustment to concrete mix design when characteristics of materials, job conditions, weather, test results, or circumstances warrant, at no additional cost to the Owner and as approved by the Project Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and approved before using in the Work.

PART 3 - EXECUTION

3.01 CONCRETE PLACEMENT

A. Concrete shall be placed so as to avoid segregation of materials and to prevent cold joints by avoiding re-handling, by keeping pours generally level, and by adequate vibration. Placing is not to be started during rain or snow, and if placing is underway when such conditions occur, continue operations only long enough to provide a suitable construction joint.

B. During hot weather or periods of low humidity combined with a definite breeze, rapid loss of moisture shall be discouraged by thorough wetting of forms and by using a fine fog spray when finishing. At these times particular attention shall be given to providing an adequate number of finishers to expedite this operation. During cold weather fresh concrete shall be protected from freezing.

C. Prior to placing, forms shall be cleaned free of foreign material and shall be washed down with water. Placing shall be a continuous operation between planned construction joints with fresh cement mixed only with plastic concrete already in place. Avoid cold joints.

D. Vibration shall be thorough, using vibrators small enough to work within reinforcing. The vibrator shall be inserted at many points about 24 inches apart. Avoid over-vibration and transporting concrete in form by vibration. A spare vibrator, which will operate, shall be kept on the job during all placing operations.

3.02 CONSTRUCTION JOINTS

A. Locate construction joints and provide shear keys as directed by the Project Engineer / MDOT Architect. Allow concrete to set for 24 hours before an adjoining pour is started. Slabs across the joint shall be level and the surface shall be level and shall not be feathered. Before proceeding with the following pour at a joint, thoroughly clean the joint, remove all loose material, and brush in a thick cement slurry.

3.03 CURING

A. Keep all concrete moist for 5 days after placing by covering with concrete curing paper, by leaving forms in place or by using curing compound. All combined with regular wetting as necessary.

3.04 PATCHING

A. Honeycombed and defective concrete shall be removed and replaced, or repaired, as directed by the Project Engineer. Form tie holes and minor areas, as determined by the Project Engineer, shall be repaired as follows:

1. Completed patch shall be indistinguishable from surrounding surfaces in color and texture.
2. Patching mixture, using same cement sand as used in concrete shall consist of 1 part cement to 2-parts sand, with just enough mixing water to permit placing. Premix mixture, allow standing at least 30 minutes before using, stirring with trowel during this period.

3. Remove material to sound concrete, dampen surface and brush thick 1 to 1 cement sand bond coat into surface.
4. When bond coat begins to lose water sheen, thoroughly pack patching mixture in place, leaving it somewhat higher than adjacent surface. Embed pieces of gravel by hand into patch.

3.05 FINISHES FOR FLATWORK

A. Trowel finish floor surfaces scheduled as concrete finish walking surfaces, or floor surfaces scheduled to receive floor covering. Trowel finished surfaces shall be true planes within 1/8 inch in 10 feet as determined by a 10 foot straightedge placed anywhere on the slab in any direction.

B. Smooth trowel finish after the surface is screeded and floated. Start troweling when all water has disappeared from the surface to first level the surface, then start final troweling when concrete has set where it no longer shows indentation from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting of cement or cement and sand will not be permitted.

C. Interior floors, with concrete finish scheduled, shall receive an application of hardener compound applied according to manufacturer's published instructions. Concrete surfaces to receive ceramic floor tile or brick shall receive float finish.

D. Exterior walks and ramps shall have smooth trowel and fine broom finish.

E. Exterior sign base shall have a Class 2, Rubbed Finish as follows:

1. After removal of forms, the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for at least three hours.
2. Surface shall be rubbed with a medium course Carborundum stone using a small amount of mortar on its face. The mortar shall be composed of cement and sand mixed in the proportions used in the concrete being finished. Rubbing shall be continued until all form marks, projections, and irregularities have been removed, all voids filled, and a uniform surface has been obtained.
3. The final finish shall be obtained by rubbing with a fine Carborundum stone and water. This rubbing shall continue until the entire surface is a smooth texture and uniform color.
4. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.

3.06 FINISHES FOR GRADE BEAMS

A. Exposed grade beam faces shall have a smooth form finish obtained by using selected form facing plywood, arranged orderly and symmetrically with a minimum of seams.

1. Repair and patch defective areas with all fins or other projections completely removed and smoothed. Provide grout cleaned finish consisting of 1 part Portland Cement to 1-1/2 parts fine sand by column, and mix with water to the consistency of thick paint.
2. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.

B. Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

END OF SECTION

SECTION 04 22 00 CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Concrete masonry units, mortar and reinforcing.

B. Related Sections:

1. Section 09 05 15 – Color Design.
2. Section 09 90 00– Painting and Coating
3. Section 01 45 23 – Testing and Inspection Services - Contractor

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include instructions for handling, storage, installation, cleaning, and protection of each.

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.03 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties and material test reports substantiating compliance with requirements.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.04 QUALITY ASSURANCE

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 unless modified by requirements in the Contract Documents.

B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.

1.05 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 ACCEPTABLE CONCRETE UNIT MASONRY MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Block USA, Inc., Jackson, MS. Tel. (601) 355-0691.
2. Columbia Block & Brick, Columbia, MS. Tel (601) 736-3791
3. Saturn Materials, LLC. Columbus, MS. Tel. (262) 902-6011.
4. Tupelo Concrete Products, Tupelo, MS. Tel: (662) 842-7811.

B. Substitution request 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 CONCRETE UNITS MASONRY, GENERAL

A. Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

C Manufacturer’s standard units. The nominal face dimensions shall be l6 inches long by 8 inches high by 8 inches deep (l5-5/8 inches by 7-5/8 inches by 7-5/8 inches actual), unless otherwise shown. Provide special shapes where shown and where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

D. Hollow Load-Bearing: Provide units complying with ASTM, C 90. Provide normal weight units using ASTM C 33l aggregate for a dry net weight of not less than l25 lbs. per cubic foot.

E. Classification: Curing shall comply with ASTM C 90, Type II, Nonmoisture-Controlled Units.

F. Exposed Face: Provide manufacturer's standard color and texture, unless otherwise indicated.

G. CMUs: ASTM C 90.

1. Density Classification: Normal weight unless otherwise indicated.

2.03 CONCRETE AND MASONRY LINTELS

A. General: Unless indicated otherwise, provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout.

2.04 MORTAR AND GROUT MATERIALS

A. Mortar mixes shall comply with the requirements of ASTM C 270 Standard Specification for Mortar for Unit Masonry. Type N mortar shall be used for interior Work. Mortar color shall be Manufacturer's standard color.

B. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color.

C. Hydrated Lime: ASTM C 207, Type S.

D. Sand: ASTM C l44, except for joints less than l/4 inches, use aggregate graded with 70 to l00 percent passing the No. 16 sieve.

E. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
2. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF: MasterPel 240MA
   b. Euclid Chemical Company (The); Accelguard 80.
   c. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.

H. Water: Potable.

2.05 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Include spec info for vertical reinforcing rods and all cells filled with concrete.

2.06 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

C. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

D Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M

E Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying. Install cut units with cut surfaces and, where possible, cut edges concealed

3.02 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

F. Walls at hardened room shall be poured in maximum 4 ft. high lifts, Reinforcement in walls shall be centered in block. Use plastic spacers to hold reinforcing in position.

3.04 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.05 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches on center.
2. Space reinforcement not more than 8 inches on center in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.06 REINFORCED UNIT MASONRY INSTALLATION

A Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.07 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level of inspections shall comply to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C Testing Prior to Construction: One set of tests.

D Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content.

H Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.08 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining units as intended. Provide new units to match units and install with fresh mortar or grout, pointed to eliminate evidence of replacement

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Good workmanship and job housekeeping practices shall be used to minimize the need for cleaning the masonry. Should additional cleaning be required apply chemical (muriatic acid is NOT acceptable) or detergent cleaning solutions in accordance with the masonry and chemical manufacturers' recommendations.

D. Remove temporary coverings and protection of adjacent work areas. Remove construction debris from the site and legally dispose of debris.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes structural steel framing members, support members, with required bracing, welds, fasteners, base plates, bearing plates, grout, anchor bolts and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.

B. Related Sections:

1. Section 09 05 15 “Color Design”.
2. Section 09 90 00 “Painting and Coating”

1.02 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.03 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components. Shop drawings shall conform to requirements of current AISC Specifications. Indicate sizes, spacing, connections, and location of structural members. Indicate net weld lengths and welded connections with AWS welding symbols.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Source quality-control reports.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer with a minimum of five (5) years experience.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M

B. Channels, Angles, M or, S-Shapes: ASTM A 572/A 572M, Grade 50.

C. Plate and Bar: ASTM A 572/A 572M, Grade 50.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. General: All bolts not indicated otherwise on the Drawings are 3/4 inch. Tube to column connections are to be welded all around. All connections not noted otherwise shall be framed connections.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.

1. Configuration: Hooked.
2. Finish: Plain

D. Headed Anchor Rods: ASTM F 1554, Grade 36, weldable, straight.

1. Finish: Plain

E. Threaded Rods: ASTM A 36/A 36M

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.03 PRIMER

A. Primer: Shop coat paint, ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 Painting and Coating.

2.04 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1. Grout shall have a 14-day compressive strength of 6000 psi when mixed to its flowable state.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Fabrication shall not proceed until MDOT Architect’s approval is obtained.

2.06 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 SOURCE QUALITY CONTROL

A. Testing Agency: Engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports required by AHJ and ICC Building Code.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. All miscellaneous metal work. The Work includes, but is not limited to, aluminum pipe railings, pipe bollards, stair nosings and miscellaneous framing & supports.

B. Related Sections:

1. Section 09 05 15 – Color Design.
2. Section 09 90 00 - Painting and Coating: Painting for all ferrous metal exposed to view and not covered by masonry or concrete.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Structural shapes shall be standard sections conforming to the American Society for Testing Materials Specification A-36. Punch and drill as necessary for work of others. Provide bearing plates and anchors, bolts, and etc. The Work shall be true and free of twists, bends and open joints between component parts. Materials shall be thoroughly straightened in the shop before laid off or worked in any way, care being used to avoid injury to the material.

C. Gray cast iron shall conform to ASTM A 48. Castings shall be of uniform quality, free from blowholes, shrinkage defects, swells, cracks or other defects. Castings shall be free of fins, burrs and slag.

D. Expansion bolts shall be equal to Phillips Red Head or "cinch" bolts as manufactured by the National Lead Company. Hilti Fasteners, Rawlplug Company and Wej-it Corporation are acceptable manufacturers. Use toggle type bolts or similar for all anchorage into hollow construction.

E. Bolt or weld connections: Provide necessary lugs and brackets for anchorage. Welding shall be in accordance with current "Code of Fusion, Welding and Gas Cutting in Building Construction, Part A - Structural Steel" issued by the American Welding Society, both for fabrication and erection. All welders shall have certification, as a result of tests prescribed by the American Welding Society.

F. Detail metal Work for ample size, strength and stiffness and as indicated. Countersink and provide reinforcement where necessary; drill or punch holes for bolts and screws. At the proper time furnish the necessary templates, patterns and items of miscellaneous metal, such as sleeves, inserts and similar items to be built into adjoining Work.

G. Fabricate metal Work with sharp lines and angles, with smooth true surfaces and clean edges. Form exposed joints to exclude water. Furnish certificates from manufacturers stating that materials comply with the specification requirements.

H. Provide as necessary holes of proper number and spacing for the attachment of Work of other trades. Do not use cutting torch in field without permission of the Project Engineer.

I. Anchor bolts, washers, nuts and clamps shall be furnished where indicated on the Drawings and where necessary for properly securing Work in place. Bolts and anchors used on the exterior of the building or built into exterior walls shall be cadmium plated. Miscellaneous angles and plates not indicated or specified otherwise shall not be less than 1/4 inch thick.

J. Shop paint and field touch up shall be Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09 90 00 – Paints and Coatings

2.02 FASTENERS

A. General: Fastenings shall be invisible where possible. Where exposed, screws, bolts, and the like shall be vandal-proof. All welded exposed joints on steel manufactured items; etc. shall be ground smooth and filled to receive paint

B. Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.03 ALUMINUM PIPE RAILINGS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

B. Fabricate railings and posts from 1-1/2 O.D. extruded structural pipe, ASTM B 429/B 429M, Alloy 6063-T6 with clear anodized finish AAMA 611,AA-M12C22A31. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown.

C. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

2.04 PIPE BOLLARDS

A. 8-inch round extra strong steel pipe 1/2-inch thick, 36KSI. Form bent corners to the radius shown without causing grain separation or otherwise impairing the Work.

2.05 LOOSE LINTELS

A. Provide loose galvanized steel lintels for openings and recesses in masonry walls and partitions. Weld adjoining members together to form a single unit where indicated. Provide a minimum of 8 inches bearing at each side of openings.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete Work.

B. Fabricate miscellaneous units to sizes, shapes, and profiles indicated, or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes, plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

C. Galvanize exterior miscellaneous frames and supports.

2.07 STAIR NOSINGS

A. Provide extruded aluminum base-abrasive anti-slip filler stair nosing at new concrete stairs equal to Wooster Products Model #231BF Supergrit safety treads 3 inches wide by 6 inches less than tread width with protective tape and concealed integral anchors. Install nosings before “Initial Set” of the concrete. Remove protective tape after stairs are complete. Color as selected by MDOT Architect from 11 standard colors. Equivalent products by American Safety Tread and Amstep Products are acceptable.

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.

2.08 MISCELLANEOUS MATERIALS

A. Metal Primers: Where materials come in contact with dissimilar materials which may cause harmful reaction, where exposed to moisture, or such as aluminum to cement mortar or concrete, the surface shall be protected by zinc chromate primer, bituminous paint or other approved paint.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi.

2.09 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches on center.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING ALUMINUM PIPE RAILINGS

A. Anchoring Posts: Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

3.03 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.04 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Utility shelving.
6. Plywood backing panels.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 06 40 00 - Architectural Woodwork.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.

1.04 COORDINATION

A. Fit carpentry Work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks. Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the Work. Contractor shall comply with manufacturer’s required protection procedures.

1.06 PROJECT CONDITIONS

A. Installer must examine all parts of the supporting structure and the conditions under which the carpentry Work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841 For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.
4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3 grade of any species.

B. Other Framing: Construction or No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.
4. Grounds.
5. Utility shelving.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For utility shelving, provide lumber with 15 percent maximum moisture content of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 3 Common grade; NELMA.
3. Northern species, No. 3 Common grade; NLGA.
4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.06 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening to Metal Framing: ASTM C 1002 length as recommended by screw manufacturer for material being fastened.

2.08 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Cut, join, and tightly fit framing around other Work. Do not splice structural members between supports unless otherwise indicated.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

3.02 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 40 00 ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Architectural woodwork as shown on the Drawings and schedules. Architectural woodwork is defined to include (in addition to items so designated on the Drawings) miscellaneous exposed wood members commonly known as "Finish Carpentry" or "Millwork", except where specified under another Section of these Specifications

B. The types of architectural woodwork include, but are not limited to:

1. Standing and Running Trim.
2. Laminate-Clad Cabinets.
3. Countertops.
4. Solid Surface Materials.
5. Shelving.
6. Hardware.
7. Accessory materials.
8. Miscellaneous work.

C. Related Sections:

1. Section 05 50 00 – Metal Fabrications.
2. Section 06 10 00 – Rough Carpentry.
3. Section 09 05 15 – Color Design.
4. Section 09 90 00 – Painting and Coating

1.02 DEFINITIONS

A. Terms used in this Section are in accordance with terminology of the Architectural Woodwork Standards, ©2014 AWI I WI 2nd Edition, October 1, 2014 including Errata through, April 29, 2016.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, cabinet hardware and accessories with installation instructions and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples: Submit actual samples for color selection from manufacturer’s appropriate line for plastic laminate, melamine, and solid surfacing to comply with level of quality of specified color and finish.

1. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.04 QUALITY ASSURANCE

A. Unless otherwise shown or specified, comply with specified provisions of the Architectural Woodwork Standards (AWS) and approved "Quality Standards".

B. Quality Marking: Mark each unit of architectural woodwork with mill's or fabricator's identification and grade marks, located on surfaces which will not be exposed after installation.

C. Millwork fabricator shall comply with the following:

1. Have a minimum of five (5) years documented experience and shall have completed projects of similar scope and size to the work of this project.
2. Have technologically advanced woodworking facilities employing the use of modern equipment and techniques for fabricating and finishing to meet the level of quality for the manufacture of all fabrication specified.
3. Employ skilled workmen experienced in the fabrication and finishing of premium quality millwork.
4. Be responsible for fabrication, finishing and installation of all products and procedures specified in this Section.

D. Unless stricter requirements are indicated, comply with the AWS Standards as applicable for (but not limited to) the following types of architectural woodwork:

1. Lumber
2. Standing and running trim
3. Cabinets and Countertops
4. Shelving
5. Miscellaneous work
6. Finishing
7. Installation of woodwork

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas.

1. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.06 FIELD CONDITIONS

A. The installer shall examine the substrates and conditions under which the work is to be installed; and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer

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

PART 2 - PRODUCTS

2.01 ARCHITECTURAL WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Easley & Easley Millwork, Inc., Jackson, MS. Tel. (601) 372-8881.
2. Scanlon -Taylor Millwork Company, Jackson, MS. Tel. (601) 362-5333.
3. Southeastern Constructors, Inc., Brandon, MS. Tel. (601) 825-9791.

2.02 BASIC MATERIALS AND FABRICATION METHODS

A. Except as otherwise indicated, comply with the following requirements for architectural woodwork not specifically indicated as pre- fabricated or pre-finished standard products.

B. Wood Moisture Content: Provide kiln-dried lumber and maintain optimum 8 to 13 percent range (damp region) moisture content in solid wood (hardwood and softwood) through fabrication, installation, and finishing operations of interior Work.

C. Wood for Painted Finish: Comply with AWI quality standards for selection of species, grade and cut (fabricator's option, except as otherwise indicated). Wood for trim shall be maple or other closed-grain hardwood subject to Project Engineer/ MDOT Architect’s prior approval.

D. Wood for Stained Finish: Comply with AWS Edition 2 quality standards for selection of species, grade and cut.

E. Plastic Laminate: Comply with NEMA LD3; type, thickness, color, pattern and finish as indicated for each application.

F. Solid Surfacing: Provide solid surfacing equal to Cambria, Surell as manufactured by the Formica Corporation, Corian as manufactured by El Dupont De Nemours & Company, Inc. or Gibraltar as manufactured by Wilsonart International, Inc.

G. Thermoset melamine resin impregnated paper shall be equal to Duramine at all interior surfaces of cabinets with exterior plastic laminate finish. Cabinet doors, drawers, etc. shall be edge banded in the specified laminate. Cabinet door backs shall be provided in the specified laminate.

H. Design and Construction Features: Comply with the details shown for profile and construction for architectural woodwork; and where not otherwise shown, comply with applicable Quality Standards, with alternate details at fabricator's option.

I. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth the edges of cut outs and where located in countertops and similar exposures, seal the edges of cut outs with a water resistant coating.

J. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

K. 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.

2.03 ARCHITECTURAL WOODWORK TYPES

A. Plastic Laminate Finished Casework: Grade: Premium, Plastic Laminate for Horizontal Surfaces: 0.050 inch thick, General Purpose Type (high pressure). Plastic Laminate for External Vertical Surfaces: 0.028 inch thick, General Purpose Type (high pressure).

1. AWI Type Cabinet Construction: Flush overlay.
2. Door and Drawer Front Style: Flush overlay.
3. Horizontal Surfaces: Grade HGS.
4. Vertical Surfaces: Grade HGS
5. Edges: Equal to Charter Industries, Inc. (Grand Rapids, MI Tel. 800 538-9088) 90 Durometer PVC T-Mold model No. 3333, size; 1-1/4 Inch, standard color as selected by MDOT Architect. Equivalent products by Alibaba and Rehau are acceptable.
6. Drawer Sides and Backs: Thermoset decorative overlay.
7. Drawer Bottom: Thermoset decorative overlay.
8. Composite Wood Products: Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
9. Thermoset Decorative Panels: Particleboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL.

B. Plastic Laminate Colors and Patterns: Refer to 09 05 15 Color Design

2.04 CABINETS HARDWARE AND ACCESSORY MATERIALS

A. Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units that are specified as "door hardware" in other sections of these specifications. Except as otherwise indicated, comply with ANSI A156.9 "American National Standard for Cabinet Hardware." Unless shown or noted otherwise, cabinet hardware shall comply with the following:

1. Hinges: Concealed type equal to Blum Clip Top 120 degree, 71T5550 series with cover caps.
2. Cabinet Pulls: Equal to Amerock 4 inches center to center brass pulls with satin nickel finish. Model No. BP 76312G10.
3. Grommets: Equal to Doug Mockett, Flip Top Series - 2 inch hole plastic grommet. Provide at all workstation office area counter tops. Locations to be confirmed in submittal. Color to be selected from Manufacturer’s full range.
4. Drawer guides: Equal to Accuride model 2132, 20 inch, side mount, 75 pound rated, black zinc plated.

5. Adjustable shelf hardware (side support) AWI Quality Standards, 5mm holes at 32mm on center upon approval of sample submitted. Shelf supports shall be equal to Knape and Vogt 332 ANO.
6. Wall Cabinet Hangers: Equal to Kingclip as manufactured by Brooklyn Hardware, LLC.
7. Keyboard: Underdeck Adjustable Keyboard Platform equal to Kensington Model K60067. Equivalent products by Fellows and Safco are acceptable
8. Workstation Support Bracket: Equal to Hafele, 287.74.304 sized to provide 500-1000 pound minimum load limit in pairs, installed as pairs 16 inches on center, heavy duty folded steel workstation bracket. Two conduit holes for running power. Architect shall select finish based on location.

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.06 FABRICATION

A. Complete fabrication, including assembly**,** and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of the time substrates are to be built. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8-inch in 8 feet for plumb and level (including countertops); and with 1/16-inch maximum offsets in revealed adjoining

surfaces. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

B. Secure woodwork with anchors or blocking built-in or directly attached to substrates. Attach to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

C. Casework: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, and comply with Quality Standards for joinery.

E. Countertops: Anchor securely to base units and other support systems as indicated.

F. Grommets: Provide at openings in countertops at knee spaces.

G. Keyboard: Install per manufacturer’s instructions at knee spaces.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth ready for painted or stained finishes.

3.04 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate and make final adjustments for proper operation. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

C. Refer to Section 09 90 00 for final finishing of installed painted and stained architectural woodwork.

D. Protection: The Installer of architectural woodwork shall advise the Contractor of final protection and maintenance conditions necessary to ensure that the Work will be without damage or deterioration at the time of acceptance

END OF SECTION

SECTION 07 21 28 CELLULOSE THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Building insulation for interior walls.

1. Pneumatically sprayed damp into open wall cavities.

B. Related Sections: Section 13 34 19 Metal Building Systems for insulated panels.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product and technical data for insulation describing location, extent, material and method of application prior to installation for MDOT Architect’s acceptance.

1.03 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacture of Cellulose Thermal Insulation with 10 years minimum experience.

B. Installer: Company specializing in Cellulose Thermal Insulation Products, with 5 years minimum experience, who has completed work similar to that indicated for this project and with a record of successful in-service performance and is approved by manufacturer to install manufacturer’s products. Submit identification of at least 3 projects of similar scope and complexity along with name, address, and telephone number of the Architect, Owner and General Contractor.

1.05 PRODUCT HANDLING

A. Protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs or replacements as necessary.

1.06 WARRANTY

A. Provide manufacturer’s standard life time warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by NU-WOOL Company, Inc., 2472 Port Sheldon Street, Jenison, MI. Tel. (800) 748-0128.

B. Equivalent products by the following manufacturers are acceptable:

1. Fiberlite Technologies, Inc., Joplin, MO. Tel: (800) 641-4296.
2. Hamilton Manufacturing Inc., Twin Falls, Idaho. Tel: (208)733-9689.

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 CELLULOSE INSULATION MATERIALS

A. Cellulose Insulation: Insulation shall be manufactured from recycled newspapers containing a minimum of 85 percent paper fiber content. Fibers shall be treated with boric acid and sodium polyborate (ammonium or aluminum sulfate are NOT allowed) to create permanent flame resistance.

1. Shall contain a EPA registered fungicide, be mold-resistant, non-toxic, non-corrosive.
2. Shall not irritate normal skin.
3. Shall not give off odor during or after installation.
4. Shall not attract vermin or insects.
5. Shall not adversely affect other building materials.

B. Thermal Performance: Cellulose insulation shall resist the flow of heat. Heat transfer is limited as indicated by its R-Value of 3.8 per inch. Air infiltration through the material shall be limited by the density of the material and methods used to install it.

C. Sound Control: Cellulose insulation shall provide significant noise reduction in walls.

D. Standards: Cellulose insulation shall conform to the CPSC standard 16 CFR Parts 1209 and 1404. In addition, the cellulose insulation shall meet or exceed all of the test requirements of ASTM C-739, E-84 and E-119, and UL-723.

2.03 MATERIAL CHARACTERISTICS

A. The following properties were tested by Underwriters Laboratories (R-8078):

1. Settled Density: The maximum density after long-term settling of dry application: 1.6 lb/ft©.
2. Thermal Resistance: The average thermal resistance per inch: 3.8 (R-Value/in).
3. Flammability Characteristics**:** Critical Radiant Flux - greater than or equal to 0.12 watts/cm2; Smoldering Combustion - less than or equal to 15 percent.
4. Moisture Vapor Sorption**:** This requirement assures that normal variations in relative humidity will not adversely affect thermal resistance. Cellulose insulation shall meet the requirements of less than 15 percent for maximum weight gain under the specified test conditions.
5. Surface Burning Characteristics: Flame Spread – 15; Smoke Developed – 5.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where building insulation is to be installed and notify the Contractor and MDOT Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work

3.03 INSTALLATION

A. Extend insulation full thickness as shown over entire area to be insulated. Fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.

B. Nu-Wool WALLSEAL: Cellulose insulation shall be pneumatically sprayed with a controlled water fog for adhesion into open wall cavities after mechanical, plumbing, electrical and other utility installations have been completed. Drywall may be installed 24 hours after application. Total drying time is approximately 30 days. Installation shall be made only by Nu-Wool factory-certified WALLSEAL contractors using approved equipment.

END OF SECTION

SECTION 07 26 00 VAPOR RETARDERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vapor retarder under concrete floor slab.
2. Concrete curing paper on top of freshly poured concrete floor slab.
3. Floor protection paper used for positive protection of finished floors.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical product data, installation instructions and recommendations for products specified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Fortifiber Corporation, 300 Industrial Drive, Fernley, NV 89408. Tel. (800) 773-4777.

B. Equivalent products by the following manufacturers are acceptable:

1. Grace Construction Products, Cambridge, Ma. Tel: (800) 444-6459.
2. Griffolyn ® Division, Reef Industries, Inc., Houston, TX. Tel: (800) 231-6074.
3. Stego Industries LLC, San Juan Capistrano, CA. Tel: (877) 464-7834.

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 VAPOR RETARDER

A. Membrane shall be a 15 mil polyolefin film meeting ASTM E-1745-97 Class A Test Method, equal to Fortifiber Corporation, Moistop® Ultra™ 15, including Moistop® tape and sealants with the following characteristics:

1. Moisture Vapor Permeance: ASTM E-154, Section 7 (E-96, Method A) = 0.01 Perms.
2. Dry Tensile Strength: ASTM D-882 = (80 lbf/in min)-MD & (78 lbf/in min.) CD.
3. Puncture Resistance: ASTM D-1709, Method B = 4,900 Grams.

2.03 CONCRETE CURING PAPER

A. Laminated tri directional glass fiber reinforced long fibered kraft curing papers with double coating of high-melting-point asphalt, meeting ASTM C-171 Test Method, equal to “Orange Label Sisalkraft®”.

2.04 FLOOR PROTECTION PAPER

A. Non-staining reinforced floor protection paper consisting of two heavy kraft sheets and glass reinforcing fibers laminated with a non-staining adhesive, meeting ASTM D 828 and ASTM D 781 Test Methods, equal to “Seekure®”.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure items that pass through building paper / membrane are properly and rigidly installed, substrate is free of projections and irregularities that may be detrimental to proper installation of building paper / membrane.

3.02 INSTALLATION

A. Vapor Retarder:

1. Unroll underslab vapor retarder over thoroughly compacted subgrade and turn down at inside perimeter of grade beams.
2. Seal joints watertight, with a pressure sensitive tape as recommended by manufacturer, allowing a minimum overlap of 6 inches.
3. Apply tape evenly over seams and rub out wrinkles formed during application.
4. Seal pipes and conduits passing through the membrane with Moistop boot and tape.
5. Inspect membrane thoroughly and repair all punctures immediately before placing concrete. Equipment, tools, and procedures that might puncture the membrane shall not be used while placing and finishing the concrete.
6. Comply with manufacturer’s recommendations and installation procedures as outlined in ASTM E-1643.

B. Curing Paper:

1. Unroll concrete curing paper over the entire surface once the concrete has set sufficiently hard to permit application without marring the surface.
2. Lap joints 4 inches and seal with pressure sensitive tape.
3. Apply tape evenly over seams and rub out wrinkles formed during application.
4. Ensure that all tears or penetrations are repaired.

C. Floor Protection Paper:

1. Apply floor protection paper immediately after floor covering is installed.
2. Do not remove until final completion and acceptance by the Project Engineer.
3. Lay paper in widest practical width with 6-inch laps to provide complete coverage of flooring.
4. Seal joints with minimum 2 inch wide pressure sensitive tape.

3.03 CLEANING

A. Inspect vapor barrier membrane thoroughly and keep clean. Remove dirt, oils, mud, debris, etc. prior to placing concrete.

END OF SECTION

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Flashing and sheet metal work as indicated on the Drawings and provisions of this Specification. The types of work include the following:
   a. Metal flashing and counter flashing.

B. Related Sections:

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

1.02 PREINSTALLATION MEETINGS

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data, technical specifications, installation instructions and general recommendations for each specified sheet material and fabricated product for Project Engineer / MDOT Architect's approval.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, and connections to adjoining work.

C. Samples: Submit 2 samples, eight inch square, of specified sheet materials to be exposed as finished surfaces. Submit 2 twelve inches long, completely finished units of specified factory-fabricated products exposed as finished work. Submit 2 color charts of manufacturer's complete line of standard colors available.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit 2 copies for firms and persons that demonstrate capabilities and experience. Include a list with five (5) completed Project names and addresses, and name and addresses of Architects and Owners.

B. Product certificates.

C. Product test reports.

D. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.07 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from Date of Completion as determined by MDOT.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 FLASHING AND SHEET METAL MATERIALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Thickness: 24 gage.
2. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.
   a. Equal to Petersen Aluminum Corp., Tel. (800) 722-2523.
   b. Use galvanized finish where concealed from view only.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide and / or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.04 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate [wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - Joint Sealants.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.02 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 04 20 00 - Unit Masonry.

C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

E. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings, sheet metal work, and accessories during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

F. Flashings and sheet metal with cuts, abrasions, or imperfections will not be acceptable and is to be replaced.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Joints in or between fire-resistance-rated constructions.
5. Joints in smoke barriers.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, specifications and installation procedures for each type of firestopping and accessory required. Submit detailed location where each will be used. Submit UL data for assemblies where shown on the Drawings.

B. Product Schedule: For each firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestopping condition, submit illustration, with modifications marked, approved by firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.03 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

B. Product test reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration and fire-resistive joint system firestopping tests are performed by UL, Intertek ETL SEMKO, or FM Global.
   a. Qualified testing agency shall be acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hilti, Inc. Tulsa, OK. Tel. (800) 879-8000.,
2. 3M Fire Protection Products, Saint Paul, MN. Tel. (800) 328-1687.
3. USG Corporation, Chicago, IL. Tel. (880) 874-4968.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

2.03 FIRE- RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Ratings determined per ASTM E 1966 or UL 2079:

1. Fire - Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.

1. Fire - Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Ratings determined per UL 2079.

1. L- Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

2.04 FINISHES

A. Concealed locations: Manufacturer’s Standards.

B. Exposed to View Locations: “Custom” Colors as selected by Project Engineer / MDOT Architect unless Manufacturer’s Standards closely matches finish of penetrated surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, Joint configurations, substrates, and other conditions affecting performance of the Work.

B. Verify application required and location for each type of firestopping to be used and install firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

D. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, joints and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings, joints and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

E. Install approved metal sleeves with fireproof sealant at all communication and control wiring passing through rated walls throughout the entire project.

F. After installation of all Work, including but not limited to ductwork, fire and smoke dampers, communication cabling, electrical conduit, etc., properly seal all openings, cracks, crevices and penetrations throughout the entire project, to maintain fire ratings shown.

3.02 IDENTIFICATION

A. Identify firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.03 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or firestopping is damaged or removed because of testing, repair or replace firestopping to comply with requirements.

C. Proceed with enclosing firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.04 FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ, Category XHBN or Category XHDG

B. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

C. Sealants: Equal to Hilti, Inc. FS-One.

D. Caulking and Putty: Equal to 3M Brand Fire Barrier CP- 25 Caulk and Putty 303.

E. Penetration Sealants: Equal to 3M Fire Barrier Penetration Sealing Systems 7902 and 7904 series as required.

F. Insulation: Equal to United States Gypsum Company “Thermafiber” Safing Insulation, 4 pcf density, unfaced.

G. Intumescent Firestopping: Equal to Hilti, Inc. FS-One, CP 642 and FS 657 Fire Block as required.

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation of substrate surfaces to receive materials.

B. Sealant and joint backing (backer rod) materials and installation in the following general locations (even though not shown on the Drawings):

1. Exterior and interior wall joints, including control / expansion joints and abutting like or similar materials (in walls, ceilings, and roof construction) that have spaces between in excess of 3/16 inch (except where less restrictive tolerances are indicated or where the condition is specifically the responsibility of others).
2. Abutting dissimilar materials, exterior and interior.
3. Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
4. Exterior and interior wall openings (including at perimeter doors, exterior thresholds, windows, louvers, and penetrations required by piping, ducts, and other service and equipment, except for sealants provided by Section 07 84 00-Firestopping).
5. Joints in pavement and walks.
6. Other locations, not included above but, specifically required by manufacturers of installed materials / products (except that sealing materials for glazing are under provision of other Section.).

C. Accessories: Including, but not limited to, primer, cleaner, backer rod, bond breaker, and masking tape.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures and Section 09 05 15 – Color Design.

1.03 DEFINITIONS

A. Whenever the words "caulk" or "seal" occur, they shall be interpreted to mean "effectively seal the indicated joint with a material to render it air and watertight." "Caulk" shall indicate the use of the interior materials specified hereinafter and "Seal" shall indicate the use of the exterior materials.

1.04 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.05 WORK OF OTHER SECTIONS

A. Caulking and sealing may be performed as Work of other Sections when specified. However, all Work shall conform to the requirements of this Section.

1.06 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each type of sealant required. Product data shall include chemical characteristics, limitations, and color availability.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.07 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Certificate.

B. Applicator’s experience documentation.

C. Product test reports.

D. Preconstruction field-adhesion test reports.

E. Field-adhesion test reports.

F. Warranties.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Manufacturer’s Certificate: Provide manufacturer’s letter of certification that products meet or exceed specified requirements and are appropriate for uses indicated.

C. Applicator: Company specializing in the work of this Section with minimum 3 years documented satisfactory experience.

D. Preinstallation Conference: Conduct conference at Project site.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver caulking and sealant material to the site in original unopened packages with manufacturer’s labels, instructions and product identification and lot numbers intact and legible.

B. Store materials under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer’s instructions.

1.10 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from Date of Completion as determined by MDOT.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from Date of Completion as determined by MDOT.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438. Tel: (800) 523-6688.

B. Equivalent products by the following manufacturers are acceptable:

1. BASF Construction Chemicals, LLC, Building Systems. Shakopee, MN. Tel: (800) 243-6739.
2. Dow Corning Corporation, Midland, MI. Tel: (800) 322-8723.
3. GE Silicones, Waterford, NY. Tel: (518) 233-2639.
4. Tremco, Inc., Beachwood, OH. Tel: (800) 562-2728.

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 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.03 SILICONE JOINT SEALANTS

A. Silicone Joint Sealant: ASTM C 920.

2.04 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

2.05 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.06 PREFORMED JOINT SEALANTS

A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

2.07 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.08 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.09 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

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

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.03 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 5 tests for the first 500 feet of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.04 CURE AND PROTECTION

A. Cure sealant and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Sealant Supplier / Applicator shall advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at Time of Completion.

3.05 JOINT-SEALANT SCHEDULE

A. Type 1: Use for interior locations, sealing around windows, doors, louvers, drywall and other locations to be painted and where joints are less than 1/8 inch with none to slight movement anticipated: Pecora AC-20 + Silicone (Acrylic Latex Caulking Compound).

B. Type 2: Use for sealing nonporous interior surfaces where conditions of high humidity and temperature extremes exist, including at and in conjunction with toilet fixtures, counters, vanities, thresholds and joints in tile finishes: Pecora 898 (Silicone Sanitary Sealant).

C. Type 3: Use for horizontal floor and pavement joints: Pecora Urexpan NR-200 (two-part, self-leveling, traffic-bearing, polyurethane sealant).

D. Type 4: Use for exterior sealing at door, louver, and window frames at masonry, and other materials: Pecora 890NST (one-part Architectural Silicone Sealant). Color(s) to be selected by the Project Engineer / MDOT Architect from manufacturer's full range of standard Architectural colors.

E. Type 5: Use for Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces. Pecora AC – 20 FTR.

END OF SECTION

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes hollow-metal work, including but not limited to, the following:

1. Interior and exterior hollow metal doors and frames; rated and non-rated.
2. Trimmed openings.
3. Preparation of metal doors and bucks to receive finish hardware, including reinforcements, drilling and tapping necessary.
4. Preparation of hollow metal door to receive glazing (where required).
5. Factory prime painting of Work in this Section.

B. Related sections:

1. Section 06 10 00 - Rough Carpentry.
2. Section 08 14 29 - Prefinished Wood Doors.
3. Section 08 71 00 - Door Hardware.
4. Section 08 80 00 - Glazing.
5. Section 09 05 15 - Color Design.
6. Section 09 90 00 - Painting and Coatings.

1.02 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including schedule and manufacturer's technical product data / literature.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, glazing, anchor types and spacing, reinforcement, and other details.

C. Samples (not required for named products):

1. Submit hollow metal frame, corner section of typical frame, of sufficient size to show corner joint, hinge reinforcement, dust cover boxes, anchors, and floor anchors.
2. Submit hollow metal door section of typical door, of sufficient size to show edge, top and bottom construction, insulation, hinge reinforcement, face stiffening, corner of vision opening construction, and glazing beads.

D. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.04 QUALITY ASSURANCE

A. In addition to complying with all pertinent codes and regulations, manufacture labeled doors in accordance with specifications and procedures of Underwriters' Laboratories, Inc. In guarantee and shop drawings, comply with nomenclature established in American National Standards Institute publication A123.1, latest edition, "Nomenclature for Steel Doors and Steel Door Frames".

B. Work is subject to applicable portions of the following standards:

1. ANSI A115 "Door and Frame Preparation for Door Locks and Flush Bolts", American National Standards Institute.
2. ANSI A123.1 "Nomenclature for Steel Doors and Steel Door Frames", American National Standards Institute.
3. NFPA 101 "Life Safety Code", National Fire Protection Association.

C. Hollow metal doors and frames shall comply with the specifications for Custom Hollow Metal Doors and Frames, National Assoc. of Architectural Metal Manufacturers (NAAMM) Standard CHM 1-74, and the Steel Door Institute, SDI 100-80.

1.05 PRODUCT IDENTIFICATION

A. Deliver doors and frames and other work of this section properly tagged and identified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.

B. Provide packaging, separators, banding, spreaders, and individual wrappings as required to completely protect all metal doors and frames during transportation and storage.

C. Store doors upright, in a protected dry area, at least 4 inches off the ground and with at least 1/4 inch air space between individual pieces, protect all pre-finished and hardware surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Steelcraft Manufacturing Company, 9017 Blue Ash Road, Cincinnati, OH 45242 Tel. (513) 745-6400.

B. Equivalent products by the following manufacturers are acceptable:

1. Amweld Building Products, Inc., Garrettsville, OH. Tel. (330) 527-4385.
2. Ceco Door Products, Brentwood, TN. Tel. (615) 661-5030.
3. Curries Co., Mason City, IA. Tel. (641) 423-1334.
4. Republic Builders Products, McKenzie, TN. Tel. (901) 352-3383.

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 FABRICATION, GENERAL

A. Fabricate hollow metal units rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Unless otherwise indicated, provide countersunk flat Philips or Jackson heads for exposed screws and bolts.

B. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping per final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware".

C. Locate finish hardware in accordance with approved shop drawings.

2.03 FABRICATION

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

B. Hollow-Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

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

1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.
      3) Four anchors per jamb from 90 to 120 inches high.
      4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
   c. Compression Type: Not less than two anchors in each frame.
   d. Post installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches on center.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates. Prepare exterior HM frames in Admin and Shop Building for electric strikes and include conduit to above ceiling and provide cover plate to install conventional strike at this time.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.04 FRAMES

A. Frames Types:

1. Exterior Openings: Frames shall be made of commercial grade 14 gage minimum cold rolled steel conforming to ASTM A366-68 with a zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.
2. Interior Openings: Frames shall be commercial grade cold rolled steel conforming to ASTM A366-68 or commercial grade hot rolled and pickled steel conforming to ASTM A569-66T. Metal thickness shall be 16 gage for frames in openings 4 feet or less in width; 14 gage for frames in openings over 4 feet in width.

B. Design and Construction: Frames shall be custom made welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Knocked-down frames WILL NOT be accepted. Finished work shall be strong, rigid, and neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths. Jamb depths, trim, profile and backbends shall be as shown on Drawings. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops mitered. The use of gussets will not be permitted.

1. Stops shall be 5/8 inch deep. Cut-off (sanitary or hospital type) stops, where scheduled, shall be capped at 45 degrees at heights shown on Drawings, and all jamb joints below cut-off stops shall be ground and filed smooth, making them imperceptible. Do not cut off stops on frames for soundproof, lightproof and lead-lined doors.
2. When shipping limitations so dictate, frames for large openings shall be designed and fabricated for field splicing by others.
3. Frames for multiple or special openings shall have mullion and / or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.
4. Hardware reinforcements: Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates. Frames shall be reinforced for closers. Minimum thickness of hardware reinforcing plates shall be as follows:
   a. Hinge and pivot reinforcements - 7 gage, 1-1/4 inch by 10 inches minimum.
   b. Strike reinforcements - 12 gage.
   c. Flush bolt reinforcements - 12 gage.
   d. Closer reinforcements - 12 gage.
   e. Reinforcements for surface-mounted hardware - 12 gage.
5. Floor anchors: Floor anchors shall be securely welded inside jambs for floor anchorage. Where required, provide adjustable floor anchors, providing not less than 2 inches height adjustment. Floor anchors shall be 14-gage minimum.

C. Finish: After fabrication, tool marks and surface imperfections shall be removed, and exposed faces of welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and coated on accessible surfaces with rust-inhibitive primer complying with FS-TT-P-57 (Type II) or FS-TT-P-659 with 2.0 mils minimum thickness. Fully cure before shipment.

2.05 HOLLOW METAL DOORS

A. General: Doors shall be made of commercially quality, level, cold rolled steel conforming to ASTM A366-68 and free of scale, pitting or other surface defects.

B. Face Sheets:

1. Exterior Doors: Shall be 16-gage minimum with zinc coating conforming to ASTM A653, with a coating designation of A60 or G60 and a minimum coating thickness of 0.60 oz. per sq. ft. minimum.
2. Interior Doors: Shall be18 gage minimum.

C. Design and Construction: Doors shall be custom made, of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 1-3/4 inches unless otherwise noted. Doors shall be strong, rigid and neat in appearance, free from warp or buckle. Corner bends shall be true, straight and of minimum radius for the gage of metal used.

D. Face Sheet Stiffeners: Stiffen with continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gage minimum, spaced 6 inches apart and securely attached to face sheets by spot welds 5 inches on center. Spaces between stiffeners shall be sound-deadened insulated full height of door with an inorganic non-combustible batt-type material.

E. Welding: Join door faces at their vertical edges by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

F. Top and Bottom Edges: Edges of doors shall be closed with a continuous recessed 16 gage minimum steel channel, extending the full width of the door and spot welded to both faces. Exterior doors shall have additional flush closing channel at top edges and, where required for attachment of weather-stripping, a flush closure at bottom edges. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.

G. Edge Profile: Shall be provided on both vertical edges of doors as follows:

1. Single-acting swing doors - beveled 1/8 inch in 2 inches.
2. Double-acting swing doors - rounded on 2-1/8 inch radius.

H. Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closures, etc.) is to be applied, doors shall have reinforcing plates. Minimum gages for hardware reinforcing plates shall be as follows:

1. Hinge and pivot reinforcement - 7 gage.
2. Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gage.
3. Reinforcement for all other surface mounted hardware - 16 gage.

I. Glass Moldings and Stops:

1. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others per glass opening sizes shown on Drawings. Fixed moldings shall be securely welded to door on security side.
2. Loose stops shall be 20-gage steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced 8 inches on center. Snap-On attachments will not be permitted. Stops shall be flush with face of door.

J. Finish: After fabrication, tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall be chemically treated to ensure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive primer. Fully cure before shipment.

K. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum in any direction, including a diagonal direction.

2.06 HARDWARE LOCATIONS

A. Hinges:

1. Top: 9-3/4 inches from head of frame to centerline of top hinge.
2. Bottom: 10-3/8 inches from bottom of frame to centerline of bottom hinge.
3. Intermediate centered between top and bottom hinges on Dutch Doors:
   a. 9-3/4 inches from head of frame to centerline of hinge.
   b. 10-3/8 inches from bottom of frame to centerline of bottom hinge.
   c. 5 inches from split line to top and bottom respectively of lower and upper intermediate hinges.

B. Locks and Latches:

1. Unit and integral type locks and latches – 3’- 2” to centerline of knob.
2. Deadlocks - 5’- 0” to centerline of cross bar.
3. Roller latches - 3’-9” to centerline.

C. Panic hardware – 3’-1” to centerline of cross bar.

D. Pulls and Push Plates:

1. Door pulls – 3’-6” to center of grip.
2. Push-pull bars – 3’-1” to centerline of bar.
3. Arm pulls – 3’-11” to centerline.
4. Push plates – 4’- 0” to centerline of plate.

E. All of the above dimensions from paragraph 2.06(B) through 2.06(D) are from finished floor and shall comply with ADA and AHJ requirements.

2.07 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

2.08 CLEARANCES

A. Edge Clearances:

1. Between doors and frame, at head and jambs - 1/8 inch.
2. Door Sills: where no threshold is used - 1/4 inch maximum above finished floor; where threshold is used - 3/4 inch maximum above finished floor.
3. Between meeting edges of pairs of doors - 1/8 inch.

B. Finished floor is defined as top surface of floor, except when resilient tile or carpet is used, when it is top of concrete slab. Where carpet is more than 1/2 inch thick, allow 1/4 inch clearance.

2.09 PREPARATION FOR FINISH HARDWARE

A. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Include preparation for mortise and concealed hardware.

B. Provide reinforcements for both concealed and surface applied hardware. Drill and tap mortise reinforcements at factory, using templates. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

2.10 REJECTION

A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed. Replace rejected materials.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on shop drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.

   c. At Bottom of Door:
      1) 1/4 inch, where no threshold or carpet.
      2) 1/8 inch, where with threshold or carpet.
   d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.02 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 14 29 PREFINISHED WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Extent and location of each type of wood door is shown on the Drawings and in Schedules. Types of doors required include solid core flush wood doors with veneer faces. Lite openings for wood doors, including furnishing and installation, are specified under this Section.

B. Related Requirements:

1. Section 08 71 00 “Door Hardware” for installation.
2. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
3. Section 09 05 15 "Color Design" for colors.

1.02 ACTION SUBMITTALS

A. Product Data: Indicate door core material and construction; veneer species, type and characteristics. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.
8. Indicate by transmittal form that copy of each instruction has been transmitted to the installer.

C. Samples: For factory-finished doors.

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturer’s sample warranty.

1.04 QUALITY ASSURANCE

A. Comply with the requirements of the following standards unless otherwise indicated:

1. Non-Fire Rated Wood Doors: WDMA I.S.1-A, "Architectural Wood Flush Doors."

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the on-site care recommendations of AWI “Care & Instruction at Job Site” Section 1300, G-22.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Graham Manufacturing Corp., P.O. Box 1647, Mason City, IA. Tel. (641) 423-2444.

B. Equivalent products by the following manufacturers are acceptable:

1. Marshfield Door Systems, Inc., Marshfield, WI. Tel. (800) 869-3667.
2. TruStile Doors, LLC, Denver, CO. Tel. (888) 286-3931.
3. VT Industries, Inc., Holstein, IA. Tel. (800) 827-1615.

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 DOOR CONSTRUCTION, GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

B. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site.

C. Particleboard-Core Doors:

1. Provide Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde resin.
2. Blocking Provide wood blocking in particleboard-core doors as follows:
   a. 5-inch top-rail blocking, in doors indicated to have closers.
   b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
3. Provide doors with either glued-wood-stave or better than stave cores instead of particleboard cores for doors indicated to receive exit devices.

D. Structural- Composite-Lumber-Core Doors:

1. Structural- Composite-Lumber: WDMA I.S.10.
   a. Screw Withdrawal, Face: 700 lbf.
   b. Screw Withdrawal, Edge: 400 lbf.

E. Mineral- Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
   a. 5-inch top-rail blocking.
   b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
   c. 5-inch mid-rail blocking, in doors indicated to have armor plates.
   d. 4-1/2 by 10 inch lock blocks in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

F. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: SELECT White Birch.
3. Cut: Plain sliced (flat sliced).
4. Doors with sharp contrast of shades and/or barber poling SHALL NOT be permitted and will be REJECTED. Provide exposed edges and other exposed solid wood components of same species as face veneers.
5. Match between Veneer Leaves: Slip match.
6. Assembly of Veneer Leaves on Door Faces: Center-balance match.
7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
8. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
   a. Provide door faces of compatible color and grain within each separate room or area of building.
9. Transom Match: Continuous match.
10. Exposed Vertical Edges: Same species as faces or a compatible species.
11. Core Non-rated: Particleboard.
12. Core Fire-rated: Mineral.
13. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

B. Light Openings: Factory cut openings. Trim openings for non-fire rated doors with solid wood moldings of manufacturer's standard shape, unless indicated otherwise. Same species as door faces.

2.04 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.05 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing. Finish faces, all four edges, edges of cutouts, and mortises.

B. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Gloss, unless indicated otherwise.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer: Examine doorframes and verify that frames are correct type and have been installed for proper hanging of corresponding doors. Installer shall notify Contractor in writing of conditions detrimental to proper and timely installation of wood doors; do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

3.03 INSTALLATION

A. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
   a. Comply with NFPA 80 for fire-rated doors.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.04 ADJUSTING AND CLEANING

A. Re-hang or replace doors that do not swing or operate freely. Refinish or replace doors damaged during installation.

3.05 PROTECTION OF COMPLETED WORK

A. Installer shall advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of the Work.

B. Doors damaged before acceptance of the Work shall be repaired or replaced.

END OF SECTION

SECTION 08 31 13 ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
2. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
3. Division 09 Section “Gypsum Board” for gypsum board ceilings.
4. Division 09 Section "Acoustical Ceilings" for suspended acoustical tile ceilings.
5. Division 23 Section "Duct Accessories" for heating and air-conditioning duct access doors.

C. References:

1. ITS (DIR) – Directory of Listed Products, Intertek Testing Services NA, Inc. current edition.
2. UL (FRD) – Fire Resistance Directory; Underwriters Laboratories Inc; current edition.
3. Warnock Hersey – Certification Listing.

1.02 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work. .

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

E. Plaster Beads: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.03 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Babcock-Davis; A Cierra Products Co., Minneapolis, MN. Tel. (888) 412-3726.
2. J. L. Industries, Inc., Bloomington, MN. Tel. (800) 554-6077.
3. Larsen's Manufacturing Company, Minneapolis, MN. Tel. (800) 527-7367.
4. Milcor Inc., Lima, OH. Tel. (800) 528-1411.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.

1. Locations: Wall surfaces.
2. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Latch: Self-latching bolt operated by screwdriver with interior release.
6. Lock: Mortise cylinder.
   a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

D. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead flange.
4. Hinges: Continuous piano.
5. Latch: Self-latching bolt operated by screwdriver with interior release.
6. Lock: Mortise cylinder.

   a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

E. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.

1. Locations: Wall surfaces.
2. Door: Minimum 0.040-inch- thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- thick fiberglass insulation.
3. Frame: Minimum 0.060-inch- thick extruded aluminum.

4. Hinges: Continuous piano, zinc plated.
5. Lock: Dual-action handles with key lock.

F. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with mortise cylinder lock.
   a. Lock Preparation: Prepare door panel to accept cylinder specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
3. Provide mounting holes in frames for attachment of units to metal or wood framing.
4. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Aluminum-framed entrance and storefront system includes tubular aluminum sections with supplementary internal support framing as required, aluminum and glass entrances, shop fabricated, factory finished, glass and glazing, related flashing, anchorage and attachment devices.

B. Related Sections:

1. Section 07 92 00 – Joint Sealants.
2. Section 08 71 00 – Door Hardware.
3. Section 08 80 00 – Glazing.
4. Section 09 05 15 - Color Design.
5. Section 12 21 14 - Horizontal Louver Blinds-Metal: Attachments to framing member.
6. Division 26 Section for Electrical.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications for materials and fabrication of aluminum-framed entrance and storefront, and instructions and recommendations for installation and maintenance. Include certified test reports showing compliance with requirements where a test method is indicated. Submit product data for door hardware and accessories.

B. Shop Drawings: Submit drawings showing adaptation of manufacturer's standard system to project; include typical unit elevations at 1/2 inch scale and details at 3 inch scale, to show dimensioning, member profiles, anchorage system, interface with building construction, and glazing. Show section moduli of wind-load-bearing members, and calculations of stresses and deflections for performance under design loading. Show clearly on shop drawings where and how manufacturer's system deviates from Contract Drawings and these Specifications.

C. Samples: Submit samples of each type and color of aluminum finish, on l2 inch long sections of extrusions of formed shapes and on 6 inch squares of sheet/plate. Include 2 or more samples in each set, showing near-limits of variations (if any) in color and texture of finish.

D. Delegated-Design Submittal: For glazed aluminum-framed entrance and storefront walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced to perform work of this section who has at least five years experience in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect material against damage from elements, construction activities, and other hazards before, during and after installation.

1.08 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Final Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum storefront walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum-framed entrance and storefront walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum-framed entrance and storefront walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Uniform Loads:

1. A static air design load of 40 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.

D. Air Infiltration:

1. The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 pounds per square foot.

E. Water Resistance, (Static):

1. The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 pounds per square foot as defined in AAMA 501.

F. Water Resistance, (Dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 pounds per square foot as defined in AAMA 501.

G. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 73 for frame.

H. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.

I. Sound Transmission Loss: When tested to ASTM E90, the Sound Transmission Class (STC) shall not be less than 34 based upon one inch insulating glass (1/4 inch glass, 1/2 inch air space, 1/4 inch glass).

2.02 MANUFACTURERS

A. Drawings and Specifications are based on products as manufactured by Kawneer Company, Inc., 555 Guthridge Court, Norcross, GA 30092. Tel. (770) 449-5555.

B. Equivalent products by the following manufacturers are acceptable:

1. EFCO Corporation, Monett, MO. Tel. (800) 221-4169.
2. Oldcastle Building Envelope, Terrell, TX. Tel. (866) 653-2278.
3. Traco, Cranberry Township, PA. Tel. (724) 776-7000.

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. .

2.03 MATERIALS

A. Aluminum-framed Storefront Framing: Kawneer Trifab VG 451 - 2 inches by 4-1/2 inches nominal dimensions; Screw Spline Fabrication.

1. Material Standard: Extruded Aluminum, ASTM B 221, 6063-T5 or 6063-T6 alloy and temper.
2. Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements
3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.04 ACCESSORIES

A. Fasteners: Where exposed, shall be Stainless Steel.

B. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion.

2.05 ENTRANCES

A. Aluminum entrance doors shall be equal to Kawneer Series 350 Medium Style Swing Doors. Coordinate door hardware with Division 26 Sections.

2.06 HARDWARE

A. Refer to Section 08 71 00 – Door Hardware for requirements for hardware items other than those indicated herein to be provided by manufacturer of aluminum entrances.

B. Exterior Door: Provide door manufacturer's standard heavy-duty hardware units as shown, schedule, or required for operation of each door, including the following items of size, number, and type recommended by manufacturer for service required, finish to match door, unless otherwise indicated:

1. Top, Bottom, and Intermediate Pivots: Cast aluminum ally with steel pins and oilite bearings (ball-bearing bottom pivots). Finish No. 17 Clear.
2. Overhead Closers: Equal to LCN 4040 Parallel Arm with Cush-N-Stop and custom powder coat metal cover.
3. Locks: Adams-Rite MS 1850A (Refer to Section 08 71 00 for cylinder) mount 41-9/16 inches above bottom of door.
4. Push / Pull Handles: Architects Classic Hardware Style "CO-9" pull and "CP-11" push bar. Mount pull top attachment 44-3/16 inches above bottom of door and push bar 37 inches above bottom of door. Finish shall be No. 17 clear anodized aluminum.
5. Weatherstripping: Sealair weathering comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
6. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. Finish shall match door color.
7. Thresholds: Extruded aluminum in clear anodized finish, complete with anchors and clips, coordinate with pivots. Size and shape of thresholds as indicated on the Drawings.:

2.07 FABRICATION

A. General:

1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
3. Prepare components to receive anchor devices. Fabricate anchors.
4. Arrange fasteners and attachments to conceal from view.

2.08 ALUMINUM FINISHES

A. Anodic Finish: Kawneer Permanodic™ AA-M10C21A31, Architectural Class II Clear Anodic Coating (Color No. 17 Clear).

2.09 SOURCE QUALITY CONTROL

A. Source Quality: Provide aluminum-framed entrance and storefront specified herein from a single source.

1. Building Enclosure System: When aluminum-framed entrance and storefront are part of a building enclosure system, including entrances, entrance hardware, windows, storefront framing and related products, provide building enclosure system products from a single source manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer's acceptable tolerances.

1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

A. General: Install aluminum-framed entrance and storefront systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.

1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" on center.
3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

3.03 PROTECTION AND CLEANING

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum-framed entrance and storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions. Clean units and glazing again no more than one week prior to Substantial Completion. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 08 43 13 ALUMINUM-FRAMED STOREFRONTS-INTERIOR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Interior aluminum-framed storefront system with tubular aluminum sections with supplementary internal support framing as required, shop fabricated, factory finished, glass and glazing, intermediate rails / muntins, related anchorage and attachment devices.

B. Related Sections:

1. Section 08 80 00 - Glazing.
2. Section 08 56 20 – Exchange Window
3. Section 09 05 15 - Color Design.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Submit component dimensions; describe components within assembly, anchorage, fasteners, and glass.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Design structural support framing components under direct supervision of a professional engineer experienced in design of this Work and licensed at the place where the Project is located.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by MDOT Architect, except with MDOT Architect's approval. If changes are proposed, submit comprehensive explanatory data to MDOT Architect for review.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store, protect, and handle products to and on project site per manufacturer’s instructions.

B. Store products on minimum 4-inch high wood blocking and cover. Do not use non-vented plastic or canvas that could create a humidity chamber.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Final Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2.02 MANUFACTURERS

A. Manufacturers: Drawings and Specifications are based on products manufactured by Kawneer Co., Inc., 555 Guthridge Court, Norcross, GA 30092. Tel. (770) 449-5555.

B. Equivalent products by the following manufacturers are acceptable:

1. EFCO Corporation, Monett, MO. Tel. (800) 221-4169.
2. Oldcastle Building Envelope, Terrell, TX. Tel. (866) 653-2278.
3. Traco, Cranberry Township, PA. Tel. (724) 776-7000.

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.

2.03 MATERIALS

A. Framing Members: Aluminum Storefront Framing; Kawneer series Trifab VG 450 – 1-3/4 inches by 4-1/2 inches nominal dimensions; Non-Thermal; Center Glazed; Interior Structural Silicone Glazed; Screw Spline Fabrication

B. Aluminum Framing and Components:

1. Material Standard: Extruded Aluminum; ASTM B221; 6063-T6 alloy for extruded structural members.
2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
3. Glass: Specified in Section 08 80 00.
4. Glazing Materials: Specified in Section 08 80 00..
5. Sealant and Backing Materials: Specified in Section 07 92 00.

C. Accessories:

1. Fasteners-Storefront: Shall be 300 Series Stainless Steel.
2. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
3. Intermediate Rails / Muntins: As indicated on Drawings.

2.04 FABRICATION

A. General:

1. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
3. Prepare components to receive anchor devices. Fabricate anchors.
4. Arrange fasteners and attachments to conceal from view.
5. Reinforce interior horizontal head rail to receive blind track brackets and attachments.
6. Reinforce framing members for imposed loads.

2.05 ALUMINUM FINISHES

A. Anodic Finish: Kawneer Permanodic™ AA-M10C21A31, Architectural Class II Clear Anodic Coating (Color No. 17 Clear).

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Set continuous sill members in full sealant bed as specified in Section 07 92 00 "Joint Sealants".

C. Install components plumb and true in alignment.

D. Install glazing as specified in Section 08 80 00 "Glazing."

3.02 PROTECTION AND CLEANING

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from harmful contaminants.

1. Replace broken glass.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 08 56 20 EXCHANGE WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: deal drawer, deal tray and speak hole.

B. Related Sections: Section 08 43 13 - Aluminum-Framed Storefront-Interior.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for all items specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Creative Industries Inc., 1024 Western Drive, Indianapolis, IN 46241. Tel. (800) 776-2068.

B. Equivalent products by the following manufacturers are acceptable:

1. C.R. Laurence Company, Gardena, CA. Tel. (800) 421-6144.
2. Nissen & Company, Inc. South El Monte, CA. Tel. (323) 723-3636.
3. Quikserv Corporation, Houston, TX. Tel. (800) 388-8307

A. 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 DEAL DRAWER

A. Provide flush mount, 16 gage brushed stainless steel manual deal drawer with lexan drawer cover with pivot hinge and ball bearing drawer glides.

B. Drawer unit shall be 15 -7/8 inches wide, 16-1/4 inches deep and 4 -15/16 inches high.

2.03 DEAL TRAY

A. Provide flush mount, brushed stainless steel deal tray.

B. Tray unit shall be 12 inches wide, 16 inches deep and 2 inches high. Inside depth shall be 1-1/2 inches.

2.04 SPEAK HOLE

A. Equal to Creative Industries model number 6-D.

B. Provide 6 inches diameter cast stainless steel talk thru with evenly space concentric louvers. Model shall be equal to Creative Industries No. 6-D Talk Thru.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install items included in this section in locations and at mounting heights indicated.

B. Securely fasten to millwork, square and plumb, comply with manufacturer's instructions.

C. Provide all required templates to millwork fabricator for coordination.

D. Check all units for scratched, nicked, and other surface defects.

1. Units with these conditions shall be repaired or replaced.

E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.02 CLEANING AND PROTECTION

A. Immediately after installing, clean exposed surfaces in accordance with manufacturer’s instructions. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hardware as shown on the Drawings and in Schedules. Door hardware is hereby defined to include all items known commercially as builder's hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. The required types of hardware include (but are not limited to) the following:

1. Butts and hinges
2. Lock cylinders and keys
3. Lock and latch sets
4. Bolts
5. Panic exit devices
6. Mag Locks (See Electrical Specifications)
7. Push / pull units
8. Closers
9. Door trim units
10. Stripping and seals
11. Thresholds

C. Items of hardware not definitely specified, but required for the completion and proper operation of the doors, shall be suitable in type, comparable to the type specified for similar openings.

1. Labeled doors shall be fitted with labeled hardware.

D. Modifications of hardware required by reason of construction characteristics shall provide the proper operation or functional features.

1. Contractor shall be fully responsible for checking all details, such as wall trim clearance, bevels, backsets, proper type strike plates, length of spindles, hands of locks, etc., in order that all items of hardware shall fit properly.
2. Hardware for application to metal shall be made to standard templates.
3. Furnish template information to door and frame fabricators and all other trades requiring same, in order that they may cut, reinforce or otherwise prepare in the shop, materials for reception of hardware.

E. Hardware shall be free from defects affecting appearance and serviceability.

1. Working parts shall be well fitted and smooth working without unnecessary play.
2. Hardware shall be delivered to the building site in sufficient time in advance of its requirement for use for inspection prior to installation.

1.02 REFERENCES

A. Coordinate with the following Sections for the installation of finish hardware:

1. Section 08 11 13 – Hollow Metal Doors and Frames.
2. Section 08 14 29 – Pre-finished Wood Doors.

3. 08 41 13 – Aluminum Framed Entrances and Storefronts.
4. Divisions 26 and 28 Sections for electronic door hardware.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and Installation instructions for each type of hardware.

1. Include operating instructions, maintenance information and spare part sources.

B. Shop Drawings: Details of electrified door hardware.

C. Samples: Submit samples for color of finishes (Black WILL NOT Be Acceptable In Lieu Of Antique Bronze Oiled Finish) and such samples as required by the Project Engineer / MDOT Architect for approval. Do not deliver hardware until approval is obtained.

D. Templates: Provide templates and / or physical hardware to trades as required and in sufficient time to prevent delay in the execution of the Work.

E. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
   b. Content: Include the following information:
      1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.
3. Approval of schedule will not relieve Contractor of responsibility for furnishing all necessary hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, MDOT Architect and Project Engineer (Owner’s Representative) about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Draft-Control Door Assemblies: Where draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

B. Packing and Marking: Package each item of hardware and lockset separately in individual containers, complete with screws, keys, instructions and installation template for spotting mortising tools. Mark each container with item number corresponding to number shown on Contractor's hardware schedule.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from Date of Completion, unless otherwise indicated.
   a. Electromagnetic Locks: Five years from Date of Completion.
   b. Lock Sets: Two years from Date of Completion.
   c. Manual Closers: 10 years from Date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Hinges – Hager, Ives, McKinney.
2. Continuous Hinges – Hager, Ives, Markar.
3. Cylinders – Best, Corbin / Russwin, Sargent, Schlage.
4. Flushbolts and Accessories – Hager, Ives, Rockwood.
5. Locksets – Corbin / Russwin, Sargent, Schlage.
6. Deadbolts – Corbin / Russwin, Sargent, Schlage.
7. Exit Devices – Precision, Sargent, Von Duprin.
8. Door Closers – Corbin / Russwin (DC3000), LCN (1460), Sargent (1430).
9. Protective Plates – Hager, Ives, Rockwood.
10. Door Stops – Hager, Ives, Rockwood.
11. Overhead Stops / Holders – Glynn Johnson, Rixson, Sargent.
12. Gasketing and Thresholds – National Guard Products, Pemko, Reese.
13. Silencers – Hager, Ives, Rockwood.
14. Power Supplies – Schlage Electronics, Securitron, Von Duprin.

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 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled **on** Drawings to comply with requirements in this Section.

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

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

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.03 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.
2. Existing System:
   a. Master key or grand master key locks to Owner's existing system.
   b. Re-key Owner's existing master key system into new keying system.
3. Keyed Alike: Key all cylinders to same change key.

B. Removable Cores: Furnish all cylinders & locksets with removable type cores. The removable core system shall be one that uses either temporary construction cores or construction keyed cores operated by a construction key until such time the construction key is rendered inactive by the change key or retractor key.

C. Keys: Brass.

1. Quantity: In addition to one extra key blank for each lock, provide the following:
   a. Cylinder Change Keys: Three.
   b. Master Keys: Six.

2.04 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
   a. Wood or Machine Screws: For the following:
      1) Hinges mortised to doors or frames.
      2) Strike plates to frames.
      3) Closers to doors and frames.
   b. Steel Through Bolts: For the following unless door blocking is provided:
      1) Surface hinges to doors.

2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.05 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

F. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.
2. Furnish permanent cores to Owner for installation.

G. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

H. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Project Engineer / MDOT Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

I. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

1. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hairline joints.
2. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel that will not corrode in contact with the threshold metal.
3. Do not plug drainage holes or block weeps.
4. Remove excess sealant.

J. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

K. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

M. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended).

3.02 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.03 DOOR HARDWARE SCHEDULE

A. Abbreviations

1. MK - McKinney
2. PE - Pemko
3. MR - Markar
4. SU - Securitron
5. SA - Sargent
6. YA - Yale
7. BE - Best Access Systems

8. RO - Rockwood
9. OT - Other

HW1 (For Aluminum Storefront Door @ Exterior from Vestibule)
Doors: 101A
2 – Each Cylinders Best 1E72/1E74 (as required) 613
(Balance of Hardware by Door Manufacturer)

HW2 (For Exterior Hollow Metal Doors)
Doors: 108, 110A, 110B, 123B, 129

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Magnetic Lock	by others		
1	Rim Exit Device	LC 43 8804 ETL	US32D	SA
1	Cylinder	1E-74/ 1E-72 (as required)	626	BE
1	Door Closer	TB 1431 CPS	EN	SA
1	Kick Plate	K1050 8" x 2" LDW (mounted push side)	US32D	RO
1	Threshold	2005AV		PE
1	Gasketing	303SNV		PE
1	Door Bottom	2211AV		PE
3	Silencer	608-RKW		RO

Note:
All wiring by others. Contractor shall coordinate with Divisions 26 and 27 Sections.

HW3 (For Interior Wood Door @ Vestibule from Corridor)
Doors: 101B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Magnetic Lock	by others		
1	Rim Exit Device	12 LC 43 8804 ETL	US32D	SA
1	Cylinder	1E-74/ 1E-72 (as required)	626	BE
1	Door Closer	TB 1431 O/P (where applicable)	EN	SA
1	Kick Plate	K1050 8" x 2" LDW (mounted push side)	US15	RO
1	Mop Plate	K1050 6" x 1" LDW (mounted pull side)	US15	RO
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

Note:
All wiring and buzzer at desk by others. Contractor shall coordinate with Divisions 26 and 27 Sections.

HW4 (For Interior Wood Doors @ Break, Conference, Crew Rm. & Multiple Occupant Offices, Survey Rm. and Survey Equipment)
Doors: 112, 113, 114, 115, 121, 122, 123A, 127A, 128, 130A, and 130B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Passage Latch	28 10U15 LL	US15	SA
1	Door Closer	TB 1431 O/P (where applicable)	EN	SA
1	Kick Plate	K1050 8" x 2" LDW (mounted push side)	US15	RO
1	Mop Plate	K1050 6" x 1" LDW (mounted pull side)	US15	RO
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

HW5 (For Interior Wood Doors @ Break Room to Conference Room)
Doors: 127B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Passage Latch	28 10U15 LL	US15	SA
1	Door Stop	440	US15	RO
3	Silencer	608-RKW		RO

HW6 (For Interior Wood Door @ Single Occupant Offices and Storage Rooms)
Doors: 102, 103, 104, 105, 106, 107, 109A, 109B, 111, 116, and 117

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Entry Lock	28 70 10G24 LL	US15	SA
1	Permanent Core	as required to match existing key system	626	BE
1	Door Closer	TB 1431 O/P (where applicable)	EN	SA
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

HW7 (For Interior Wood Door @ Janitor's Closet / Shower)
Doors: 120

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Privacy Lock	28 10U65 LL	US15	SA
1	Deadbolt	D292	619	YA
1	Door Closer	TB 1431 O/P (where applicable)	EN	SA
1	Kick Plate	K1050 8" x 2" LDW (mounted push side)	US15	RO
1	Mop Plate	K1050 6" x 1" LDW (mounted pull side)	US15	RO
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

HW8 (For interior Wood Door @ Elec / Comm. Room and Closet)
Doors: 118,119

3	Hinge (spring)	1502 4-1/2" x 4-1/2"	US15	MK
1	Storeroom/Closet Lock	28 70 10G04 LL	US15	SA
1	Permanent Core	as required to match existing key system	626	BE
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

HW9 (for Interior Wood Door @ Public Toilet Rooms)
Doors: 124, 125

3	Hinge	TA2714 4-1/2" x 4-1/2"	US15	MK
1	Passage Latch	28 10U15 LL	US15	SA
1	Door Closer	TB 1431 O/P (where applicable)	EN	SA
1	Kick Plate	K1050 8" x 2" LDW (mounted push side)	US15	RO
1	Mop Plate	K1050 6" x 1" LDW (mounted pull side)	US15	RO
1	Door Stop	440	US15	RO
1	Smoke Seal	S88BL		PE

END OF SECTION

SECTION 08 80 00 GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Glass and glazing for doors, aluminum framed entrances and storefronts, and other glazed openings, interior and exterior locations.

B. Related Sections:

1. Section 08 11 13 - Hollow Metal Doors and Frames.
2. Section 08 14 29 - Prefinished Wood Doors.
3. Section 08 41 13 - Aluminum Framed Entrances and Storefronts.

1.02 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.03 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.05 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. Prime Glass Standard: FS DD-G-45l.
2. Heat-Treated Glass Standard: FS DD-G-l403.
3. Safety Glass Standard: CPSC l6 CFR l20l.
4. GANA Publications: GANA's "Glazing Manual."
5. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect glass during transit, storage and handling to prevent scratching or breakage of glass. Replace broken glass.

1.07 PROJECT CONDITIONS

A. Schedule meeting with Glazier and other trades affected by glass installation, prior to beginning of installation.

1. Do not perform work under adverse weather or job conditions.
2. Install liquid sealant when temperatures are within lower or middle third of temperature range recommended by manufacturer.

1.08 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following prime glass manufacturers are acceptable:

1. Arch Aluminum & Glass Co., Inc., Columbus, OH. Tel No. (800) 870-2519.
2. Cardinal Glass Industries, Eden Prairie, MN. Tel. (952) 229-2600.
3. Old Castle Building Envelops, Santa Monica, CA. Tel. (866) 653-2278.
4. PPG Industries, Inc., Pittsburgh, PA. Tel. (800) 377-5267.
5. Safti First, San Francisco, CA. Tel. (888) 653-3333.
6. Viracon, Inc., Owatonna, MN. Tel. (800) 533-2080.

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 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.03 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

2.04 INSULATING GLASS

A. Material: Organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated. Unless shown otherwise on Drawings, use this type glass for all exterior applications.

B. Characteristics: Other requirements specified for glass characteristics, air space, sealing system, sealant spacer material, corner design and desiccant are as follows:

1. Thickness of Each Pane: 1/4 - inch.
2. Airspace Thickness: 1/2 - inch.
3. Sealing System: Manufacturer’s standard 1 inch sealing system with Argon.
4. Spacer Material: Manufacturer's standard metal-white.
5. Desiccant: Manufacturer's standard, either molecular sieve or silica gel.
6. Corner Construction: Manufacturer's standard.
7. Exterior Pane: Tinted; color – “Solargray” with Solarban 60 MSVD (Sputter) Low-E on 2nd (air space) surface by PPG Industries, Inc.
8. Interior Pane: Clear.
9. Unit Performance Requirements for “Solargray”
   a. Light Transmission (visible): 35 percent
   b. U-Value, Summer: 0.28
   c. U-Value, Winter: 0.29
   d. Relative Heat Gain: 73 BTU per Hour Ft².
   e. Solar Heat Gain Coefficient (SHGC): 0. 25
   f. Shading Coefficient: 0. 29

2.05 LAMINATED CLEAR SAFETY GLASS

A. Two layers of 1/8 inch glass Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select) with a 0.030 polyvinyl butyryl interlayer. Total thickness, 1/4 inch (plus). Unless shown otherwise on Drawings, use this type glass for all interior applications.

2.06 UNFRAMED MIRRORS

A. Number 1 quality, 1/4 inch thick, select float glass mirror electrolytically copper-plated surface, guaranteed against silver spoilage for 10 years. Size as shown on the Drawings. Mirror edges shall be eased. Mounting clips shall be bright polished chrome corrosion resistant metal.

2.07 SETTING MATERIALS

A. Provide necessary primers, sealants, channels, setting blocks, etc. with items to be glazed. Conform to requirements set forth in FGJA Glazing Manual.

2.08 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

PART 3 - EXECUTION

3.01 PREPARATION FOR GLAZING

A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.

1. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

3.02 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel-bead.

J. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.03 GLAZING INSTALLATION

A. Do not commence glazing Work until the required primers have been applied and have dried. Clean all surfaces to which setting materials are to be applied to assure that the materials properly adhere and seal.

B. Experienced glaziers having highest quality workmanship shall perform all glazing. Glass shall be set without springing or forcing. Putty, glazing compound, stops and the like shall not project above the sight line. Exposed surfaces of putty and glazing compound shall be left straight, flat and clean. Corners shall be well formed.

C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

D. Apply clear glazing compound around perimeter and at all glass-to-glass connections of butt-glazing system. Compound shall be the type recommended by the glass manufacturer for this particular installation.

E. Door Lites: Install glass in frames in sizes as shown on the Drawings. Where fire ratings are indicated for doors, frames shall comply with applicable U.L. fire rating standards.

F. Unframed Mirrors: Install unframed mirrors with a combination of metal clips and construction adhesive securely attached to the wall studs and/or concealed blocking.

3.04 STANDARDS AND PERFORMANCE

A. Watertight and airtight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealant or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.

B. Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the Work. During installation, discard units with significant edge damage or other imperfections.

C. Glazing channel dimensions where shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thickness, with reasonable tolerances. Adjust as required by job conditions at time of installation.

D. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual," except where more stringent requirements are indicated.

3.05 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

1. Cure sealant for high early strength and durability

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 08 91 19 FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Extruded aluminum fixed louvers with insect/bird screens and sill extensions as indicated on the Drawings including indications of sizes and locations.

B. Related Requirements:

1. Section 07 92 00 – Sealants (for sealant in connection with installations of louvers).
2. Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product; Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: Submit 6-inch square samples of each required finish.

1. Prepare samples on metal of same gage and alloy to be used in Work.
2. Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Construction Specialties, Inc., 49 Meeker Ave., Cranford, NJ 07016. Tel. (908) 272-5200.

B. Equivalent products by the following manufacturers are acceptable:

1. All-Lite Louvers, Mineral Wells, WV. Tel. (304) 489-8113.
2. Ruskin Manufacturing, Kansas City, MO. Tel. (816) 761-7476.

C. 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 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. acting inward or outward.

C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design earthquake spectral response acceleration, short period (Sds) for Project as required by IBC 2012 and AHJ.
2. Component Importance Factor 1.0, unless noted otherwise.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Fixed Louver-4 Inches Deep:

1. Manufacturer and Model: Equal to C/S Model A4097.
2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.081 inch.

4. Mullion Type: Hidden vertical mullions of type and at spacing indicated but not further apart than recommended by manufacturer or 72 inches on center, whichever is less.
   a. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated
5. Louver Performance Ratings:
   a. Free Area: Not less than 50.44 percent for 48-inch- wide by 48-inch- high louver.
   b. Air Performance: Not more than 0.14-inch wg static pressure drop at 872-fpm free-area intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

A. Provide removable screens for exterior louvers. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated. Provide frames consisting of U-shaped metal for permanently securing screen mesh.

B. Use insect screens of 18X14 aluminum mesh and additional 1/2-inch sq. mesh, 0.050-inch aluminum wire bird screen. Locate screens on inside face of louvers, unless otherwise indicated. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on center between.

C. Use bird screen only for louvers that are connected to duct work.

2.05 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T2. Blade and frame thickness shall be 0.081 inch minimum.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.06 FABRICATION

A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thickness indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage; strength; durability; and uniform appearance.

B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealant in joints between louvers and adjoining Work.

C. Include supports, anchorage, and accessories required for complete assembly.

D. Sill Extensions: Loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.

1. Setback dimension is 3-3/4 inches to 6 inches.

E. Join frame members to one another and to stationary louver blades.

1. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

2.07 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range of standard and premium colors. Refer to Section 09 05 15 for color.

2.08 SOURCE QUALITY CONTROL

A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.

B. SMACNA Recommendations: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

C. Shop Assembly: Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.

1. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations.
2. Clearly mark units for re-assembly and coordinated installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

E. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

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
• 04 20 00 - CMU	SW7029 Agreeable Gray
• 06 40 00 - Plastic Lam - Base Cab.	Formica - 837 Graphite - Matte Finish
• 06 40 00 - Plastic Lam - Wall Cab.	Formica - 464 Graystone - Matte Finish
• 06 40 00 - Plastic Lam - Countertop	Formica - 9285 White Twill
• 06 40 00 - Solid Surface - Countertop	Cambria - Snowdon White
• 07 92 00 - Joint Sealants	Pecora-Match adjacent lighter color
• 08 11 13 - HM Drs & Frames (Ext)	(P4) SW7674 Peppercorn
• 08 11 13 - HM Drs & Frames (Int)	(P3) SW7025 Backdrop
• 08 41 13 - Alum Fr Ent & Storefront	Kawneer - #17 Clear Anodized
• 08 14 29 - Prefinished Wood Doors	Graham - Select Shite Birch #400
• 08 71 00 - Door Hardware	Satin Nickel
• 08 91 19 - Fixed Louvers	C/S Group - Metallic #705 Bright Silver
• 09 29 00 – Gyp. Board (Walls)	SW #7031 Mega Greige
• 09 29 00 – Gyp. Board (Wall-Trim)	SW #7029 Agreeable Gray
• 09 29 00 – Gyp. Board (Wall-Accent)	SW #7048 Urbane Bronze
• 09 29 00 - Gypsum Board(Ceilings)	S/W #7007 Ceiling Bright White
• 09 31 13 - Porcelain Tile Floor	POR-1 American Olean (12 x48) Style: Scene Colorbody Porcelain Color: Horizon Unpolished SC04
• 09 31 13 - Porcelain Tile Base	POR-1 American Olean (12 x 48) Style: Scene Colorbody Porcelain Color: Horizon Unpolished SC04
• 09 31 13 - Porcelain Tile Wall	POR-1 American Olean (12x48) Style: Scene Colorbody Porcelain Color: Horizon Unpolished SC04
• 09 31 13 - Cer. Tile Wall (Accent)	Florida Tile (5/8 x 5/8) Style: Bliss Color: Cotton Wood
• 09 31 13 - Grout (Floors)	Laticrete - #24 Natural Grey
• 09 31 13 - Grout (Walls)	Laticrete - #24 Natural Grey
• 09 65 00 - Lux Vinyl Floor Tile	J+J Flooring Luxury Vinyl Tile (9x48) Style: LVT Color: Framework V5001
• 09 65 00 - Rubber Base	Johnsonite - #24 Grey Haze WG
• 09 68 18 - Modular Walk-Off Carpet	(TFC-1) J+J Flooring Style: Catwalk II Walk-off Modular Color: Glitterati #1424 Installation Method: Quarter Turn 24x24
• 09 68 18 - Modular Textile Flooring	(TCF-2) Kinetex by J+J Flooring Style: Timber Demi-Plank Color: Buckhorn #1926 Installation Method: Herringbone 12x48
• 09 68 18 - Modular Textile Flooring	(TCF-3) Kinetex by J+J Flooring Style: Strata Plank Color: 1848 Feldspar Installation Method: Parquet 18x36

• 10 21 15 - Toilet Compartments	Scranton Texture: Orange Peel Color: Shale
• 10 26 13 - Corner Guards	C/S Group: Acrovyn #314 Ozark
• 10 51 13 - Metal Lockers	Penco - #028 Gray
• 10 73 16 - Canopies	Mapes - Clear Anodized
• 11 31 15 - Appliances (Range)	GE-Stainless Steel
• 11 31 15 - Appliances (Microwave)	GE-Stainless Steel
• 11 31 15 - Appliances (Refrigerator)	GE-Stainless Steel
• 12 21 14 - Horiz Lvr Blinds - Metal	Hunter Douglas - Dover Matte
• 12 48 43 - Floor Mats (Carpet)	C/S Group - 7325 Wrought Iron
• 12 48 43 - Floor Mats (Rails)	C/S Group - Black
• 12 48 43 - Floor Mats (Vinyl Edge)	C/S Group - Black
• 12 48 43 - Floor Mats (Frame)	C/S Group - Black
• 13 34 17 - Roof Panels - Equip Shed	Ceco - Galvalume® Plus
• 13 34 17 - Roof Fascia	Ceco - Galvalume® Plus
• 13 34 17 - Gutter & Downspouts	Ceco - Galvalume® Plus
• 13 34 19 - Roof Panels - Proj. Ofc.	Kingspan - Galvalume® Plus
• 13 34 19 - Wall Panels #1	Morin - Galvalume® Plus
• 13 34 19 - Wall Panel #2	Morin - Blue Gray
• 13 34 19 - Trim (Panels)	Kingspan/Morin - Match Adjacent Material
• 13 34 19 - Roof Fascia	Kingspan - Galvalume® Plus
• 13 34 19 - Gutter & Downspouts	Kingspan - Galvalume® Plus

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 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Gypsum board work with a tape-and-compound joint treatment system known as "drywall finishing" work.

B. The types of Work required include the following:

1. Gypsum board including screw-type metal support system.
2. Gypsum board applied to metal framing and furring.
3. Gypsum backing boards for application of other finishes.
4. Drywall finishing (joint tape-and-compound treatment).

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical product data, installation instructions and recommendations for products specified.

1.03 QUALITY ASSURANCE

A. Fire Resistance: Where work is indicated for fire resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL.

B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.

C. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.

D. Manufacturer: Obtain gypsum boards, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.05 PROJECT CONDITIONS

A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work.

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

B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Obtain gypsum board, framing and fasteners, trim accessories, adhesives and joint treatment products from one of the following:

1. CertainTeed Corporation, PA Tel: (800) 233-8990.
2. Georgia-Pacific Corp, Atlanta, GA, Tel. (800) 327-2344.
3. National Gypsum Company, Charlotte, NC, Tel. (800) 343-4893.
4. United States Gypsum Company, Chicago, IL, Tel. (800) 874-4968.

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 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.03 METAL SUPPORT MATERIALS

A. To the extent not otherwise indicated, comply with Gypsum Association Specification GA-203 "Installation of Screw-Type Steel Framing Members to Receive Gypsum board" (as specified and recommended) for metal system supporting gypsum drywall work.

B. Interior Studs: ASTM C 645; 20-gage by 3-5/8 inches deep, except as otherwise indicated or specified herein. Provide stud manufacturer's standard accessories such as clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.

1. Runners shall match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2. Provide double 20 gage studs at all openings and doorjambs and at door and opening headers.

C. Furring Members: ASTM C 645; 20-gage, hat-shaped. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

D. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.

2.04 GYPSUM BOARD PRODUCTS

A. Furnish gypsum board products in maximum lengths available to minimize end-to-end butt joints. To the extent not otherwise indicated, comply with GA-216, as specified and recommended.

B. Exposed gypsum board shall be Type X, fire rated type with tapered long edges and as follows:

1. Edge Profile: Special rounded or beveled edge.
2. Sheet Size: Maximum length available that will minimize end joints.
3. Thickness: 5/8 inch, except where otherwise indicated.
4. Water-resistant Type (WR-1): Provide at exterior walls and at “Wet” areas without ceramic tile; equal to 5/8 inch thick DensArmor Plus Fireguard by G-P Gypsum.
5. Cement Board: Provide water-resistant cement based backer board as a base for all ceramic wall tiles, equal to 5/8 inch thick Durock by USG.

2.05 TRIM ACCESSORIES

A. Manufacturer’s standard galvanized steel beaded units with flanges for concealment in joint compound including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

B. Where metal moldings are specifically called out on the Drawings, provide the appropriate item from below:

1. Edge Trim: USG No. 200-A.
2. Control Joint: USG No. 093.

2.06 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper, perforated type.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound: On interior work provide chemical hardening type for bedding and filling, ready-mixed vinyl-type or non-case in-type for topping. On exterior work provide water- resistant type.

2.07 MISCELLANEOUS MATERIALS

A. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board. Gypsum board fasteners shall comply with GA-216. Provide anti-corrosive type at exterior applications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the Work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.02 INSTALLATION OF METAL SUPPORT SYSTEMS

A. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions.

1. Furnish, steel deck hanger clips, and similar devices to other trades for installation well in advance of time needed for coordination with other work.
2. Isolate stud system from transfer to structural loading to system, both horizontally and vertically.
3. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work.
4. Terminate partition stud systems one foot above finished ceiling, braced each side at 45 degrees at 4 feet on center, except where indicated to be extended to structural support or substrate above.
5. Space studs 16 inches on center except as otherwise indicated.

B. Door Frames: Install additional jamb studs at door frames as indicated, but not less than 2 studs (minimum 20 gage) at each jamb. Space jack studs over doorframes at same spacing as partition studs, with bottom runner secured to doorframe.

C. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.03 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

1. In addition to compliance with GA-216 and ASTM C 840, comply with manufacturer's instructions and requirements for fire resistance ratings (if any), whichever is most stringent.

B. Install wall / partition boards vertically to avoid end- butt joints wherever possible.

1. At high walls, install boards horizontally with end joints staggered over studs.
2. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

C. Install sound attenuation blankets and insulation as indicated, prior to gypsum board unless readily installed after board has been installed.

D. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.

E. Space fasteners in gypsum boards in accordance with manufacturer's recommendations.

3.04 SPECIAL GYPSUM BOARD APPLICATIONS

A. Install exposed gypsum board by fastening with screws.

B. Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install water-resistant cement based backing board.

C. At toilets, showers, labs, janitor closets, drinking fountains and similar "wet" areas without ceramic tile, install water-resistant gypsum board.

D. Apply with uncut long edge at bottom of work, and space l/4 inch above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant sealant before installation.

3.05 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

B. Install metal corner beads at external corners of drywall work.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed.

1. Provide type with face flange to receive joint compound except where semi-finishing type is indicated.
2. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints.)
3. Install metal control joint (beaded type) where indicated or required for proper installation.

3.06 INSTALLATION OF DRYWALL FINISHING

A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare Work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound specified herein and recommended by manufacturer.

B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.

C. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.

D. Base for Ceramic Tile: Do not install drywall finishing where ceramic tile and similar rigid applied finishes are indicated.

E. Unless otherwise indicated, install drywall finishing at all gypsum board exposed to view and to receive finishes as specified. Where not exposed to view and above ceilings, sanding is not required.

F. Finishing Gypsum Board Assemblies: Level 4 finish, unless otherwise indicated; Level 1 finish for concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and Level 2 finish where panels form substrates for tile, Level 5 finish is required in areas with a gloss or epoxy finished coating.

3.07 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protection of the gypsum drywall Work from damage and deterioration during the remainder of the construction period.

END OF SECTION

SECTION 09 31 13 THIN-SET CERAMIC TILING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Thin-set ceramic floor tile, cove base, wall tile and accessories.

B. Related Sections:

1. Section 07 26 00 - Vapor Retarders (for floor protection paper).
2. Section 09 29 00 - Gypsum Board (for cement based backer board).
3. Section 09 05 15 - Color Design (for color selections).

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data and written instructions for recommended installation and maintenance practices for each type of product indicated.

B. Samples:

1. Two samples of each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
   a. Mount on 24 Inches square plywood or hardboard backing.
3. Stone thresholds in 6-inch lengths.

C. Contract Closeout: Provide Maintenance Data and Manufacturer's recommendations on cleaning.

1.03 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.04 QUALITY ASSURANCE

A. Furnish tile conforming to the Standard Grade Requirements of ANSI A137.1.

1. Coefficient of Friction: Slip resistant in accordance with the Ceramic Tile Institute, i.e. a static coefficient of friction of not less than 0.60 when tested in accordance with ASTM C 1028-89 as modified by the Ceramic Tile Institute

B. Provide materials obtained from only one source for each type of tile, grout and color to minimize variations in appearance and quality.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's directions.

1.06 PROJECT CONDITIONS

A. Continuously heat areas to receive tile to 50 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required.

1. Maintain 50 degrees F. temperature continuously during and after installation as recommended by tile manufacturer but not less than 7 days.

B. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent tile products by the following manufacturers are acceptable:

1. American Olean Tile Company, Lansdale, Pennsylvania.
2. Crossville Inc., Crossville, Tennessee
3. Dal-Tile Corporation, Dallas, Texas.
4. Floor Gres Ceramiche, Italy.
5. Florida Tile Industries, Lakeland, Florida.
6. Lone Star Porcelain Mosaic Tile, Dallas, Texas.
7. Mohawk.
8. United States Ceramic Tile Co., East Spatra, Ohio.

A. 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 MATERIALS

A. General: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

B. Porcelain Floor Tile: 12 inches by 48 inches by 7/16 inch, cushioned edge, unpolished, color to be selected from standard colors available.

C. Porcelain Tile Base: 12 inches by 48 inches by 7/16 inch, cushioned edge, unpolished, color to be selected from standard colors available.

D. Porcelain Wall Tile Size 12 inches by 48 inches by 7/16 inch, cushioned edge, unpolished, colors to be selected from standard colors available.

E. Glass Mosaic Accent Wall Tile: 5/8 inch by 5/8 inch by 8mm, colors to be selected from standard colors available.

F. Threshold: Stainless Steel transition strip equal to Schluter – Reno-TK.

G. Adhesive: ANSI A136.1 and ANSI A118.4 when mixed with additive, with Tile Contractor's Association or Adhesive and Sealant Council certification of conformance, for base and wall tile set on each type of substrate. Provide primer-sealer as recommended by adhesive manufacturer. Equal to Laticrete Type 272 Premium or 317 Floor 'N Wall Thin-Set with 333 Super Flex Additive. Equivalent products by Mapei and Bostik are acceptable.

H. Grout: ANSI A 118.3, with Tile Contractor's Association certification of conformance. Equal to Laticrete Type SpectraLOCK Pro Grout.

1. Equivalent products by Custom Building Products and Mapei are acceptable.
2. Color of grout to be selected by the MDOT Architect from manufacturer's full range of standard colors.

I. Accessories:

1. Three way cove-shaped profiles made of recycled rigid PVC for inside wall corners equal to Schluter®-DILEX-EKE.
2. L-shaped profile made of color-coated aluminum with 1/8 inch wide top section and vertical wall section for outside corners equal to Schluter®-JOLLY
3. Equivalent products by Blanke Corp are acceptable.
4. Color to be selected by the MDOT Architect from manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.02 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer..

B. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 INSTALLATION

A. Comply with the applicable parts of ANSI 108 Series of tile installation standards included under “American National Standard Specifications for the Installation of Ceramic Tile", and the tile and grout manufacturer's printed instructions, and applicable installation specifications of the Tile Council of America's "Handbook for Ceramic Tile Installation", latest edition.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Floor Tile: 1/16 inch.
2. Porcelain Wall Tile: 1/16 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

J. Accessories: Comply with manufacturer’s installation instructions.

K. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

L. Color Pattern: A simple color pattern shall be provided with approved color chart and sample submittal to Contractor using 3 or less colors on walls and floors.

3.04 CLEANING AND PROTECTION

A. Cleaning: Clean grout and setting materials from face of tile while materials are workable. Leave tiles face clean and free of all foreign matter.

1. Unglazed tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation.
2. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning.
3. Flush the surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile Work.

C. Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors.

1. Protect installed tile Work by covering with floor protection paper during the construction period to prevent damage and wear.
2. Prohibit all foot and wheel traffic from using tiled floors for 7 days after installation.
3. Before final inspection, remove protective covering and rinse neutral cleaner from all tile surfaces.

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. Section 09 29 00 – Gypsum Board.
2. Division 23 for Mechanical Requirements.
3. 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 00 RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Luxury Vinyl Tile (LVT), rubber base, and accessories.

B. Related Sections:

1. Section 07 26 00 – Vapor Retarders (for floor protection paper).
2. 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 resilient flooring and accessories.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Wherever possible, provide resilient flooring, 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.

1.05 PROJECT CONDITIONS

A. Continuously heat areas to receive flooring 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 flooring manufacturer but not less than 48 hours.
2. Maintain a minimum lighting level of 50 fc during installation.

1.06 WARRANTY

A. Special Warranty for LVT: Manufacturer agrees to repair or replace components of LVT installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Warranty Period: Limited 10 year commercial wear from date of completion Commercial Warranty and limited 5 year from date of completion under bed warranty (when installed with J&J LVT adhesive).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Luxury Vinyl Tile is based on products manufactured by J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586.

B. Equivalent products by the following manufacturers are acceptable:

1. Armstrong Commercial Flooring, Lancaster, PA. Tel. No. (800) 292-6308.
2. Johnsonite, Chagrin Falls, OH. Tel. No. (800) 899-8916.
3. Mannington Commercial, Calhoun, GA Tel. No. (800) 241-2262.
4. Patcraft, Dalton, GA. Tel. No. (800) 241-4014.

A. 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 LUXURY VINYL FLOOR TILE

A. Components:

1. Style / Number: Framework – V5001.
2. Class / ASTM F-1700: Class III Printed Film Vinyl Plank - Type B (embossed)
3. Finish/Coating: Enhanced UV Urethane w/ Ceramic Bead
4. Nominal Dimensions: 9 inches wide, by 48 inches long.
5. Pattern Repeat: Random Wood Pattern
6. Thickness: 5mm.
7. Backing Class: Commercial Grade.
8. Commercial Traffic: Heavy Commercial.
9. Installation Method: Glue down.
10. Adhesive: J&J LVT Adhesive

B. Color: Color to be selected by Project Engineer / MDOT Architect from manufacturer's full range of colors. Refer to Section 09 05 15 – Color Design for color selection.

C. Testing:

1. Slip Resistance (ASTM C-1028): Passes, ADA Compliant.
2. Heat Stability (ASTM F-1514): Passes.
3. Light Resistance (ASTM F-1515): Passes.
4. Stain & Chemical Stability (ASTM F-925): Passes.

5. Flooring Radiant Panel (ASTM E-648): Passes
6. N.B.S. Smoke Chamber (ASTM E-662): Passes.
7. Indoor Air Quality: FloorScore® Certified.

2.03 ACCESSORIES

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.

1. Base shall be 4 inches high, 0.125 inch gage, length 120 feet, standard top-set cove.

B. Resilient Edge Strips: 1/8-inch thick, homogenous vinyl of rubber composition, tapered or bullnose edge, color to match flooring, or as selected by MDOT Architect from standard colors available; not less than 1 inch wide.

2.04 INSTALLATION MATERIALS

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

B. Adhesives: Water-resistant type recommended by LVT floor and adhesive manufacturer(s) to suit LVT floor, rubber wall base and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content:
   a. LVT Adhesives: 50 g/L or less.
   b. Rubber Floor Base Adhesives: 60 g/L or less.

C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine the areas and conditions under which resilient flooring 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. Prepare substrates according to LVT floor manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by luxury vinyl tile floor manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by luxury vinyl tile floor manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to LVT floor manufacturer's written recommendations, but not less stringent than the following:
   a. Perform anhydrous calcium chloride test according to ASTM F-1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
5. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install LVP until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by LVT.

3.03 LUXURY VINYL Tile (LVT) INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Install flooring after finishing operations, including painting, have been completed and permanent-heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by flooring manufacturer.

C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 ACCESSORIES 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.

3.05 CLEANING AND PROTECTION

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

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

C. Maintenance Immediately After Installation:

1. Do not wash or scrub the floor for 5 days after installation to allow the floor tiles to bond to the underlayment / subfloor.
2. Keep heavy furniture and equipment off the floor at least 48 hours to allow the adhesive to set.
3. Sweep or vacuum thoroughly, and remove residual adhesive with a clean white cloth dampened with cleaners as recommended by flooring manufacturer.

D. Protection: Protect installed flooring from damage by covering with floor protection paper. Protect completed Work from traffic and damage until acceptance by the Owner

END OF SECTION

SECTION 09 68 18 TEXTILE COMPOSITE FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Textile composite flooring modules and accessories as shown on the Drawings and schedules and as indicated by the requirements of this Section.

B. Related Sections:

1. Division 03 Concrete - not included work this section.
2. Division 07 Thermal and Moisture Protection - not included work this section.
3. Section 09 05 15 Color Design for color selection.
4. Section 09 65 00 Resilient Flooring for rubber base and accessories.

1.02 SUBMITTALS

A. Submit to MDOT Architect two (2) 6-1/2 inches by 6-1/2 inches (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing for acceptance prior to shipment.

B. Submit manufacturer's warranties, installation instructions, and maintenance instructions for acceptance prior to shipment.

1. Do not submit Material Safety Data Sheets to MDOT Architect for approval.

C. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.03 E

1.03 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of flooring installation contractor: The work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in manufacturer's environmental program including responsible flooring removal, recycling, and installation.

B. Flooring installer will be responsible for the proper product installation, including floor preparation in all the areas indicated in the Drawings to receive Kinetex modules. The installation standard will be as listed in J+J Flooring Group Kinetex Installation Instructions.

C. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 10 years experience in the manufacture of commercial flooring.

D. Manufacturer to provide field service personnel to assist in project start-up as required by the job and will notify Owner, Architect, General Contractor, or another designated contact if any installation instructions are not followed.

E. Flooring materials shall meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Products submitted for approval shall meet requirements listed below:

1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass
2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)
3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.
4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.
5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.
7. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30
8. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64
9. Slip Resistance (ASTM 1028-96): Complies with ADA Guidelines for level surface
10. Thermal Insulation (ASTM C 518): R-4

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets).

B. Delivered and stored materials shall be available for inspection as required by the Owner, Architect, installer and the manufacturer.

C. Materials, including adhesives, shall be delivered to the installation site at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65 deg F and below 95 deg F and measures between 10 percent and 65 percent relative humidity (RH).

1.05 ENVIRONMENTAL/FIELD CONDITIONS

A. To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) shall be in operation. After work is completed, the ambient room temperature should remain at 65 deg F and relative humidity between 10 percent and 65 percent for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.

1.06 WARRANTIES

A. Manufacturers Warranties: All warranties shall be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J+J Flooring Group's Kinetex installation instruction and maintained according to J+J Flooring Group's Kinetex maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. J+J Flooring Group will provide standard published written performance warranties for the following:

1. Lifetime product performance. Will not delaminate along seams or lose more than five (5 percent) percent by weight of fiber during its useful life.
2. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.
3. Lifetime Stain Removal
4. Lifetime Colorfastness (Light and Crocking)

B. Installers Warranty: Flooring installer shall provide Owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after the Date of Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Equal to Kinetex and Invision brands of J+J Flooring Group, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586. JJ-KINETEX.COM and JJ-INVISION.COM. Please contact Amy Taylor , (601) 317-9919, Amy.Taylor@jjflooringgroup.com .

1. Manufacturers: Subject to compliance with requirements, the following manufacturers products are acceptable::
   a. Forbo - Flotex
   b. Bolyu – Svelte

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 FLOORING MATERIALS

A. Invision Catwalk II Walk-off Modular (tiles) by J&J Flooring Group (TCF-1)

1. Product: Catwalk II Walk-off Modular 7268
2. Color: Ref to Section 09 05 15-Color Design
3. Construction: Textured Patterned Loop
4. Backing: Nexus® Modular
5. Dye Method: Solution Dyed
6. Fiber Type: EncoreÂ® SD (with recycled content)
7. Face Weight: 34oz./sy(1153grams/m2)

8. Pile Density: 7443 oz./y3. (275.99.kg/m3)
9. Gauge: 1/10 (3. 94 rows/cm)
10. Stitches: 8.33 stitches/in (3.28 stitches/cm)
11. Pattern Repeat: N/A
16. Standard Size: 24 inches by 24 inches
17.. Warranties: Lifetime Fiber Performance for Wear, Lifetime for Tuft Bind Strength (edge ravel, yarn pulls, zippering), Lifetime Protection from Delamination Failure, Lifetime Fiber Performance for Static, Lifetime Colorfastness to Atmospheric Contaminants, Lifetime Stain Removal
18. Testing Specifications:
    a Pill Test: Yes
    b. Flooring Radiant Panel: Class 1
    c. Smoke Density: Less than 450.0 flaming (ASTM E 662)
    d. Static Test: Less than 3.0kv (AATCC-134)
    e. Lightfastness : Yes

B. Kinetex Textile Composite Flooring Modules (tiles) by J&J Flooring Group (TCF-2)

1. Product: Timber Demi-Plank 1825
2. Color: Ref to Section 09 05 15-Color Design
3. Backing: Polyester Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: Universal Fibers Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Standard Size: 12 inches by 48 inches
8. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
9. Testing Specifications:
    a Pill Test: Yes.
    b. Flooring Radiant Panel: Class 1
    c. Smoke Density: Less than 450.0 flaming (ASTM E 662)
    d. Static Test: Less than 3.0kv (AATCC-134)
10. Recycled content: Minimum of 55 percent recycled content
11. NSF/ANSI 140 Platinum Certified
12. Closed-loop recyclable

C. Kinetex Textile Composite Flooring Modules (tiles) by J&J Flooring (TCF-3)

1. Product: Strata Plank 1826
2. Color: Ref to Section 09 05 15-Color Design
3. Backing: Polyester Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: Universal Fibers Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: Yes
9. Standard Size: 18 inches by 36 inches
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.

11. Testing Specifications:
    a Pill Test: Yes.
    b. Flooring Radiant Panel: Class 1
    c. Smoke Density: Less than 450.0 flaming (ASTM E 662)
    d. Static Test: Less than 3.0kv (AATCC-134)
12. Recycled content: Minimum of 55 percent recycled content
13. NSF/ANSI 140 Platinum Certified
14. Closed-loop recyclable

2.03 ADHESIVES

B. Comply with manufacture's written recommendations.

1. Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.
2. Commercialon® Premium Modular Pressure Sensitive Adhesive, a premium modular flooring adhesive specifically formulated for bonding J+J Flooring Group's Nexus® Modular PVC backed carpet to the floor

2.04 ACCESSORIES

B. Provide transition/reducing strips tapered to meet abutting materials as indicated in the Drawings.

B. Provide edge strips made of extruded aluminum with a mill finish, unless otherwise noted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.

B. Verify that floor-mounted utilities are in correct location and that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.

C. J+J Flooring Group requires that flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call J+J Flooring Group's Customer Relations Department at 800.241.4586.

3.02 PREPARATION

A. Surface Preparation: Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.

B. Floor slab preparation is to include all required work to prepare the floor for installation of the product as specified in this document. Floor slab preparation shall meet conditions as specified in J+J Flooring Group's Kinetex textile composite flooring installation instructions.

C. Concrete Moisture Testing and Ph Testing: Substrate surfaces must be tested for moisture emission. The Contractor shall perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 95 percent RH. Alkalinity tests shall also be performed per ASTM F 710. The maximum acceptable pH is 10.0.

D. New Concrete - New concrete must be fully cured and free of moisture (comply with ASTM F 710). New concrete requires a curing period of approximately 90 days.

3.03 INSTALLATION OF FLOORING

A. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

B. Install flooring in strict accordance with the finish drawings and J+J Flooring Group's installation instructions for each type of flooring.

C. Full Spread Adhesive System: J+J Flooring Group require the use of their adhesives. No substitutions are allowed for adhesive

1. Full Spread Kinetex Adhesive: The spread rate for Kinetex Adhesive is approximately 1080 square feet per four gallon pail and can be spread using a 1/16 inch by 1/32 inch by 1/32 inch U-notched trowel or applied using a 3/8 inch foam or nap roller.
   a. Allow to dry until transparent or adhesive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried.
2. Full spread Commercialon® Premium Modular Pressure Sensitive Adhesive using a 1/32 inch by 1/16 inch by 1/16 inch “U” or “V” notch trowel or spread using a 3/8 inch foam paint roller. Keep the roller saturated and wet with adhesive throughout the installation in order to maintain a constant spread rate. Allow to completely dry so adhesive does not transfer when touched. The spread rate for Commercialon Premium Modular Adhesive is approximately 140 sq. yds. per four gallon bucket. Nexus® Modular Spray Adhesive is available in a 14 lbs cylinder (coverage is approx. 165 sq yds). Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. Warranty coverage requires the use of Commercialon Premium Modular.

D. Module Placement: Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. See specific product specifications for approved installation method(s).

E. Pallet and Bundle Sequencing: It is very important to install Kinetex and Invision modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to J+J Flooring Group's Kinetex and Invision Installation Instructions.)

F. Completing Installation: To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. Protect new modular surface with sheets of plywood or hardboard when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.04 NSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer's specifications.

3.05 CLEANING AND PROTECTION

A. Follow J+J Flooring Group's maintenance guidelines.

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum surfaces.

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, elevator entrance frames, door and equipment.

D. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundations spaced, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

E. Finished Metal surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

F. Operating Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.03 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 surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instruction. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

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. Schedule the cleaning and painting so that contaminates from the cleaning process with not fall onto wet, newly painted surfaces.

B. Ferrous Metals:

1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
2. Touch-up shop-applied prime coats wherever damaged or bare. Where required by other Sections of these Specifications, clean and touch-up with the same type shop primer.

C. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent.

D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat.

1. Prime, stain, or seal wood required being job-painted, as soon as practicable upon delivery to job. Prime edges, ends, faces, under sides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dry.
2. When transparent finish is required, use sealer as recommended by manufacturer. Seal tops, bottoms, and cutouts of unprimed wood doors with sealer immediately upon delivery to project.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.04 APPLICATION

A. Apply paint in accordance with the manufacturer's directions. Use 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
   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 Ferrell-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
   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 PPG Paints, Inc. paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: PPG Pitt Tech DTM Acrylic Primer Finish, 90-712 Series (2.0-3.0 mils dry)
   b. Intermediate Coat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
   c. Topcoat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
2. Steel Shop Primed: Structural steel framing exposed to view including steel lintels
   a. Prime Coat: PPG Pitt Tech DTM Acrylic Primer Finish, 90-712 Series (2.0-3.0 mils dry)
   b. Intermediate Coat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)
   c. Topcoat: PPG Pitt Tech DTM Acrylic Gloss Enamel, 90-374 Series (2.0-3.0 mils dry)

D. Provide the following Rust-Oleum paint systems for various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: Rust-Oleum Universal Primer, (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum 3700 Series DTM Acrylic, (2.0-3.0 mils dry)
   c. Topcoat: Rust-Oleum 3700 Series DTM Acrylic, (2.0-3.0 mils dry)
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: Rust-Oleum Universal Primer (1.0-2.0 mils dry)
   b. Intermediate Coat: Rust-Oleum Sierra Performance Beyond No VOC UMA (2.0-3.0 mils dry)
   c. Topcoat: Rust-Oleum Sierra Performance Beyond No VOC UMA (2.0-3.0 mils dry)

E. 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 Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
   c. Topcoat: S/W Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 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. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: #203 Universal Wall Grip Primer
5. 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
6. 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
7. 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
8. 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
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: TuffCrete Solvent Acrylic Stain Clear
   b. Topcoat: TuffCrete Solvent Acrylic Stain Clear.

B. Provide the following Ferrell-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 #3300 Line Evergreen “Zero Voc” Acrylic Int/Ext Semi-Gloss Enamel (2.0 mils DFT)
   c. Topcoat: F/C #3300 Line Evergreen “Zero Voc” Acrylic Int/Ext
   d. Semi-Gloss Enamel (2.0 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 #3900 Line Evergreen “Zero Voc” Acrylic Int/Ext Latex Eggshell Enamel (2.1 mils DFT)
   c. Topcoat: F/C #3900 Line Evergreen “Zero Voc” Acrylic Int/Ext Latex Eggshell Enamel (2.1 mils DFT)
3. Gypsum Drywall (in wet areas)
   a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.7 mils DFT)
   b. Intermediate Coat: F/C #3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
   c. Topcoat: F/C #3300 Line 100% Acrylic Interior Semi-Gloss Enamel (1.6 mils DFT)
4. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: F/C #699 Waterborne 100% Acrylic Enamel Undercoater (1.6 mils DFT)
5. 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 #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. 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)
7. 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)
8. 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)
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer
   b. Topcoat: F/C #1106 Tuff-Boy Clear Acrylic Waterproofing Sealer: Add Skid-Tex Slip Resistant to topcoat.

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, 9-300XI (1.4 mils dry)
   c. Topcoat: PPG Pure Performance Zero VOC Interior Latex Eggshell, 9-300XI (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. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: PPG Seal Grip Interior Acrylic Primer Finish, 17-951 (1.2 mils dry)
5. Concrete Masonry Units (Enamel)
   a. Prime Coat: PPG Speedhide Interior Exterior Latex Block Filler, 6-7 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)
6. 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)
7. 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, 6-725XI
   c. Topcoat: PPG Super Tech WB Waterborne Acrylic Dry Fall, 6-725XI
8. 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)

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. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: Rust-Oleum Zinsser Shieldz Universal Wallcovering Primer (1.0-1.5 mils dry)
5. 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)
6. 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)
7. 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
8. 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

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 Harmony Low Odor Interior Latex Semi-Gloss, B10 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 Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5-3.0 mils dry)
   c. Topcoat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (2.5-3.0 mils dry)
4. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: S-W Multi-Purpose Interior / Exterior Primer / Sealer, B51W450 (1.2 mils dry
5. 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)
6. 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)
7. 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 Waterborne Acrylic Dry Fall, B42W2
   c. Topcoat: S-W Waterborne Acrylic Dry Fall, B42W2

8. 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)
9. Concrete Floor Sealer (Clear)
   a. Prime Coat: H&C Concrete Stain Solid Color Water Based - Clear
   b. Topcoat: H&C Concrete Stain Solid Color Water Based - Clear; H&C SharkGrip Slip Resistant Additive to the topcoat. Note-New concrete must be etched prior to application.

END OF SECTION

SECTION 10 11 00 VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Markerboards.
2. Tackboards.

B. Related Sections:

1. Section 09 05 15 – Color Design (for color selections).

1.02 ACTION SUBMITTALS

A. Product Data: For manufacturer's technical data and installation instructions for each material and component parts, including data substantiating materials comply with requirements.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

C. Samples: 3 copies of full range of color samples for each exposed product and for each color and texture specified.

1. Furnish 12-inch square samples of sheet materials and 12-inch lengths of trim members for color verification after selections have been made.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

B. Warranties: Sample of special warranties.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Unless otherwise acceptable to Project Engineer / MDOT Architect, furnish all visual display boards by one manufacturer for entire project.

B. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where possible, to ensure proper fitting of Work. However, allow for trimming and fitting wherever taking of field measurements before fabrication might delay Work.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

1.06 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Surfaces lose original writing and erasing qualities.
   b. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Claridge Products and Equipment, Inc., P.O. Box 910, Harrison, AR 72602. Tel. (870) 743-2200.

B. Equivalent products by the following manufacturers are acceptable:

1. Best-Rite Manufacturing, Temple, TX, Tel. (800) 749-2258.
2. Marsh Industries, Inc., New Philadelphia, OH, Tel. (800) 426-4244.
3. PolyVision Corporation, Suwanee, GA, Tel. (800) 620-7659.

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 MATERIALS

A. Markerboard: Equal to Claridge Series #LCS-2000-R type “A” factory built marker board with map rail with tan cork insert, jamb trim, and chalk trough with end closures. LCS = porcelain enamel liquid chalk surface on Duracore with 0.002 aluminum foil back approx. 1/2 inch thick overall, color No. 32 white.

1. Extruded aluminum trim to have anodized satin finish. Include standard eraser and assorted LCS markers.
2. Size: 4 feet by 6 feet.
3. One unit required unless additional units are indicated on the Drawings.

B. Tackboard: Equal to Claridge Series # 1 type “CO” factory built tackboard.

1. Tackboard is Claridge 1/4-inch Cork on 1/4 inch Hardboard, color as selected by Project Engineer / MDOT Architect from manufacturer’s standards.
2. Size: 4 feet by 6 feet.
3. One unit required unless additional units are indicated on the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

Installer shall examine areas and conditions under which units are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation. Comply with Manufacturer’s written installation instructions.

1. If units are not shown on Drawings, install units in location(s) as directed by Project Engineer.

3.03 ADJUSTING AND CLEANING

A. Verity accessories required for units are properly installed and operating units are adjusted and properly functioning. .

B. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Signage for room identification system.
2. Wall mounted exterior sign.
3. Truss emblem signage.

B. Related Sections: Section 09 05 15 – Color Design (for color selection).

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions for each type of signage required.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples: Submit 3 samples of each color and finish of exposed materials and accessories required for specialty signs. Project Engineer / MDOT Architect’s review of samples will be for color and texture only.

1. When requested, furnish full-size samples of specialty sign materials.

D. Sign Schedule: Use same designations (Room numbers) specified or indicated on Drawings or in a sign schedule.

1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Provide each type of sign as a complete unit produced by a single manufacturer including necessary mounting accessories, fittings and fastenings.

1.06 DELIVERY,STORAGE, AND HANDLING

A. Deliver components correctly packed to prevent damage. Store in secure area out of weather. Handle per manufacturer's instructions.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications for interior and exterior signage are based on products manufactured by ASI Sign Systems, Inc., 3890 W. NW Hwy, Suite 102, Dallas, TX. 75220. Tel. (800) 274-7732. Truss emblem signage (exterior) is based on products manufactured by Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.

B. Equivalent products by the following manufacturers are acceptable:

1. Gemini Incorporated, Cannon Falls, MN. Tel. (800) 538-8377.
2. Matthews International Corp., Pittsburgh, PA. Tel. (800) 628-8439.
3. Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.
4. Scott Sign Systems, Inc., Sarasota, FL. Tel. (800) 237-9447.

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 PERFORMANCE REQUIREMENT SIGN SYSTEM

A. Exterior Signage: Wall mounted LC Series, Helvetica and Helvetica Medium styles, size and location(s) as shown on Drawings. Text shall be center justified unless shown otherwise.

B. Interior Signage: Wall or desktop mounted WS Series with rounded corners. Design so that paper insert can be installed from each end. Comply with 2010 ADA requirements.

C. Truss Emblem Signage (Exterior): Wall mounted, Helvetica Medium styles, size as shown on Drawings.

2.03 COMPONENTS - EXTERIOR SIGNAGE

A. Materials: Cast aluminum, projected mount with sleeve and stud.

B. Finish: Baked enamel in manufacturer's standard color.

2.04 COMPONENTS - TRUSS EMBLEM SIGNAGE (EXTERIOR)

A. Material: Emblem shall be made of (0.063) aluminum with a bright reflective paint or applied vinyl surface.

B. Shape: Emblem shall be in the shape of an isosceles triangle measuring six (6) inches horizontally and three (3) inches vertically.

C. Lettering: Emblem shall have letters printed in the center of the triangle based on the type of truss construction used in the building being identified by the emblem:

1. “F” signifies floor with truss construction.
2. “R” signifies roof with truss construction.
3. “F/R” signifies both floor and roof with truss construction.

D. Colors and Graphics:

1. Text Style: Helvetica Medium.
2. Boarder: 3/8 inch wide white boarder on all sides.
3. Center Background Triangle Color: Red.
4. Lettering: 1-1/4 inch tall lettering (F, R, or F/R) shall be white and centered on red background.
5. Along base (6 inch length) of triangle centered on the white border include the following 1/4 inch tall all capital lettering in red:
   a. Do Not Remove By Order Of the Local Fire Inspector.

E. Accessories: Provide stainless steel mounting screws appropriate for surface to which sign will be mounted.

F. See suggested layout at the end of this Section.

2.05 COMPONENTS – INTERIOR SIGNAGE

A. Window Inserts: Laser printed paper insert with MDOT watermark will be furnished by Owner. Text will be left justified unless noted otherwise.

B. Sign Face: Clear Acrylic, 0.080-inch thick, matte first surface.

C. Adhesive: Pressure sensitive, adhesive film on second surface.

D. Insert Guide Rails: 0.040-inch thick vinyl tape.

E. Tactile Laminate: Polyamid Resin.

F. Laminating Base: Acrylic, 0.080-inch thick.

G. Fasteners: 0.030- inch thick, double-face tape.

H. Stand: Clear Acrylic, 0.080-inch thick.

I. Sizes as Follows:

1. Type No. 1: 12 inches wide by 3 inches high.
2. Type No. 2: 6 inches wide by 9 inches high.
3. Type No. 3: 9 inches wide by 8 inches high.
4. Type No. 4: 12 inches wide by 3 inches high. .

2.06 BRAILLE AND TACTILE COPY

A. Comply with requirements of the Americans with Disabilities Act 2010. Tactile copy to be raised 1/32-inch minimum from sign first surface by manufacturer's photomechanical stratification processes. Translation of copy into Braille shall be the responsibility of the manufacturer.

2.07 FINISHES – INTERIOR SIGNAGE

A. Color: Selected by Project Engineer / MDOT Architect from manufacturer's standard.

B. Surface Texture: Matte.

2.08 FONT

A. Font Type: Helvetica Medium, unless noted otherwise.

PART 3 - EXECUTION

3.01 EXANIMATION

A. Contractor, with Installer present, shall examine the substrates and conditions under which the specialty signs are to be installed and notify the Project Engineer / MDOT Architect 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 INSTALLATION – GENERAL

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions. Comply with ADA 2010 requirements.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.03 INSTALLATION – INTERIOR SIGNAGE

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install sign units and components at the locations shown or scheduled, securely mounted with concealed theft-resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
2. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Project Engineer / MDOT Architect.
3. Position sign on wall surface 2 inches from strike side of doorframe. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from baseline of the highest tactile character (comply with 2010 ADA requirements).

B. Mounting Method-Double Sided Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear strips of tape symmetrically to face of substrate. Place sign in position, and push to engage adhesive tape strips.

C. Mounting Method-Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.04 INSTALLATION – EXTERIOR SIGNAGE

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Mounting Method - Projected Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

1. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.05 INSTALLATION – TRUSS EMBLEM SIGNAGE

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.

B. Permanently affix emblem to the exterior of the building to the left of the main entrance door at a height of 5'-0" above the finish floor or grade.

C. Mounting Method-Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.06 SCHEDULES – INTERIOR SIGNAGE

A. Sign Type No. 1 Break Room
Closet
Conference
Crew Room
Electric/Communication
Engineer, Resident Engineer, and E.I.T.
Maintenance Area Superintendent
Offices, Single Occupant
Project Manager
Shower/Janitor
Storage Room
Survey
Survey Equipment

B. Sign Type No. 2: Toilet Rooms

C. Sign Type No. 3 Offices, Multiple Occupants

D. Sign Type No. 4: Reception (Desktop at Secretary / Receptionist)

3.07 SCHEDULES – EXTERIOR SIGNAGE

A. Building Letters: Flat – Letter style will be determined by Project Engineer / MDOT Architect from all styles available.

1. 14 inches high by 1-1/2 inches deep, 13 Letters: PROJECT OFFICE

B. Truss Emblem Signage:

END OF SECTION

SECTION 10 21 15 SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Solid-plastic (polymer) toilet compartments, floor-mounted and overhead braced.

B. Related Sections: Section 09 05 15 – Color Design (for color selected).

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's sample warranty, color charts and detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit job-specific shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other Work.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

C. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where possible, to ensure proper fitting of Work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Coordination: Furnish inserts and anchorage, which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

1.05 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of toilet partitions and other materials, installer shall examine the shipment for damage and completeness. Materials shall be stored in a clean, dry place. Stack all materials to prevent damage.

1.06 WARRANTY

A. Manufacturer: Furnish a written warranty covering all plastic components against breakage, warping, corrosion and delamination for a period of 25 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Scranton Products Inc., 801 East Corey Street, Scranton, PA 18505. Tel. (800) 445-5148.

B. Equivalent products by the following manufacturers are acceptable:

1. Bradley Corp / Mills Partitions, Menomonee Falls, WI. Tel (414) 354-0100.
2. General Partitions Mfg. Corp., Erie, PA. (814) 833-1154.
3. Knickerbocker Partition Corp, Freeport, NY. Tel. (516) 546-0550.

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 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Doors, partitions, pilasters and urinal screens shall be fabricated from High Density Polyethylene (HDPE) material manufactured under high pressure forming a single component section which is waterproof, non- absorbent and has a self-lubricating surface that resists marring with pens, pencils or other writing utensils. All to arrive at job site with special protective plastic covering.

C. Characteristics: Dual component compression molded High Density Polyethylene (HDPE) of solid virgin resin materials in colors that extend throughout the surface; doors, partitions and pilaster shall have (HDPE) as the core material).

1. Doors, partitions, pilasters and urinal screens shall be a minimum of 1 inch thick and all edges machined to a radius of 0.250 inch and all exposed surfaces to be free of saw marks.
2. Doors and dividing panels shall be 55 inches high and mounted 14 inches above the finish floor.
3. Pilasters shall be 82 inches high and fastened into a 3-inch high stainless steel pilaster shoe with a stainless steel, torx head sex bolt.
4. Finish shall be similar and equal to standard color chart selections from Scranton Products. Color of doors and pilasters to be selected by the Project Engineer / MDOT Architect from Manufacturer’s Classic and Mosaic color collection with orange peel texture.
5. Aluminum (heat sinc) edging strips to be fastened to the bottom edge of all doors and panels using vandal proof stainless steel fasteners.

2.03 HARDWARE

A. Door Hardware:

1. Hinges: Aluminum continuous for door height.
2. Each door shall be supplied with one coat bumper / hook made of chrome plated zamak. Each handicapped door to include one door pull and one wall stop.
3. Door Strike and Keeper: fabricated from heavy-duty aluminum extrusion (6463-T5 alloy).
   a. Finish: Clear anodized finish.
   b. Length of Strike" 6 inches.
   c. Fasteners: Wrap around flange surface mounted and through bolted to pilaster with one-way sex bolts.
4. Door Latch: Housing: Fabricated from heavy-duty aluminum extrusion (6463-T5 alloy).
   a. Finish: Clear anodized finish.
   b. Fasteners: Surface mounted and through bolted to door with one-way sex bolts.
   c. Slide Bolt and Button: Heavy aluminum with a black anodized finish.

B. Wall Brackets: Full-length continuous aluminum. Brackets shall be used for all panel to pilaster and pilasters to wall connections.

1. Attach brackets to adjacent wall construction with No. 14 by 1-1/2 inch stainless steel Phillips head screws.
2. Anchor screws directly behind the vertical edge of pilasters at 12-inch intervals along the full length of bracket and at each 12-inch interval alternately spaced between anchor connections.

C. Headrail: Heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design.

1. Finish: Clear anodized finish.
2. Fasteners: Fastened to the headrail bracket by a stainless steel, torx head sex bolt, and fastened to the tops of pilasters with stainless steel, tamper resistant torx screws.

D. Handrail Brackets: Headrail brackets shall be 16-gage stainless steel with a satin finish, and secured to the wall with #14 stainless steel screws.

E. Accessories: Furnish units with chromium-plated finish, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Clearances: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 1/4 inch.

3.02 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.03 CLEANING

A. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION

SECTION 10 26 13 CORNER GUARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Vinyl / Acrylic surfaced mounted Corner Guards.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for corner guards.

B. Samples: Submit 3 samples of material finishes, profiles and colors for corner guards.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

PART 2 - PRODUCTS

2.01 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90 degree turn to match wall condition. Install full height, unless height indicated otherwise on the Drawings, at all outside corners in corridors and elsewhere as shown on the Drawings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc. Model SSM-20 or comparable product by one of the following:
   a. Arden Architectural Specialties, Inc.
   b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   c. Korogard Wall Protection Systems; a division of RJF International Corporation.
2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
   a. Color and Texture: As selected by Project Engineer / MDOT Architect from manufacturer's full range. Refer to Section 09 05 15 – Color Design (for color selected).
3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

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.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install impact-resistant corner guards level, plumb, and true to line without distortions. Comply with manufacturer's written installation instructions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant corner guards in locations and at mounting heights indicated on Drawings.
2. Provide mounting hardware, anchors, and other accessories required for a complete installation.

B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 10 28 13 TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Mirrors
2. Toilet Paper Dispenser
3. Grab Bars
4. Towel Dispenser/Waste Receptacle
5. Clothes Hook
6. Mop Holder
7. Under Lavatory Guards (required where hot water line is exposed).

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's product and technical data indicating compliance with these specifications and shop drawings for the fabrication and installation of all toilet accessories. Show all anchorage and other necessary items including mounting heights.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, unless otherwise acceptable to the MDOT Architect. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of toilet accessories and other materials, examine the shipment for damage and completeness. Materials shall be stored in a clean, dry place. Stack all materials to prevent damage.

1.07 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings (Bradley Washroom Accessories Division, P.O. Box 309, Menomonee Falls, WI 53051. Tel. (414) 354-0100) or comparable product by one of the following:

1. A & J Washroom Accessories, Inc., New Windsor, NY. Tel. (845) 562-3332.
2. Bobrick Washroom Equipment, Inc., Jackson, TN. Tel. (731) 424-7000.
3. Plumberex Specialty Prod., Inc. Palm Springs, CA. Tel. (800) 475-8629.
4. TCI Products. Hillsboro, OR. Tel. (866) 533-4273.
5. Truebro, Inc., Ellington, CT. Tel. (800) 340-5969.

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 PUBLIC-USE WASHROOM ACCESSORIES

A. Mirrors: Provide 1/4 inch tempered glass mirrors with 3/4 inch stainless steel channel frame with mitered corners. Mirrors shall be 24 inches by 36 inches equal to Bradley model 781-24362. Locate at each toilet lavatory mounted in locations shown.

B. Toilet Paper Dispenser: Provide surface mounted stainless steel multi-roll toilet tissue dispenser equal to Bradley model 5402. Locate at each toilet mounted in locations shown.

C. Grab Bars: Provide 1-1/2 inch diameter horizontal 2 wall stainless steel grab bars with safety-grip non-slip finish and concealed mounting equal to Bradley model 8122. Locate at toilets where indicated at heights shown. Contractor shall provide at each water closet one 36-inch horizontal grab bar one 42-inch horizontal grab bar and one 18-inch vertical grab bar; installation must meet all ADA 2010 requirements.

D. Towel Dispenser/Waste Receptacle: Provide surface mounted stainless steel towel dispenser/waste receptacle equal to Bradley model 2 3 7 Locate at each area with lavatory/sink where shown and at height shown.

E. Clothes Hook: Provide surface mounted stainless steel hook equal to Bradley model 9135 at each Toilet Room, unless coat hooks are provided with toilet partition doors.

F. Mop Provide surfaced mounted stainless steel mop and broom holder equal to Bradley model 9933. One piece construction with welded gusset and hooks. Holder consists of spring activated rubber cams on plated steel retainers. Unit measures 14 inches high by 34 inches long, with 4 hooks and 3 holders. Shelf projects 8 inches. Locate at each service sink where shown and at height shown or if not shown then per the Project Engineer's instructions.

G. Under Lavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

2.03 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which toilet accessories are to be installed.

1. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation General: Comply with all ADA requirements including proper mounting heights.

B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Use concealed fastenings wherever possible.
2. Provide theft-resistant fasteners for all accessory mountings.
3. Install concealed mounting devices and fasteners fabricated of the same material as the accessories, or of galvanized steel, as recommended by manufacturer.
4. Install exposed mounting devices and fasteners finished to match the accessories.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION

SECTION 10 43 15 DEFIBRILLATORS AND CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Automated external defibrillator, including cabinet, accessories and mounting brackets.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product manufactured / distributed by (J.L. Industries, Inc., 4450 W. 78th Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850) or comparable product by one of the following:

1. Philips Healthcare, Andover, MA. Tel. (866) 333-4246.
2. Physio-Control, Inc., Redmond, WA. Tel. (800) 442-1142.

A. 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 AUTOMATED EXTERNAL DEFIBRILLATOR

A. Defibrillator: Provide Defibrillator for location(s) as indicated on the Drawings, equal to Medtronic LIFEPAK® CR "plus".

B. Cabinets: Provide cabinet equal to J.L. Industries 1437F12 stainless steel semi-recessed type cabinet complying with ADA requirements. Cabinet shall accommodate the Medtronic LIFEPAK® CR "plus" Defibrillator. Provide complete unit(s) with Commander Alarm and Saf-T-Lok™ options.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which automated external defibrillator(s) are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation General: Comply with all ADA 2010 requirements including proper mounting heights.

B. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

C. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

D. Defibrillator unit(s) shall be mounted in exposed locations as indicated on the Drawings, or if not indicated, as directed by the Project Engineer/ MDOT Architect. A minimum of one unit is required.

E. Check cabinet(s) for scratched, nicked, and other surface defects. Cabinet(s) with these conditions shall be repaired or replaced.

3.03 CLEANING AND PROTECTION:

A. At completion of installation, clean surfaces in accordance with manufacturer's instructions.

B. Protect unit from damage until acceptance by Owner.

END OF SECTION

SECTION 10 44 16 FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Portable multi-purpose, dry-chemical and class K wet chemical fire extinguishers including cabinets, accessories and mounting brackets.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions for all portable fire extinguishers required.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by J.L. Industries, Inc., 4450 W. 78th Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850.

B. Equivalent products by the following manufacturers are acceptable:

1. Amerex Corp., Trussville, AL. Tel. (205) 655-3271.
2. Larsen’s Mfg. Co., Minneapolis, MN. Tel. (612) 571-1181.
3. Potter-Roemer, Santa Ana, CA. Tel. (800) 366-3473.

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 FIRE EXTINGUISHERS

A. Provide fire extinguishers for each location indicated, in colors and finishes that comply with requirements of governing authorities.

B. Multi-Purpose Dry Chemical for Cabinet and Wall Mounting: Equal to J.L. Industries Cosmic 10E, UL rated 4A-80BC, 10 lb. nominal capacity.

C. Class K Wet Chemical for Cabinet Mounting: Equal to J.L. Industries Saturn 15, UL rated 2-A: 1-B: C: K, 6 liters nominal capacity. Locate in Break Room.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Provide manufacturer's bracket designed to prevent accidental dislodgment of extinguisher, of proper size for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

2.04 EXTINGUISHER CABINETS

A. Equal to J.L. Industries Cosmopolitan semi-recessed model1032F17 with ADAC option. Cabinet shall accommodate the Cosmic 10E extinguisher. Provide black die-cut letters, vertical.

1. Cabinets are required at drywall partitions.

B. Equal to J.L. Industries Cosmopolitan stainless steel cabinet with return trim, rolled edge semi-recessed model 2032F17 including ADAC option with flush pull handle. Cabinet shall accommodate the Saturn 15 extinguisher. Provide black die-cut letters, vertical.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with ADA and applicable regulations of governing authorities.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

C. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

D. Fire extinguisher units shall be mounted in exposed locations indicated, or if not indicated, in a manner such that no point in the building will be further than 75 feet from an extinguisher. Provide 6 units with cabinets in corridors, 4 wall mounted (no cabinets) at Equipment Shed. Units shall be required within 20 feet of all exits. Type K unit shall be required in Break Room - one unit with cabinet.

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Locker units with hinged doors, metal bases, tops, filler panels, closed bases, finished end panels, accessories, and hardware.

1.02 REFERENCES

A. ANSI/ASTM A446 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

B. ANSI/ASTM A526 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's installation instructions and product data on locker types, sizes and accessories.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and locker identification system and numbering sequence.

C. Samples: Furnish 3 samples of materials, texture, color and finishes available for Project Engineer / MDOT Architect's selection.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Penco Products, Inc., 99 Brower Ave, Oaks, PA 19456. Tel. (800) 562-1000.

B. Equivalent products by the following manufacturers are acceptable:

1. Art Metal Products, Deerfield, FL. Tel. (800) 252-5633.
2. Lyon Metal Products, Aurora, IL. Tel. (800) 323-0082.
3. Republic Storage System Co, Inc., Canton, OH. Tel. (800) 477-1255.

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.

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2.02 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.03 SELECTED LOCKER UNITS

A. Vanguard Model 6175V Single Tier Locker with standard louvered doors. Size: 72 inches overall height by 15 inches width by 21 inches depth. Provide closed bases and finished end panels.

2.04 MATERIALS

A. All parts shall be made from prime grade mild cold rolled sheet steel free from surface imperfection, and capable of taking a high grade enamel finish.

2.05 ACCESSORIES

A. Each locker shall have chrome plated zinc alloy die-cast case and door handle, door latch channel assembly, polished aluminum number plate (2-1/4 inches wide x 1 inch high with 3/8 inch high black etched numerals), hat shelf approximately 9 inches below top of locker and coat rod.

B. Continuous slope top hood with slope top fillers fit on top of flat locker tops. All hoods are to be cut to length during installation, intermediate splices, ends, rear supports required to complete installation.

C. Vertical fillers to fill gaps and provide continuous row appearance are required.

2.06 FINISHES

A. Chemically pretreat metal with a six stage cleaning phosphatizing and metal preparation process. Finish coat shall be hot airless electrostatically applied baked on enamel.

B. Paint colors as selected by the Project Engineer / MDOT Architect from manufacturer’s standard range of 17 colors. Refer to Section 09 05 15-Color Design.

2.07 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install metal lockers at location show on Drawings in accordance with manufacturer's instructions for plumb, level, and flush installation.

B. Secure lockers with anchor devices to suit substrate materials. Minimum pullout force: 100 lbs. Bolt adjoining lockers units together to provide rigid installation.

C. Install locker bases, end panels, filler panels and accessories.

3.02 ADJUSTING

A. Adjust locker doors and latches to operate without binding. Verify that latches are operating satisfactorily.

3.03 TOUCH-UP PAINT

A. Touch-up all marred finished with factory supplied paint. Color shall match finished product.

3.04 CLEANING

A. Clean locker interiors and locker exterior surfaces. Comply with manufacturer's written instructions.

END OF SECTION

SECTION 10 73 16 CANOPIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Extruded aluminum cantilever bracket support canopies as shown on the Drawings and specified herein.

B. Related Sections:

1. Section 07 92 00 – Joint Sealants.
2. Section 09 05 15 – Color Design.
3. Section 13 34 19 – Metal Building Systems.

1.02 ACTION SUBMITTALS

A. Product Data: Furnish manufacturer's standard literature and specifications for canopies.

B. Shop Drawings: Showing fabrication and installation of canopies including plans, elevations and details of components and attachments to other units of work. Indicate materials, profiles of each metalwork member and fitting, joinery, finishes, fasteners, anchorage and accessory items.

C. Samples: Samples for initial selection purposes furnish three (3) required, in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors and other finish characteristics available for each item indicated below:

1. Include 6-inch long samples of linear shapes.
2. Include 6-inch square samples of plates.
3. Include full-size samples of castings and forgings.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store materials in clean, dry location, away from polyethylene sheeting in a manner that permits air circulation within covering. Handle metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Installed products shall comply with the 2012 International Building Code, include structural computations, material properties, and other information needed for structural analysis which has been prepared by, or under the supervision of, a qualified professional engineer registered in the State of Mississippi.

2.02 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Mapes Canopies, LLC, 7748 North 56th Street Lincoln, NE 68514 Tel.(888) 273-1132

B. Equivalent products by the following manufacturers are acceptable:

1. Architectural Covers & Enclosures, LLC, Cordova, TN. Tel. (901) 355-2180.
2. Dittmer Arch. Alum., Winter Springs, FL. Tel (800) 822-1755.
3. Peachtree Protective Covers, Inc., Hiram, GA. Tel. (800) 341-3325.

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. .

2.03 MATERIALS

A. Canopy decking and fascia shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures. .

1. Fasteners shall be stainless steel or cadmium plated as provided by the manufacturer.

B. Roof deck shall be Flat Soffit Super Lumideck

1. Deck sections shall be designed to the proper length to withstand the design load as determined by the local code.

C. Cantilever supported brackets shall be standard finish.

D. Water drainage shall be accomplished as a spill out on the front corners.

2.04 MANUFACTURED UNITS

A. Equal to all weather aluminum cantilever bracket support canopy with 3 Inches extruded Flat Soffit Super Lumideck 0.078 decking members and style “J”, 1/8 inch thick by 8 inches high heavy extruded aluminum, fascia.

2.05 FINISHES

A. Standard Finish: Clear Anodized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay work.

B. Installation:

1. Installation shall comply with manufacturer's instructions.
2. Contractor: Coordinate with metal building manufacturer to provide secondary framing as required to support canopies.
3. Installer: Erection shall be performed by the manufacturer or manufacturer's approved installer.
4. Care: Extreme care shall be taken to prevent damage or scratching.
   a. Workmanship must be of the very best with neat miters and fitted joints.

3.02 REPAIR AND PROTECTION

A. Protect exiting materials from damage during the installation process.

1. When installation is complete, repair or replace damaged items.
2. Replacement items are to match the original.

3.03 CLEAN-UP

A. After work is complete, remove waste materials and dispose off the owner's property.

END OF SECTION

SECTION 11 31 15 RESIDENTIAL APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric Range.
2. Refrigerator.
3. Microwave.
4. Overhead Exhaust Hood
5. Ice Machine.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's brochures, technical data, installation, maintenance and operating instructions for each item and component part specified, including data substantiating that materials comply with requirements.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Electric Company (GE), Louisville, KY. Tel. (800) 626-2000.
2. Ice-O-Matic, Denver, CO. Tel. (303) 371-3737.
3. Magic Chef Co., Cleveland, TN. Tel. (423) 472-3371.
4. Manitowoc Ice, Inc., Manitowoc, WI. Tel. (800) 545-5720.
5. Scotsman Ice System, Vernon Hills, IL. Tel. (847) 215-4500
6. Sears Brands LLC (Kenmore). Hoffman Estates, IL. Tel. (847) 286-2994.
7. Whirlpool Corporation, Benton, MI, Tel. (800) 253-1301.

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 APPLIANCES

A. Electric Range: 30 inch drop-in electric range equal to GE® Model JD630SFSS, stainless steel, Cooktop Burner radiant smoothtop, cooktop surface gray patterned ceramic glass, self-clean oven, with Optional Backguard JXS32SS. Approx. Dimensions (HxWxD) 27 inches by 31-1/4 inches by 28-1/2 inches.

B. Refrigerator: 23.2 cu. ft. capacity Side-By-Side with Dispenser equal to GE® Model GSE23GSKSS with factory-installed icemaker, Stainless steel. Approx. Dimensions (HxWxD) 69-1/2 inches by 32-3/4 inches by 33-1/4 inches.

C. Microwave: 2.2 cu. ft. oven capacity, 1100 watts countertop type, equal to GE® Model PEB7226SFSS, stainless steel, with GE Deluxe built-in trim kit Model JX7230SFSS. Approx. Dimensions (HxWxD) 14 inches by 24-1/8 inches by 19-3/4 inches.

D. Overhead Exhaust Hood: 30” Under the Cabinet Hood equal to GE® Model JVX5300SJSS, stainless steel, complete with 120V, 2.5 amp power/rating, convertible venting type with rear exhaust and optional damper accessory JXDA22, cooktop lighting, removable grease filter, single mesh and carbon, with optional remote control. Fan and light controls shall be ADA compliant. Approx. Dimensions (HxWxD) 5-1/2 inches by 29-7/8 inches by 20 inches.

E. Ice Machine: Equal to Model C0330MA-1A-300lb. Cube Ice Machine by Scotsman. Power supply shall be 115/60/1. Ice Storage Bin Model B330P – 270 lbs. ARI Bin storage capacity.

PART 3 - EXECUTION

3.01 PREPARATION AND COORDINATION

A. Verify and provide all plumbing and electrical hook-ups, drains and electrical outlets required for proper operation by the appliances specified prior to rough-in. Coordinate with Electrical and Plumbing subcontractors.

3.02 INSTALLATION, GENERAL

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

D. Utilities: Comply with plumbing and electrical requirements.

3.03 INSTALLATION

A. Install units plumb and level, in locations and with mountings as shown. Securely attach to supporting structure with concealed fasteners, and in accordance with manufacturer's installation instructions.

B. Remove shipping packaging and install components in accordance with manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. Prepare test and inspection reports.

3.05 CLEANING AND PROTECTION

A. At completion of installation, clean surfaces in accordance with manufacturer's instructions. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 12 21 14 HORIZONTAL LOUVER BLINDS - METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Horizontal louver blinds with aluminum slats at office area windows.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of blind unit required.

1. Include methods of installation for each type of opening and supporting structure.
2. Transmit copy of instructions and recommendations to the installer.

B. Samples: Submit (3 copies) samples of each exposed metal finish, cords, tapes and tassels required. Architect's review of samples will be for design, color, and finish only.

1. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.04 QUALITY ASSURANCE

A. Provide each blind as a complete unit produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings.

1. Unless otherwise acceptable to the Project Engineer / MDOT Architect, furnish all blind units by one manufacturer for the entire project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Hunter Douglas, Inc., 2 Park Way, Upper Saddle River, NJ 07458. Tel. (800) 727–8953.

B. Equivalent products by the following manufacturers are acceptable:

1. Levolor Home Fashions Contract Division, High Point, NC. Tel. (336) 812-8181.
2. Springs Window Fashions Division, Inc., Montgomery, PA. Tel. (570) 547-6671.

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 HORIZONTAL LOUVER BLINDS

A. Manufacturer: Hunter Douglas Commercial Lightlines Aluminum Blinds 1” de-Light Model DL88.

1. Color to be selected by the Project Engineer / MDOT Architect from manufacturers’ full line of standard colors.
2. Refer to Section 09 05 15 – Color Design for color selected.

2.03 MATERIALS AND COMPONENTS

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Standard head rail, channel-shaped section fabricated from minimum 0.040 inch thick aluminum.

1. Increase metal thickness as recommended by the manufacturer for large blind units. Cross-brace for extra rigidity.
2. Furnish complete with tilting mechanism, top and end brace, top cradle, cord lock, and accessory items required for the type of blind and installation indicated.

C. Bottom Rail: Standard tubular steel bottom rail designed to withstand twisting or sagging.

1. Contour top surface to match slat curvature, with flat or slightly curved bottom.
2. Close ends with manufacturer's standard metal or plastic end caps of the same color as rail.
3. Finish rails the same color as slats, unless otherwise indicated.

D. Slats: Standard, spring tempered aluminum slats not less than 0.008 inches thick.

1. Provide l inch narrow slats, with other components sized to suit.

E. Braided Ladders: Standard polyester support cords with integrally braided ladder rungs.

1. Provide cord size and rung spacing as required for each type of blind shown.

F. Tilter: Standard enclosed, lubricated, tilting mechanism which will tilt and securely hold the tilting rod, slats and bottom rail at any set angle.

1. Furnish wand (or rod) type tilter consisting of standard tilter mechanism adopted for rotating wand operation.
2. Furnish manufacturer's standard plastic or aluminum rod of proper length to suit blind installation.

G. Cords: Standard braided polyester cord, sized to suit blind type, equipped with soft-molded plastic rubber or composition tassels securely attached to each cord end.

1. Cord Locks: Provide manufacturer's standard cord locks for each type of blind.
2. Cord Equalizers: Nylon, self-aligning type, designed to maintain horizontal blind position.

H. Hardware: Furnish standard brackets, supports and internal reinforcement as required to suit blind type and size.

1. Finish exposed hardware and accessories to match rail color.

I. Finish: Prime aluminum slats with chromate conversion coating, followed by manufacturer's standard glass-smooth, baked-on synthetic resin enamel finish.

1. Refer to Section 09 05 15 – Color Design for color selection.

2.04 FABRICATION AND OPERATION

A. Prior to fabrication, verify actual opening dimensions by accurate site measurements.

1. Adjust blind dimensions for proper fit in all openings.
2. Fabricate components of blinds from non-corrosive, non-staining, non-fading materials which are completely compatible with each other, and which do not require lubrication during normal expected life.

B. Fabricate blind units to completely fill the openings as indicated, from head to sill and jamb to jamb.

1. Space supporting tapes or cords in accordance with manufacturer's standards, unless otherwise indicated.
2. Space louver blades (slats) to provide overlap for light exclusion when in the fully closed position.

C. Equip blind units, unless otherwise indicated, for the following operation:

1. Full-tilting operation with slats rotating approximately l80 degrees.
   a. Place tilt operation controls on left-hand side of blind units.
2. Full-Height raising, to manufacturer's minimum stacking dimension with lifting cord locks for stopping blinds at any point of ascending or descending travel.
   a. Place pull cords on right-hand side of blind units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 ADJUSTING AND CLEANING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

B. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

END OF SECTION

SECTION 12 48 43 FLOOR MATS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Metal-rails, tapered (3 sides) Aluminum-frame, surfaced mounted with square end vinyl adjacent to door opening, removable, exterior carpeted floor roll-up mats located at Exterior Building Entrances where indicated.

B. Related Sections: Section 09 05 15 – Color Design (for color selection).

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. The Aluminum Association

C. The Carpet and Rug Institute (CRI)

D. The National Floor Safety Institute (NFSI)

1.03 ACTION SUBMITTALS

A. Product Data: For manufacturers' product and technical data indicating compliance with these specifications and recommended maintenance practices.

B. Shop Drawings: Materials description, component dimensions and details. Show plan view that clearly indicates traffic direction and size of mat.

C. Samples: Submit 3 samples of manufacturer's full range of available colors and finishes for materials exposed to view.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Single Source: All floor mats required by this Section shall be products of only one manufacturer.

B. Manufacturer: Company regularly engaged in producing types of floor mats required by this Section and with minimum 10 years documented satisfactory experience

C. Slip Resistance: Comply with ASTM D-2047-96, Coefficient of Friction, minimum 0.60 for accessible routes.

D. Utilize superior structural aluminum alloy 6063-T6 for rail components.

PART 2 - PRODUCTS

2.01 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.02 ACCEPTACLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arden Architectural Specialties, Inc., Saint Paul, MN. Tel. (651) 631-1607.
2. C/S Group, Muncy, PA. Tel. (888) 834-4455. (Basis-of-Design)
3. J. L. Industries, Inc. Bloomington, MN. Tel. (612) 835-6850.,
4. Musson Rubber Company, Akron, OH. Tel. (330) 773-7651.

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. .

2.03 ROLL-UP RAIL MATS

A. Roll-up, Aluminum-Rail Hinged Mats: Equal to C/S Group Surface-Mounted Floor Mat, Model M2 Pedimat AA.

1. Carpet Tread Inserts: .EC-Exterior Carpet shall be solution dyed polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament, available in one of 4 standard colors as offered by manufacturer. Color selected by Project Engineer / MDOT Architect. The texturized fibers have ultraviolet blockers and color as an integral part of the filament. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. (Waterproof fibers do not get soggy, rot, fade or stain.) Carpet weight shall be 32-oz./yd².
2. Rails: Extruded aluminum 6063-T6 as selected by Project Engineer / MDOT Architect from full range of manufacturer’s anodized colors.
3. Surface-Mounted Frames: Tapered Aluminum (3 sides) with mitered corners. Square end vinyl one side at entrance (notch in field as required to fit). Color as selected by Project Engineer / MDOT Architect from full range of manufacturer’s anodized colors.
4. Mat Size: 6 feet wide by 5 feet deep (traffic direction)

2.04 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

1. Install mats after Final Cleaning of Project Floor.

3.02 CLEANING AND PROTECTION

A. At Project Completion, clean surfaces in accordance with manufacturer’s instructions. Protect units from damage until acceptance by Owner.

END OF SECTION

SECTION 13 34 17 PRE-ENGINEERED BUILDINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building Type: The buildings are single-story, single-span, rigid-frame-type pre-engineered metal buildings of the nominal length, width eave height, and roof pitch indicated.
2. Roof system: Standard metal building ribbed-type roof system with exposed fasteners and field installed mastic.
3. Components and Accessories: Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.

B. Related sections:

1. Colors are specified in Section 09 05 15 - Color Design.
2. Painting for ferrous metal exposed to view is specified in Section 09 90 00 - Painting and Coating.

1.02 STRUCTURAL FRAMING AND ROOF PANELS

A. Design anchor bolts, structural members, and exterior covering for applicable loads and combinations of loads in accordance with the MBMA's "Design Practices Manual."

B. Structural Steel: Comply with AISC's "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

C. Light Gage Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.

D. Welded Connections: Comply with AWS's "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

E. Metal Roofing: Comply with SMACNA Architectural Sheet Metal Manual.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's sample warranty and product information for building components, accessories and color chart.

B. Shop Drawings: Submit Shop Drawings for anchor bolts, structural framing system, roofing panels, and components and accessories not fully detailed or dimensioned in manufacturer's product data.

1. Structural Framing: Furnish erection drawings. Include fabrication and assembly details. Show anchor bolts' settings and roof framing.
2. Roof Panels and Sheet Metal Accessories: 1/4-inch-scale layouts and 1-1/2-inch-scale details of accessories; show profiles, methods of joining to system components and dissimilar building materials, flashing of each condition for roof penetrations, and anchorage.

C. Certification: Prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that anchor bolts, structural framing and covering panels meet loading requirements and codes (IBC 2012), including design calculations.

D. Installer Certificates: signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

1.05 EXTRA MATERIALS

A. Furnish 5 percent excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons labeled to identify contents and store on site where directed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide buildings manufactured by a firm with ten (10) years experience in manufacturing buildings similar to those indicated.

1. The manufacturer shall be IAS Accredited (Class MB).
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Erector Qualifications: An experienced erector, with five (5) years minimum experience, who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

F. Preinstallation Conference: Conduct conference at Project site.

1.07 WARRANTY

A. Manufacturer:

1. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   a. Finish Warranty Period: Twenty-five (25) years from date of Completion.
2. Material Warranty: Provide a three (3) years warranty against failures caused by faulty or substandard materials.
3. Warranty period begins at the Date of Completion as determined by MDOT.

B. Installer:

1. Provide a 5 year watertight warranty on the roof system.
2. Warranty period begins at the Date of Completion as determined by MDOT.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Ceco Building Division, P. O. Box 6500, Columbus, MS 39703. Tel. (662) 328-6722.

B. Comparable product by one of the following manufacturers are acceptable:

1. ACI Building Systems, Inc., Batesville, MS Tel. (662) 563-4574.
2. Gulf States Manufacturers, Inc.; Starkville, MS. Tel.: (662) 323-8021.
3. Kirby Building Systems, Starkville, MS. Tel.: (662) 323-8021.
4. MBCI, Hernando, MS. Tel. (800) 206-6224
5. VP Buildings; a United Dominion Company. Memphis, TN. Tel. (901) 748-8000.

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 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Structural Drawings Sheet S1-1., with exceptions as given here – Building Classification – Type II, drift limitation of H/120, deflection of L/120. no collateral loading. This description applies to the open shed only.

2. Deflection Limits: Design metal building system assemblies to withstand design loads.
3. Drift Limits: Engineer building structure to withstand design loads with drift limits.
4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

E. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

2.03 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafters, and rake, sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
2. Frame Configuration: Single gable
3. Exterior Column Type: Tapered.
4. Rafter Type: Tapered.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.

D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.

E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

2.04 METAL ROOF PANELS

A. Standing-Seam Metal Roof Panels: PBR Ribbed-type panel, 1-1/4 inches high with 36 inches wide coverage and rib spacing at 12 inches on center, 26-gage, with Galvalume Plus® finish.

1. Panels, 45 feet and less, shall be in one continuous length.

2.05 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Fasteners: Standard coated, CAD plated or zinc-aluminum cast head screw.
   a. Color to match materials being fastened.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Flashing and Trim: Formed from 26 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match adjacent metal panels, unless indicated otherwise.

D. Gutters: Formed from 26 gage nominal-thickness, zinc-coated (galvanized G-90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF) ; finished to match roof fascia and rake trim. Box-shaped profile, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 20’-0” long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters
   a. Provide supports spaced at maximum of 4’-0” on center.
2. Strainers: Aluminum wire ball type at outlets.

E. Downspouts: Formed from 26 gage nominal-thickness (smooth, not corrugated), zinc-coated (galvanized G90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF). Fabricate in full-length long sections (rectangular-shaped), complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.
   a. Straps shall be spaced 5’-0” on center maximum (minimum of 3 required per downspout).
   b. Strap edges shall be rolled or smooth.

2.06 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

PART 3 - EXECUTION

3.01 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
   a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.02 METAL PANEL INSTALLATION, GENERAL

A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Install metal panels perpendicular to structural supports unless otherwise indicated.
2. Locate and space fastenings in uniform vertical and horizontal alignment.
3. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
4. Lap metal flashing over metal panels to allow moisture to run over and off the material.

3.03 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with fasteners recommended by manufacturer.

1. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb. Coordinate with electrical so that all penetrations through roof occur in flat portion of panel with sufficient space adjacent to penetration to be properly flashed and waterproofed.
2. Attach panels using manufacturer's standard fasteners, spaced in accordance with approved shop drawings.
3. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
4. Install sealant for preformed roofing panels as specified on approved shop drawings.
5. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
6. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
7. Remove and replace panels or components that are damaged beyond successful repair.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.

1. Provide elbows at base of downspouts to direct water away from building.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 CLEANING AND TOUCH-UP

A. Clean component surfaces. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same material as shop primer.

END OF SECTION

SECTION 13 34 19 METAL BUILDING SYSTEMS-SHOP

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Building Type: The building is a single-story, single-span, rigid-frame-type pre-engineered metal building of the nominal length, width eave height, and roof pitch indicated on the Drawings.
2. Exterior Walls: Field assembled, un-insulated panels attached to Insulated Barrier Wall System.
3. Roof system: Standing-seam insulated panel roof with concealed clips and factory-applied sealant.
4. Components and Accessories: Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.

B. Related sections:

1. Cellulose thermal insulation is specified in Section 07 21 28.
2. Personnel doors and frames and finish hardware are specified in Sections 08 11 13 and 08 71 00.
3. Colors are specified in Section 09 05 15 - Color Design.
4. Painting for ferrous metal exposed to view is specified in Section 09 90 00 - Painting and Coating.
5. Canopies are specified in Section 10 73 16.

1.02 STRUCTURAL FRAMING AND ROOF AND SIDING PANELS

A. Design anchor bolts, structural members, and exterior covering for applicable loads and combinations of loads in accordance with the MBMA's "Design Practices Manual" and in accordance with structural loading indicated on Structural Drawing Sheet S1-1.

B. Structural Steel: Comply with AISC's "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

C. Light Gage Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.

D. Welded Connections: Comply with AWS's "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

E. Metal Roofing: Comply with SMACNA Architectural Sheet Metal Manual.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's sample warranty and product information for building components, accessories and color chart.

B. Shop Drawings: Submit Shop Drawings for anchor bolts, structural framing system, roofing and siding panels, and components and accessories not fully detailed or dimensioned in manufacturer's product data.

1. Structural Framing: Furnish erection drawings. Include fabrication and assembly details. Show anchor bolts' settings and sidewall, end-wall, and roof framing.
2. Wall Panels: Provide panel layouts and details of edge conditions, joints, corners, custom profiles, supports, anchorage, trim, flashing, closures, and special details.
3. Roof Panels and Sheet Metal Accessories: 1/4-inch-scale layouts and 1-1/2-inch-scale details of accessories; show profiles, methods of joining to system components and dissimilar building materials, flashing of each condition for roof penetrations, and anchorage.

C. Certification prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that anchor bolts, structural framing and covering panels meet structural loading requirements as indicated on Structural Drawing Sheet S1-1 and codes (IBC 2012), including design calculations.

D. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

E. Submit sample copies of the Paint Finish Guarantee and Weather Tightness Warranty prior to fabrication and installation for MDOT Architect's approval. DO NOT start roofing installation without MDOT Architect's approval of Guarantee and Warranty. Refer to Division 00 Sections for State of Mississippi requirements.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Executed copies of Paint Finish Guarantee and Weather Tightness Warranty.

1.05 EXTRA MATERIALS

A. Furnish 5 percent excess over required amount of nuts, bolts, screws, washers, and other required fasteners for each building. Pack in cartons labeled to identify contents and store on site where directed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide buildings manufactured by a firm with 10 years' experience in manufacturing buildings similar to those indicated.

1. The manufacturer shall be IAS Accredited (Class MB).
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Erector Qualifications: An experienced erector, with five (5) years minimum experience, who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

F. Preinstallation Conference: Conduct conference at Project site.

1.07 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: Twenty-five (25) years from date of Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels:

1. The entire installation (sub-framing, clips, panels, fasteners, rakes, eaves, ridge/valley flashing conditions, penetrations, roof to wall conditions as well as all materials specified as supplied by the manufacturer) shall be guaranteed weather tight for a minimum of twenty (20) YEARS.
2. This warranty shall be identified as neither Non-Depreciating, Non-prorated nor have exclusions that identify, valleys, curbs, and flashings.
3. Provide written warranty, signed by the manufacturer and his authorized installer / dealer, agreeing to replace / repair defective materials and workmanship with NO COST (NDL) to the Owner during the warranty period.
4. Warranty period begins at the Date of Completion as determined by MDOT

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Kirby Building Systems, Starkville, MS. Tel.: (662) 323-8021.

B. Comparable product by one of the following manufacturers are acceptable:

1. ACI Building Systems, Inc., Batesville, MS Tel. (662) 563-4574.
2. Ceco Building Division, Columbus, MS. Tel. (662) 328-6722.
3. MBCI, Hernando, MS. Tel. (800) 206-6224
4. Metallic Building Company, Houston, TX Tel (866) 800-6353
5. VP Buildings; a United Dominion Company. Memphis, TN. Tel. (901) 748-8000.

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 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawing Sheet S1-1.
2. Design Loads: As required by MBMA's "Metal Building Systems Manual" and ASCE/SEI 7.
3. Deflection Limits: Design metal building system assemblies to withstand design loads. See deflection limits on sheet S1-1.
4. Drift Limits: Engineer building structure to withstand design loads with drift limits as shown on sheet S1-1.
5. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

E. Air Infiltration for Metal Roof and Wall Panels:

1. Insulated Roof Panels: Air leakage through assembly of not more than 0.003 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.
2. Insulated Barrier Wall System: Air leakage through assembly of not more than 0.001 cfm/sq. ft. at 20 psf air pressure differential when tested according to ASTM E E283.

F. Water Penetration for Metal Roof and Wall Panels: There shall be no uncontrolled water leakage at pressures of up to 20 psf when tested in accordance with ASTM E331 and ASTM E1646. Tested assembly must include endlap and sidelap conditions.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

H. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

I. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low-slope roof products. The panel shall provide a nominal R-value of 7.2 [hr·ft2· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature and 8.0 [hr·ft2· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 35 deg F mean temperature.

2.03 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
2. Frame Configuration: Single slope
3. Exterior Column Type: See sheet S2-1 for restrictions on column depth /taper.
4. Rafter Type: Tapered.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.

D. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.

E. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

2.04 METAL ROOF AND SIDING PANELS

A. Standing-Seam Insulated Metal Roof Panels: Equal to Kingspan Insulated Panels's KingZip formed as an insulated panel system with the following properties:

1. Panel Thickness: Three (3) inches.
2. R-Values 7.2 [hr·ft2·deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature.
3. Panel Width: Forty-two (42) inches.
4. Panel Lengths: As indicated on Drawings.
5. Insulation Material: Non-CFC foamed-in-place closed cell Polyurethane foam cured to achieve a minimum density of 2.4 pcf as determined by ASTM D 1622
6. Joint Configuration: Standing seam with thermally broken Concealed Clips.
7. Panel Exterior Face: 24 gage Galvalume®
8. Panel Interior Face: 26 gage Galvalume®
9. Exterior Profile: 2 inches high standing seam, non-embossed (smooth) between seams.

10. Coating: Galvalume® Plus.
11. Accessories: Fasteners, Sealants, Standard and Custom Trim as required for a complete system.

2.05 INSULATED BARRIER WALL SYSTEM

A. Insulated metal panel barrier system equal to Kingspan Insulated Panels Karrier Series with the following properties:

1. Panel Thickness: 2-1/2 inches
2. R-Values: 7.2 [hr·ft2· deg F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75 deg F mean temperature.
3. Panel Width: Forty-two (42) inches.
4. Panel Lengths: As indicated on drawings
5. Insulation Material: Non-CFC foamed-in-place closed cell Polyurethane foam cured to achieve a minimum density of 2.4 pcf as determined by ASTM D 1622
6. Joint Configuration: Thermally broken tongue and groove joints oriented vertically
7. Panel Exterior Face: 24 gage, Shadowline profile, smooth finish
8. Panel Interior Face: 24 gage, Shadowline profile, smooth finish
9. Coating: Fluoropolymer two-coat design series color system with 70 percent PVDF
10. Color: Standard colors from manufacturer's full range of colors to be selected by Project Engineer / MDOT Architect
11. Integral Furring: equal to Karrier Rail. Provide 16 gage flat rail integrated into the panel joint where exterior cladding is vertical. Provide 16 gage "hat channel" profile with 2 inches bearing surface integrated into the panel joint where exterior cladding is horizontal.
12. Accessories: Fasteners, Sealants, Standard and Custom Trim as required for a complete system.

2.06 EXTERIOR CLADDING METAL PANELS

A. Metal Panel Type 1 equal to Morin; a Kingspan Group Company, Exposed fastener panel:

1. Profile: C-37-7/8
2. Thickness: 7/8 inch
3. Panel width: 37- 5/16 inches (Note: 30 to 42 inches widths are acceptable)
4. Gage: 24 Ga minimum
5. Panel Joint: Lap joint with staggered vertical locations
6. Finish: Galvalume® Plus.
7. Texture: Smooth
8. Structural Performance: Maximum deflection of L/180 based on structural loads indicated on Drawing S101
9. Water penetration: Wall panels when tested shall have no water leakage at 6 pounds per square foot when tested as per ASTM E331.
10. Air infiltration: maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot when tested as per ASTM E283
11. Accessories: Closed Cell Closure strips, Fasteners, Sealants, Standard and Custom Trim as required for a complete system. Note inside corner, outside corner and field trim locations on elevations.

B. Metal Panel Type 2 equal to Morin; a Kingspan Group Company, Concealed fastener panel:

1. Profile: F-12
2. Thickness: 1-1/2 inches
3. Panel width: 12 inches
4. Gage: 24 Ga minimum
5. Panel Joint: Tongue and groove interlock joint
6. Panel Length: Vertical panels to be continuous. Flush joints with backer plate where required at horizontal panels. Where joints are required, stagger location so no joints are in alignment across three panels.
7. Finish: 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent PVDF) MICA color coat.
8. Color: Blue Gray
9. Texture: Smooth
10. Structural Performance: Maximum deflection of L/180 based on structural loads indicated on Drawing S101
11. Water penetration: Wall panels when tested shall have no water leakage at 6 pounds per square foot when tested as per ASTM E331.
12. Air infiltration: maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot when tested as per ASTM E283
13. Accessories: Closed Cell Closure strips, Fasteners, Sealants, Standard and Custom Trim as required for a complete system. Note inside corner, outside corner and field trim locations on elevations.

2.07 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

D. Flashing and Trim: Formed from 24 gage nominal-thickness, zinc-coated steel sheet (galvanized G-90) or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating (Kynar 500 with 70 percent PVDF); finished to match adjacent metal panels, unless indicated otherwise.

E. Gutters: Formed from 24 gage nominal-thickness, zinc-coated (galvanized G-90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF); finished to match roof fascia and rake trim. Box-shaped profile, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 20'-0" long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters
   a. Provide supports spaced at maximum of 4'-0" on center.
2. Strainers: Aluminum wire ball type at outlets.

F. Downspouts: Formed from 24 gage nominal-thickness (smooth, not corrugated), zinc-coated (galvanized G90) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating (Kynar 500 with 70 percent PVDF). Fabricate in full-length long sections (rectangular-shaped), complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.
   a. Straps shall be spaced 5'-0" on center maximum (minimum of 3 required per downspout).
   b. Strap edges shall be rolled or smooth.

G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

H. Fasteners: Exposed fasteners shall be color matched to the material being anchored.

2.08 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

PART 3 - EXECUTION

3.01 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
   a. Joint Type: Snug tightened or pre-tensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.
3. Diagonal rod or cable bracing at roof.
4. Portal Frame bracing at walls.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.02 METAL ROOF AND WALL PANEL INSTALLATION, GENERAL

A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
   a. Field cutting of metal panels by torch is not permitted.
2. Refer to building elevations and details for exterior cladding wall panel orientation. Install Insulated barrier wall system panels vertically across metal building girts.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material. Stagger lap joints so no two joints align across three panels.

B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.03 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Remove protective film before installation, or immediately thereafter to prevent sunlight damage.
2. Install clips to supports with self-drilling or self-tapping fasteners.
3. Install pressure plates at locations indicated in manufacturer's written installation instructions.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at rake edges and each side of ridge caps.
7. As each panel is installed, crimp hidden clip assembly prior to placement of next panel.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.04 INSULATED BARRIER WALL SYSTEM

A. Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.

B. Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C. Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer’s instructions. Personnel should wear respiratory and eye protection devices.

D. Butyl Weather Barrier Sealant: Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels. Use non-skinning butyl tube sealant only for tight metal-to-metal contact. Do not use non-skinning butyl tube sealant to bridge gaps.

E. Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.05 EXTERIOR CLADDING METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels complying with manufacturer's recommendation with 4 inches minimum.
4. Where joints occur at the ends of panels, stagger joints so that no two joints align within three panels.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.06 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8.

C. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

D. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

1. Install surface-mounted items after finishes have been completed on substrates involved.
2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

3.07 WINDOW INSTALLATION

A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.

B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

3.08 General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.

1. Provide elbows at base of downspouts to direct water away from building.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections Reports shall include:

1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Common work results for requirements specifically applicable to Division 22.

B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

1.02 REGULATORY REQUIREMENTS

A. Perform Work specified in Division 22 in accordance with the codes and standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the MDOT Architect.

1. NFPA 101: Life Safety Code
2. ANSI Handicapped Code-A117.1
3. U.L Fire Resistance Index
4. ASTM E814-08B: Standard Test Method for Fire Tests of Penetration Firestop Systems
5. IBC: International Building Code, with Mechanical and Plumbing Codes
6. NFPA 54: National Fuel Gas Code
7. NFPA 70: National Electrical Code
8. NFPA 72: National Fire Alarm and Signaling Code
9. NFPA 101A: Guide on Alternative Approaches to Life Safety
10. NFPA 101B: Standard on Means of Egress for Buildings and Structures
11. Special regulations, supplements, and amendments of the State and/or local authorities having jurisdiction.

1.03 REFERENCE STANDARDS

A. AGA: American Gas Association

B. ANSI: American National Standards Institute

C. ASME: American Society for Mechanical Engineers

D. ASTM: American Society for Testing and Materials

E. AWWA: American Water Works Association

F. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry

G. NEMA: National Electrical Manufacturers' Association

H. NFPA: National Fire Protection Association

I. UL: Underwriters' Laboratories, Inc.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 including required number of copies.

B. Include Products as specified in the individual sections of Division 22.

C. Group submittals to include complete information of related systems, products, and accessories in a single submittal.

D. Brochures: Submit manufacturer's product data and brochures including:

1. Complete descriptions.
2. Illustrations and wiring diagrams.

3. Rating data, accessories, dimensional data, and applicable options and features marked for the specific items scheduled on drawings and specified herein.
4. Capacities stated in the terms specified
5. Performance and rating data for plumbing equipment and performance curves for pumps.

1.05 QUALITY ASSURANCE

A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25 percent per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.

B. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

1.06 FIELD CONDITIONS

A. Layouts indicated on Drawings are diagrammatical and intended to show relative positions and arrangement of piping and equipment. Coordinate work with other trades and with measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings. Provide necessary rises, drops, and offsets to fit in the available space unless prevented by Project conditions.

B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of the Architect before proceeding.

C. Place anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

D. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner and all affected trades.

E. Determine sizes and verify locations of existing utilities on or near site.

F. Keep roads and other spaces clear of materials and debris.

G. Visit site and be informed of conditions under which Work must be performed.

H. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using duct, wall, or ceiling access doors.

I. Install piping to leave sufficient space for AHJ inspection of wall construction. Coordinate pipe routing with other trades including but not limited to Divisions 21, 23, 26 and 28.

1.07 FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required to perform Division 22 work.

1.08 COORDINATION DRAWINGS

A. Prior to commencement of installation, assist in preparation of coordination drawings for work under this Division, as specified in Division 01. Fully cooperate with persons coordinating and performing work under other Divisions.

B. Drawings shall not be formally submitted but shall be kept on site for reference. Notify the Architect of conflicts that cannot be resolved.

C. Coordination drawings shal be prepared to include the following:
1. Drawn to a scale of 1/4 inch = 1' - 0".
2. Room dimensions.
3. Sheet size matching contract documents.

4. Show plumbing equipment, structural columns and beams.
5. Ductwork sizes with bottom elevation from finished floor.
6. Concrete pad and foundation layouts including anchor bolt and sleeve locations.
7. Dimensioned floor drain locations.
8. Wall mounted equipment.
9. Piping 2 inches and larger.
10. Suspended equipment and piping.
11. Backflow preventers.
12. Floor to floor and ceiling heights.

1.09 COMPLETENESS OF WORK

A. The Contract Documents depict plumbing systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Catalog numbers referenced throughout the Division 22 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

1.10 PRODUCT SUBSTITUTIONS

A. 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.

1.11 RECORD DRAWINGS

A. Provide record drawings that illustrate the work of Division 22 as finally constructed. Deliver record drawings to the Architect in a form suitable for reproduction. Comply with the provisions and requirements of Division 01.

B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.

C. Deliver record drawings to Architect within 30 days of Substantial Completion.

1.12 OWNING AND OPERATING MANUALS

A. Comply with the requirements of Division 01, but provide a minimum of three sets.

B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.

C. Copies of reviewed submittals for furnished equipment shall be included.

PART 2 – PRODUCTS

2.01 EQUIPMENT SUPPORTS

A. Structural steel for supports: ASTM A36.

B. Use galvanized members installed in areas of high humidity or condensation, and outside.

C. Furnish other members with shop coat of red primer.

D. Retouch primer after field welding.

2.02 FLASHINGS AND COUNTERFLASHINGS

A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for vents, pipe, drains, and ducts.

B. Materials:

1. Sheet metal: 24-gage minimum ASTM A525, Class G90
2. Sheet lead: 3 pounds per square foot
3. Stainless steel: Minimum 20 gage
4. Sheet copper: 24 OZ/SF

C. Vent Stack Fitting (threaded roof coupling): Josam 26450 or Jay R. Smith 1750.

2.03 WALL AND CEILING ACCESS PANELS

A. Style and type as required for material in which installed.

B. Size: 12 inches by12 inches minimum, as indicated, or as required to allow inspection, service and removal of items served.

C. 14-gauge minimum sheet metal for doors, 16-gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.

D. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.

E. Prime painted or rust inhibitive paint finish.

F. UL labeled when in fire-rated construction, 1-1/2 hour rating.

G. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are valves, and equipment needing periodic or replacement maintenance.

H. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.

I. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.

1. For masonry and drywall construction: Milcor Style M
2. For plastered masonry walls and ceiling: Milcor Style K
3. For ceramic tile or glazed structural tile: Use stainless steel panels

2.04 PROTECTION AGAINST CONTACT

A. Metallic piping, except for cast iron, ductile iron and galvanized steel, shall not be placed in direct contact with steel framing members, concrete or cinder walls and floors or other masonry. Metallic piping shall not be placed in direct contact with corrosive soil. Where sheathing is used to prevent direct contact with the soil, the sheathing shall have a thickness of not less than 0.008 inch (8 mil) and the sheathing shall be made of plastic.

B. Where piping penetrates rated walls, partitions and floors, sleeves and fire safing shall be used to maintain the integrity of the wall or floor.

2.05 SLEEVES

A. Materials:

1. Concrete floors, concrete and masonry walls: 18 gauge galvanized steel sheet metal or Sch. 10 galvanized steel pipe.
2. Drywall partitions: 18 gauge galvanized steel sheet metal or Sch. 10 galvanized steel pipe.

B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Provide larger annular space if required by firestopping product installation instructions or water proofing seal at exterior wall penetrations.

C. Sleeves supporting riser piping 4" and larger shall have three 6" long reinforcing rods welded radically at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.

D. Exterior wall and floor penetrations shall be sleeved and sealed with a Link Seal Modular Seal by GPT Industries or Flexicraft Industries.

1. Exterior wall and floor penetrations: Install Link Seal Modular Seal by GPT or Flexicraft Industries. Seal shall be suitable for use in direct ground contact, water or atmospheric conditions with EPDM seal element. Provide Nitrile rubber seal element where subject to oils and fuel. All bolts, nuts and fasteners shall be Steel with 2-part Dichromate corrosion inhibiting coating or Type 316 Stainless steel.

2.06 ESCUTCHEON PLATES

A. Provide B & C No. 10 or equal chrome plated escutcheon plates where pipes penetrate partitions or ceilings in finished spaces or areas

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PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING

A. Contractor shall review Divisions 31 and 33 and shall perform excavation and backfilling in accordance with the most stringent requirements. Contractor shall request clarification before proceeding if there are conflicting instructions.

B. Contract Documents show the approximate location of underground utilities known to exist in the area of construction. Contractor shall determine the exact location of utilities.

1. Locate and uncover existing utilities which require new connections before trenching in the vicinity of indicated utility connection.
2. Clear all vegetation and other objectionable material from the area required for the excavation and backfill operations. Disposal of material removed by the clearing operation shall be approved by the Owner's representative.

C. Provide trenching, excavating, and backfilling necessary for performance of work indicated in Contract Documents.

D. Excavate to depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, backfill, structures or appurtenances. Provide a firm, undisturbed, uniform surface in the bottom of trenches. Where excavation exceeds the required depth, bring the excavation to proper grade through the use of an approved incompressible backfill material. Store excavated material and dispose of surplus excavated material.

1. Excavate trench to sufficient depth to permit a minimum of 36" of cover over the top of the pipe unless otherwise required by pipe elevations indicated on the Drawings. The trench width shall be 18" plus the diameter of the pipe and/or the largest bell.

E. Trenching and excavation shall be unclassified. No extra will be paid in the event that rock is encountered.

1. Should rock excavation be required, use only experienced personnel for blasting.
2. Exercise extreme care when blasting with signals of danger given before firing any charge.
3. Conform to and obey all public authority regulations for the protection of life and property.

F. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition and to meet applicable codes.

G. Provide a minimum of 6 inches of No. 67 crushed stone or clean sand bedding, or equal, in the bottom of the trench to maintain the required grade and continuous support of the bottom quadrant of the pipe. On bell and spigot piping, dig bell holes so bottom of bells do not support pipe.

H. Upon completion of excavation, and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with min. 6 inches pipe bedding. Pipe bedding shall be select material deposited in the trench, and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Material for pipe bedding shall comply with local codes. In absence of local code requirements the bedding shall be bank sand or select back fill material approved by the Architect. Any material used shall pass a 1/4 inch screen.

I. Clean and inspect pipe for defects before lowering into trench for assembly. Install pipe in accordance with provisions of Contract Documents and with the recommendations of the pipe manufacturer.

1. Ensure pipe is of proper strength and classification for specified service. Discard damaged or defective pipe discovered during pipe laying operations.
2. Maintain alignment and grade during layout operation. Use acceptable method for maintaining grade and alignment to produce desired results.

J. Where crushed stone backfill is required, use No. 67 stone, clean sand or equal.

K. After bedding has been shaped and the pipe assembled, place crushed stone carefully around the pipe and to a point 12 inches above the pipe. Backfill above this point shall be as described below:

1. Backfill areas of vehicular traffic shall consist entirely of crushed stone and compacted crusher run material.
2. Backfill for shoulders of roadways, sidewalk, and slab on grade structures shall consist entirely of crushed stone.
3. Backfill areas not subject to vehicular traffic may consist of suitable excavated material as described above.

L. Where crushed stone is not required, suitable excavated material may be utilized. This includes fine, dry earth or a mixture of earth and shot rock. Rocks larger than 6 inches in any dimension may not be included in any portion of the backfill material.

M. Trenches shall be backfilled only after piping has been inspected, tested, and approved by the Architect. All backfill material shall be placed in the trench either by hand or by approved mechanical methods. The compaction of backfill material shall be accompanied by tamping, with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Architect. Backfill completely around pipe, including 18 inches above the pipe, with suitable bank sand, tamped in 4 inch layers under, around, and over pipe. Water down backfill as required. The remainder of the backfill shall be select backfill material tamped at intervals of no more than 12 inch depths. All materials to be used as selected material backfill shall be approved by the Architect. If, in the opinion of the Architect, []the excavated material does not meet the requirements of selected material, the Contractor shall be required to screen the material prior to its use as selected material backfill. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than six inches in its longest dimension. No wood, vegetable matter, or other material which, in the opinion of the Architect, is unsuitable shall be included in the backfill. The upper 24 inches of backfill may be water jetted, if desired. Backfill shall be brought up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation.

3.02 CUTTING AND PATCHING

A. Repair or replace damage caused by cutting or installation of work specified in Division 22.

B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.03 FLASHING AND COUNTERFLASHING

A. Counterflash pipes where penetration of roofs and outside walls occur.

3.04 CONNECTION TO EQUIPMENT FURNISHED BY OWNER

A. Connect or install equipment shown on plumbing drawings that requires plumbing connections.

B. Provide piping, shutoff valves, unions, and other piping appurtenances required for a complete installation. Provide backflow preventers and/or pressure reducing valves where required by the equipment design or local code. All components shall be line size unless noted otherwise.

3.05 DELIVERY, STORAGE, AND PROTECTION

A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where delivery in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.

B. Store items in a clean, dry place, and protect from damage. Plumbing equipment may not be staged or stored outdoors unless intended for outdoor use.

C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.

D. Protect plumbing fixtures and brass or chromium plated trim, valves and piping from damage. Cover fixtures during work of finishing trades.

E. Keep dirt and debris out of pipes.

F. Repair, restore, and replace damaged items.

G. Cover factory finished equipment during work of finished trades.

3.06 SLEEVES

A. Floors: Sleeve all pipe penetrations including mechanical equipment rooms and other wet areas. Extend sleeve 2" above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.

B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.

C. Drywall partitions: Sleeve all pipe penetrations.

D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.

E. For all fire rated walls, floors and partitions install piping, insulation and sleeves in strict accordance with applicable U.L. Fire Resistance Index assembly and with firestop manufacturer's installation instructions for floor or partition penetrations. Coordinate installtion and firestop material with Division 07.

F. Clearance between sleeve and pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping or as otherwise dictated by U.L. Fire Resistance Directory.

G. Penetrations not sleeved or firestopped:

1. Seal voids between pipe and partition. Seals shall be airtight.

3.07 ESCUTCHEON PLATES

A. Provide chromium plated escutcheon plates for exposed uninsulated pipes projecting through floors or wall in finished spaces. Mechanical rooms, storage rooms, electric closets and housekeeping closets are not considered finished spaces.

B. Clearance between sleeve and pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping or as otherwise dictated by the UL Fire Resistance Directory.

3.08 CLEANING PLUMBING SYSTEMS

A. General Cleanup:

1. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, old materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Architect. See Division 01 of specifications for further requirements.
2. Seepage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems shall be repaired without cost to the Owner.

B. Factory Finishes:

1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.

C. Domestic Water System:

1. Flush system progressively by opening building operable valves, faucets and hose bibs and permitting flow to continue from each unit until water runs clear.
2. Sterilize system in accordance with requirements of State Department of Public Health by the following method or other methods acceptable to authority having jurisdiction.
   a. Introduce chlorine or a solution of calcium or sodium hypochlorite. Fill lines slowly and apply sterilizing agent at a rate of 50 ppm of chlorine as determined by residual chlorine tests at ends of lines. Open and close all valves while system is being chlorinated.
   b. After sterilizing agent has been applied and left standing for 24 hours, test for residual chlorine at ends of lines. If test indicates there is less than 25 ppm, repeat sterilizing process.
   c. After system has been standing 24 hours and test indicates at least 25 ppm of residual chlorine, flush out system until all traces of chemical used are removed.
3. Have local health department check and approve system before connecting it to existing water system.
4. If the domestic water system is sterilized more than 24 days prior to the owner/user taking beneficial occupancy, the entire water system shall be re-sterilized so that it is tested clean as noted above at the time of occupancy.
   a. All piping, dead legs, safety showers, eyewashes, and faucets shall be opened and thoroughly flushed for at least 15 minutes prior to re-sterilization.
5. The domestic water system shall be tested for the presence of Legionella by a third party testing laboratory certified and experienced in Legionella testing prior to the owner taking occupancy. The location and results of testing must be documented and presented to the owner.
6. If only a portion of the domestic water system was opened for repair or other construction such that the system was subjected to water pressure changes or stagnation, the system or portions thereof shall be thoroughly flushed and sterilized by high temperature flushing or chlorination as appropriate. High temperature flushing shall be performed for at least 5 minutes and at temperatures as recommended by the CDC.

3.09 TESTING PLUMBING SYSTEMS

A. Test all systems and equipment installed to demonstrate proper operation.

B. Advise the Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

C. Correct and retest work found defective or leaking when tested.

D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.

E. Domestic Water Piping: Test hot and cold water piping systems upon completion of rough-in, before fixtures are connected, at a hydrostatic pressure of 125 psig or 150% of working pressure whichever is greater for a period of two hours.

F. Natural Gas Piping: Test piping with air, CO2, or nitrogen at 100 psi pressure for two hours without leaking.

G. Flush Valves: Test all flush valves for proper operation.

H. Bed Pan Washers: Test all bed pan washers for proper operation.

I. Drainage and vent system

1. Test plug opening(s) to permit system to be filled with water, and subject system to a 10 foot head of water pressure. System shall hold water for 30 minutes without a drop in water level in a 4 inch diameter standpipe, and without visible leakage.
2. If system is tested in sections, a minimum head of 10 feet shall apply.

J. All plumbing equipment and systems must be balanced by a certified third party as noted in Division 23 Testing and Balancing requirements.

K. Records of Testing: Maintain records of system testing and results thereof. Deliver results as part of the project closing file and on an intermediate basis as requested by the Architect.

3.10 INFECTION CONTROL REQUIREMENTS

A. Coordinate with the Owner the exact requirements for the infection control measures to be executed and performed during the course of this Project.

B. Prior to execution, present to the Owner for approval a written execution plan for each infection control measure.

C. Coordinate infection control measures as needed with all other trades and disciplines.

D. Provide documentation of infection control measures to the Owner, as required and specified in the ICRA.

END OF SECTION

SECTION 22 05 23 VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Valves for plumbing systems.

1.02 RELATED REQUIREMENTS

A. Section 22 11 16 - Domestic Water Piping

1.03 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01. Valves used or indicated to be used in domestic potable water systems must be lead free in accordance with the Reduction of Lead in Drinking Water Act effective January 4, 2014.

1.04 QUALITY ASSURANCE

A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.

1. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

B. Valve bodies, shells, and seats: Factory tested.

C. Bronze body valves:

1. Materials for pressure containing parts: ASTM B-62 (less than 200 psi), B-61 (200 psi and above)
2. Design, workmanship, testing: MSS-SP-80

D. Valve stems: ASTM B584-78, Class 13C (cast silicon brass), ASTM B-371-79, Alloy A (rolled silicon brass), or other material equally resistant to dezincification.

E. Pressure castings: Free of impregnating materials.

F. Valve name or trademark and working pressure stamped or cast into body.

G. Standard for 200 PSI and 300 PSI valves with metallic seats: ASTM B61-76.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bronze body valves: Nibco, Apollo, Stockham, Milwaukee, Dezurik or Kennedy

B. Ball valves: Nibco, Apollo, Watts, Milwaukee, Jamesbury or Hammond

2.02 MATERIALS

A. Nibco Figure numbers are indicated below unless noted otherwise:

B. Check Valves:

1. Domestic Water:
   a. 2 inches and less, Figure T-413-Y-LF, or S-413-Y-LF, threaded or solder, Lead Free silicone bronze body, Class 150, PTFE seat

C. Ball Valves

1. Domestic Water
   a. 2" and less, Figure T585-80-LF or S-585-80-LF, 2-piece, full port, 600 psi WOG, PTFE packing seal and seat ring, lead free silicone bronze alloy body and ball.
2. Provide ball valves with locking handles.
3. Provide extended lever for insulated service.

D. Valve connections: Two inches and smaller - threaded; 2-1/2 inches and larger - flanged.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish and install valves in each piping connection at each piece of plumbing equipment to allow equipment to be isolated from piping systems.

B. Furnish and install valves above each group of plumbing fixtures.

C. Install valves in water piping systems so ordinary maintenance work can be performed on the equipment that the valves isolate, without having to drain the system beyond the valve.

D. Locate valves so as to be easily accessible by maintenance personnel.

E. All plumbing systems including pumps, domestic water piping and valve settings and hot water recirculation systems must be tested and balanced. Coordinate with Section 23 05 93 for test and balance requirements.

END OF SECTION

SECTION 22 05 29 HANGERS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hangers for plumbing piping

1.02 RELATED REQUIREMENTS

A. Section 22 11 16 - Domestic Water Piping

B. Section 22 13 16 - Storm And Sanitary Waste And Vent Piping

C. Section 22 07 00 - Plumbing Insulation

1.03 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Anvil, Carpenter and Patterson, Fee and Mason, B-Line, Viking, Reliable, and Michigan. Anvil model numbers are used for reference.

2.02 HANGERS

A. Anvil Figure #260 MSS Type 1, clevis hangers for:

1. Non-insulated steel and galvanized piping 2 inches through 24 inches diameter
2. Non-insulated cast iron pipe

B. Anvil Figure #260 clevis hangers with Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption.

1. Domestic hot water piping above 160 degrees F. 4" diameter and less
2. All other insulated piping

C. Anvil Figure CT-69, MSS Type 10 with adjustable wrought tubing ring hanger, copper plated for:

1. Non-insulated copper tubing with no longitudinal movement
2. Isolation of copper tubing from dissimilar material shall also be accomplished through the use of PHD Manufacturing, Model Numbers 2501 - 2514 Unistrut clamps with PVC inserts or PHD model number 143 PVC coated swivel ring hangers.

D. Anvil Powerstrut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with trapeze hangers. Provide blocking as required to run pipe insulation continuous across hanger.

E. Water piping supports within walls to be by Caddy, Holdrite, Sioux Chief or approved equivalent. Support vertical drops and piping at fixture supplies in wall. Hanger material to be suitable for piping material installed. Piping supports shall be installed per manufacturer’s recommendations.

2.03 HANGER RODS

A. Provide mild steel all-thread rods with maximum loads as follows:

1. 3/8 inch - 300 lbs
2. 1/2 inch - 600 lbs
3. 5/8 inch - 1,200 lbs
4. 3/4 inch - 2,000 lbs
5. 1 inch - 5,000 lbs

2.04 CLAMPS

A. C-Clamps: Anvil Figure #92, MSS Type 23.

1. Use these for attaching hangers to steel beams. Do not weld hanger rods to structural steel members.

B. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30: Use these for attaching hangers to bar joists. Attach clamps to top chord of bar joists only. Confirm with structural engineer for maximum loading and restrictions.

PART 3 - EXECUTION

3.01 PIPE HANGERS

A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight or stresses from vibration and swaying of pipe. Support pipe risers at regular intervals in pipe shafts at least once at each floor level or a maximum of 12'-0" apart. Do not use perforated metal, strap iron, or band iron. Do not make offsets in hangers.

B. Maximum allowable spacing of pipe hangers is listed below. Space hangers and brackets at closer intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging or swaying of pipe.

C. STEEL - Vapor

1. 1/4 inch to 1-1/2cinch - 8'- 0" on center.
2. 2 inches to 2-1/2 inches - 13'- 0" on center.
3. 3 inches and above - 15'- 0" on center.

D. COPPER PIPE - Water

1. 1/4 inch to 1-1/4 inch - 5'-0" on center.
2. 2 inches to 2-1/2 inches - 8'-0" on center.
3. 3 inches and above - 10'-0" on center.

E. CAST IRON PIPE

1. Space hangers not to exceed 5 feet on centers. Provide minimum of two hangers per section within 18" of joint on barrel and at change of direction and branch connection. Install hanger and supports per CISPI 301-12.

F. SWAY BRACING

1. Provide sway bracing and additional supports to meet the seismic bracing requirements. See Section 22 05 48 for additional requirements.

END OF SECTION

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

D. Installation of all tags, markers and identification for plumbing piping and equipment.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Identification painting.

B. Section 22 07 00 - Plumbing Insulation.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.04 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Water Heaters: Nameplates.

B. Control Panels: Nameplates.

C. Domestic Water Piping: Pipe markers.

D. Storm, Waste and Vent Piping: Pipe Markers

E. Other Plumbing Piping: Pipe Markers

F. Small-sized Equipment: Tags.

G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Acceptable Manufacturers:

1. Kolbi Pipe Marker Co.; Model _____: www.kolbipipemarkers.com.
2. Seton Identification Products; Model _____: www.seton.com.
3. 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.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Plastic: Conform to ASTM D709.

2.03 TAGS

A. Acceptable Manufacturers:

1. Advanced Graphic Engraving; www.advancedgraphicengraving.com.
2. Brady Corporation; www.bradycorp.com.
3. Kolbi Pipe Marker Co.; www.kolbipipemarkers.com.
4. Seton Identification Products; www.seton.com.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame. Also provide an Xcel spread sheet of all valves, with location and tag number to owner.

2.04 PIPE MARKERS

A. Acceptable Manufacturers:
1. Brady Corporation; www.bradycorp.com.
2. Kolbi Pipe Marker Co.; www.kolbipipemarkers.com.
3. MIFAB, Inc.; www.mifab.com.
4. Seton Identification Products; www.seton.com.

B. Colors and lettering: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Color code as follows:

1. Potable hot and cold water, Other make-up Water: Green with white letters.
2. Sanitary waste and vent: Green with white letters.

2.05 CEILING TACKS

A. Acceptable Manufacturers:

1. Craftmark; www.craftmarkid.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
1. Plumbing Equipment: Yellow.
2. Plumbing Valves: Green.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

C. Piping requiring insulation shall be insulated prior to pipe identification being installed.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions. Install markers at least once in every room and at no more than 20 foot intervals.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Use tags or pipe markers on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs, at least once in every room and including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install equipment with plastic nameplates.

H. Locate ceiling tacks to locate valves or equipment above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Insulation of plumbing piping

B. Insulation of plumbing equipment

1.02 RELATED REQUIREMENTS

A. Section 23 07 00 - HVAC Insulation

1.03 DEFINITIONS

A. Exposed - Equipment and piping in areas which will be visible without removing ceilings or opening access panels.

B. Concealed - Installed above ceiling, in walls or chases.

C. Outdoors - Exposed to the weather or ambient conditions.

D. Underground - Buried.

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation procedures for review in accordance with the requirements of Division 01.

1.05 QUALITY ASSURANCE

A. Insulation, adhesives, coatings, sealers, jackets and tapes shall have a flame spread rating of 25 or less and smoke development of 50 or less in accordance with ASTM E-84 and UL 723.

B. Materials shall meet the requirements of NFPA 90A.

C. Manufacturer qualifications: ISO 9001-2000 Certified specializing in manufacturing the products specified in this section.

D. Applicator qualifications: Company specializing in the installation of the specified products and the work required to install the products with not less than 5 years experience.

PART 2 - PRODUCTS

2.01 PIPE AND EQUIPMENT INSULATION

A. Materials for Pipe and Equipment: Provide factory premolded insulation for pipe, pipe fittings, and valves.

B. Fitting insulation: Same thickness and material as adjoining pipe insulation.

C. Flexible Tubular Elastomeric:

1. Provide fire-retardant closed-cell slip-on flexible type; with a "K" value of 0.245 BTU-in/hr-ft2-degree F at 75 degrees F.
2. Acceptable manufacturers: Armacell AP Armaflex; K-Flex USA Insul-Tube; Aeroflex Aerocell.
3. Use on the following services:
   a. Moisture condensate drains - 1/2" thick
   b. Drain bodies, traps and horizontal drain lines recieving cold condensate – 1/2 inch thick

D. Fiberglass Pipe Insulation:

1. Acceptable manufacturers: Johns-Manville "Micro-Lok 850"; CertainTeed; Knauf; Owens Corning, Foster. Jacket: ASJ fiberglass reinforced kraft paper with aluminum foil; minimum R value of 3.7.
2. Use on the following services:
   a. Domestic hot water supply piping (105 to 140 degrees F) - 1-1/4 inch and smaller—1 inch thick; 1-1/2 inch and larger--1-1/2 inch thick.
   b. Domestic cold water piping indoors – 1/2 inch thick

E. Fiberglass Equipment insulation:

1. Acceptable Manufacturers: Johns-Manville; Certainteed; Knauf; Owens Corning, Foster.
2. Apply to equipment as directed by the manufacturer.
3. Install rigid or flexible insulation, 2 inches minimum thickness with 'K' value of 0.27 at 75 degrees F with a maximum service temperature of 850 degrees F. (1200 degrees F for engine exhaust insulation).
4. Provide vapor barrier as required when the liquid temperature is below 65 degrees F.

2.02 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

A. For all services, use premolded insulation for pipe fittings, elbows, tees, butterfly valves, and couplings. Finish shall be as specified under Products above or as specified below. fitings and elbows shall be finished with glass cloth wrap and coated with mastic. PVC fitting covers with full thickness fiberglass inserts may NOT be used on piping fittings elbows and valves 2 inches and less.

B. For piping installed above grade exposed-to-the-weather outside the building, cover straight pipe insulation with 0.016 inch thick aluminum jacket equivalent to Childers and cover fittings with factory formed covers equivalent to Elljacs.

C. Elastomeric adhesives and finishing:

1. Adhesive shall be the insulation manufacturer's reccommended contact adhesive, Armaflex 520, Armaflex 520BLV or equivalent.
2. Insulation finish shall be the insulation manufacturer's recommended finish--WB Armaflex finish and shall be paintable.
3. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and not detract from any of the system reatings as specified.
4. Where exposed to view inside buildings, the painted finish color shall be as selected by the Architect.

2.03 JACKETS

A. Canvas Jacket: UL listed 6oz/sq. yd. plain weave cotton fabric treated with dilute fire retardant lagging adhesive compatible with insulation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Deliver and store insulation materials in manufacturer's containers and keep free from dirt, water, chemical and mechanical damage.

B. Complete piping pressure testing prior to applying insulation.

C. Apply insulation in workmanlike manner by experienced and qualified workmen.

D. Surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.

E. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.

3.02 FLEXIBLE SHEET ELASTOMERIC INSULATION

A. Prior to application of flexible sheet elastomeric insulation, thoroughly clean all metal surfaces, making sure that all dirt, scale, loose paint, plaster, and oil has been removed and that surfaces are dry. If surface has been primed, test a two square foot section using adhesive equivalent to Armaflex 520 in order to determine whether solvent in adhesive will loosen or lift the primer. If primer is loosened, then remove it. When testing proves acceptable, adhere insulation with smooth side out, using thin but adequate coating of same adhesive. Follow manufacturer's instructions. Coat all butt edges of each sheet. Stagger all joints. Insulate all standing seams or flanges with same thickness of insulation material as that used on main surface.

3.03 INSTALLATION OF PIPE AND EQUIPMENT COVERING

A. Where glass fiber or flexible tubular elastomeric insulation is used on piping sized 2 inches and larger, insert a section of foamglass or calcium silicate insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Where insulation passes through pipe hangers and across trapeze supports, 12 inches long metal saddles shall be used. Insulation thickness to be same as adjoining glass fiber insulation. On cold pipe, vapor barrier should be carried through the hanger and sealed. Saddles shall be used where rigid foamglass inserts are not acceptable.

B. 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.

C. Install equipment insulation in accordance with manufacturer's requirements and OSHA requirements.

D. Apply foamglass insulation as follows:

1. Both the circumferential and longitudinal joints shall be buttered with fire-resistive pliable sealer. Voids and cracks shall be filled with sealer. Apply appropriate mastic as specified under Part 2 - Products. Secure insulation with 3/4" wide x 0.010 inch thick aluminum bands on 8 inch centers.
2. The circumferential joints shall be staggered.
3. Fittings, valves, flanges, traps, and air vents shall be insulated with the same thickness of insulation using factory fabricated fitting sections or pre-molded insulated fittings.
4. Block type insulation shall be adhered by stick-clips or bands, in addition to the sealer, as required to provide support for the insulation.
5. Finish shall be White ASJ jacket.

END OF SECTION

SECTION 22 08 00 COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to Division 22.

B. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. The Commissioning Authority directs and coordinates the day-to-day commissioning activities as well as the overall commissioning process. The start-up, testing, support for commissioning, and demonstration of the equipment and systems operation to be in accordance with the contract documents is the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions or work in a satisfactory and fully operations manner.

C. Work of Division 22 includes:

1. Testing and start-up of the plumbing equipment, with special emphasis on the domestic hot water system.
2. Assistance in functional testing to verify equipment/system performance.
3. Providing qualified personnel to assist in commissioning tests, including seasonal testing.
4. Completion and endorsement of Pre-functional Construction Checklists provided by the Commissioning Authority to assure that Division 22 equipment and systems are fully operations and ready for functional testing.
5. Providing equipment, materials and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
6. Providing operation and maintenance information and as-built drawings to the Commissioning Authority for review prior to distribution.
7. Providing assistance to the Commissioning Authority to develop, edit and document system operation descriptions.
8. Providing training for the systems specified in this Division.

1.02 SUBMITTALS

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" Designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Equipment and System Submittals to include, at minimum, the following:
    a. Manufacturer's printed Installation Instruction sheets for all system components & devices
    b. Performance data
    c. Manufacturer's pre-startup checklists
    d. Manufacturer's start-up checklists
    e. Cut Sheets

2. Shop drawings (including any resubmittals required by the A/E)
3. Piping - Supply one copy of all of the hydrostatic pressure test results.
4. Initial Pre-startup and start-up plan
5. Completed Prefunctional checklists
6. Operational and maintenance documentation

7. Training plan and training materials
8. As-built documentation.

1.03 RELATED WORK

A. All installation, testing and start-up procedures and documentation requirements specified within Division 22.

B. Section 01 91 00 COMMISSIONING.

C. Commissioning Functional Test Procedures that required participation of the Division 22 Contractors.

D. Cooperate with the Commissioning Authority in the following manner:

1. All testing and start-up procedures and documentation requirements specified within Division 1 and Division 22 and related portions of this project.
2. Allow sufficient time before final completion dates so mechanical systems start-up, test and balance, and commissioning can be accomplished.
3. Provide labor and material to make corrections when required without undue delay.
4. Put all plumbing equipment into full operation and continue the operation of the same during each working day of the testing, balancing and commissioning.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Standard test equipment for commissioning will be provided by the Contractor.

B. Division 22 Contractor shall provide standard and specialized test equipment as necessary to test and start up the plumbing systems.

C. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use and assist the Commissioning Authority in the commissioning process.

D. The contractor shall provide all equipment, software and all tests programming support as necessary to start up, calibrate, debug and verify proper function of the control/facility management system. This equipment and software shall be provided for use by both the test and balance contractor and Commissioning Authority.

PART 3 - EXECUTION

3.01 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so the systems can be energized, started, tested and otherwise commissioned. Division 22 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are functional. This includes the complete installation of all equipment materials, raceways, wire, terminations, controls, etc., per the Contract Documents and related directives, clarifications, change orders, etc.

B. A commissioning Plan will be developed by the Commissioning Authority. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor-initiated system changes have been made that alter the commissioning process, the Commissioning Authority will notify the Architect and the Contractor may be obligated to compensate the Commissioning Authority to test the revised product or confirm the suitability/unsuitability of the substitution or revision.

C. Specific pre-commissioning responsibilities of Division 22 are as follows:

1. Normal start-up services required bringing each system into a fully operational state. This includes motor rotational check cleaning, lug tightening, control sequences of operation, etc. The Commissioning Authority will not begin the commissioning process until each system is complete, including normal contractor start-up and debugging.
2. The Contractor shall perform pre-functional construction checklists on the systems to be commissioned to verify that all aspects of the work are complete in compliance with the plans and Specifications. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
3. Provide written notification to the Contracting Officer and Commissioning Authority when systems are ready for functional testing a minimum of seven (7) days prior to start of testing.

D. Commissioning is to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is approved by the Contracting Officer. Commissioning activities and schedule will be coordinated with the Contractor. Start of Commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

3.02 PARTICIPATION IN COMMISSIONING

A. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. Provide skilled technicians to start up and debug all systems within this division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, times required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments and/or problem resolutions.

B. System problems and discrepancies may require additional technician time, Commissioning Authority time, redesign and/or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item or equipment, system and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representative does not constitute the availability of a qualified technician for purpose of this work.

3.03 WORK TO RESOLVE DEFICIENCIES

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under direction of the architect, with input from the Contractor and Contracting Officer, equipment supplier and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate and work out problems, the Architect/ Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance.

3.04 ADDITIONAL COMMISSIOING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers and Commissioning Authority shall include a reasonable reserve to complete this work as part of the standard contractual obligations.

B. The cost of compensation of the Commissioning Authority for repeat testing or troubleshooting due to systems that do not meet specified performance shall be borne by the Contractor.

C. Corrective work shall be completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely to the commissioning process, the Commissioning Authority will notify the Contracting Officer indicating the nature of the problem, expected stems to be taken and the deadline for completion of activities. If the deadline passes without resolution of the problem, the Government reserves the right to supplementary services and equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor’s responsibility.

3.05 SYSTEMS TO BE COMMISSIONED

A. Domestic hot water heaters, including the water to water heat pump system.

B. Recirculation pumps

3.06 TRAINING

A. Per the specifications, the Contractor will be required to participate in the training of the Government’s operation and maintenance staff for each system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom aids, or in the field with the specific equipment. The type of training will be per the Government’s option. Refer Section 01 79 00 Demonstration and Training, Section 01 91 00 General Commissioning and Division 22 for additional requirements.

END OF SECTION

SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping and pipe fittings for domestic cold, hot and recirculating water piping.

1.02 RELATED REQUIREMENTS

A. Section 22 05 00 - Common Work Results For Plumbing

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment

C. Section 22 11 19 - Domestic Water Piping Specialties

1.03 SUBMITTALS

A. Submit product data for review on piping and fittings in accordance with the requirements of Division 01. Submittal data shall include:

1. Manufacturer of pipe.
2. Tests or listings by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
3. Product data for pipe and fittings to be used on each piping system.
4. Solder and brazing product data and installation procedures for copper pipe.
5. Pressed pipe and fitting installation methods and instructions for copper pipe.

1.04 QUALITY ASSURANCE

A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.

B. NSF Compliance: NSF/ANSI 61, NSF 61-G and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

C. Identify pipe with marking including size, ASTM material classification and specification and water pressure rating.

D. Compliance with ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

E. Compliance with ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of the completed system.

1.06 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 COPPER PIPE

A. Conform to ASTM B-88 specification for wrought seamless copper.

B. Type L, hard for:

1. Domestic cold water piping
2. Domestic hot water

C. Use Type K, rolled, soft for: Piping installed under floor slabs.

2.02 COPPER PIPE FITTINGS

A. Sweat type, wrought copper, ASTM B62, with dimensions conforming to ANSI B16.22 and sweep patterns for copper tubing.

B. Dielectric Connections:

1. Provide at junction of copper pipe and equipment with steel piping systems within the temperature limitations of the product.
2. Dielectric insulating flange connections, as manufactured by CTS Fabrication USA, or George Fischer Central Plastics, (1-1/2 inch thru 8 inches). Provide bolt insulating sleeves and washers as required.
   a. Flanges shall be drilled to ASME B16.5, 150 Standard, powder coated with an EPDM insulator adhered to the plate steel protruding inside to prevent contact with the coppper companion flange adapter. The copper component of the flange adapter shall be manufactured to ASME B16.22.
3. Provide Watts LF3001A series Lead Free dielectric unions, 1/2 inch through 1-1/4 inch and shall consist of a union nut, two tailpieces and an insulating gasket that separates the tailpieces to prevent an electric current from occurring between the dissimilar materials.
4. Brass fittings and valves shall not be used for dielectric union locations.

C. Unions: Brass ground joint, 250 lb. working pressure.

D. Nipples: Brass.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean inside of pipe before installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.

B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment, or to electrical equipment.

C. Run pipes in straight lines and square with building. Install risers plumb. Make offsets only where indicated and where necessary.

D. Install branch connections using separate tee or lateral fittings for each branch. Do not combine branches into "bullhead tee" arrangement.

E. Do not install water pipes in electric rooms, tele/data rooms, transformer rooms, audio/visual rooms or elevator equipment rooms.

F. Do not install piping above electrical equipment such as starters, variable frequency motor controllers, motor control centers, or disconnects. Maintain code required clearance above, below and to sides of electrical equipment.

G. Provide flanges or unions throughout the pipe systems at all equipment. Make provisions for servicing and removal of equipment without dismantling piping.

H. Piping Expansion:

1. Install piping to allow thermal expansion and contraction without injury to piping, equipment or structure.
   a. Use loops or expansion joints where necessary and where detailed. See Section 22 05 48.
   b. Provide pipe guides

I. Branch Lines:

1. Where possible branch lines shall come off top of mains to prevent sediment, welding slag, or pipe deburrs from entering the branch lines and causing valve leakage or failure.

J. Identify piping and systems in accordance with Section 22 05 53.

3.02 PIPE JOINTING

A. Preparing Pipe Ends:

1. Machine cut pipe ends square
2. Ream pipe ends, after cutting, to full diameter

B. Soldered and Brazed Joints:

1. Make Type L copper pipe joints with suitable flux and 95/5, lead free solder.
2. Make Type K copper pipe joints with silver (BAg series) brazing filler material with flux or copper-phos (BCuP series) brazing filler material without flux per the recommendations of the Copper Development Association.
3. Domestic cold and hot water piping 4 inches and larger shall be brazed. Copper to copper joints shall be brazed using a copper-phosphorus or copper-phosphorus-silver brazing filler metal (BCuP Series) without flux. Dissimilar metals such as copper and bronze or brass shall be brazed using an appropriate flux with a silver (BAg Series) brazing filler metal.
    a. In lieu of brazing, domestic cold and hot water piping 4 inches and larger may be joined with rolled grooved copper fittings and valves by Victaulic or Anvil, copper pipe grooved systems.

C. Bracing Joints:

1. Provide braces and bridle rods as required to reinforce joints.
2. If mechanical couplings are used, then prepare pipe ends and make joints in accordance with pipe coupling manufacturer's printed instructions.
3. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings, and changes of pipe direction. Provide "kicker" blocks in accordance with applicable pipe industry trade or research organization recommendations.
    a. For example, for ductile iron pipe follow recommendations of Ductile Iron Pipe Research Association.

3.03 ESCUTCHEONS

A. Provide chrome plated escutcheons where uninsulated pipes penetrate walls or ceilings of finished spaces.

3.04 STRAINERS

A. Install strainers so the strainer basket can be removed without spilling water on motors and electrical equipment.

3.05 AIR VENTING

A. Provide manually operated air vents at high points in vertical risers to eliminate air from systems.

B. Use ball valves for manual air vents.

3.06 VALVE ACCESS

A. Locate ceiling/wall access panels at shut-off and control valves for proper access and operation. Furnish and install access doors in accordance with Section 22 05 00 and other Divisions as applicable.

3.07 TESTING

A. Before piping is concealed or insulated, recheck it for leaks.

B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking, and doping are not permitted.

END OF SECTION

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes requirements for:

1. Shock arrestors.
2. Domestic water service connection.
3. Thermometers and pressure gauges.
4. Domestic Water expansion tank

1.02 RELATED REQUIREMENTS

A. Section 22 05 00 - Common Work Results For Plumbing

B. Section 22 05 23 - Valves For Plumbing Piping

C. Section 22 07 00 - Plumbing Insulation

1.03 QUALITY ASSURANCE

A. Lead Free: All wetted surface of pipe, fittings and fixtures in potable water systems shall have a weighted average lead content equal to or less than 0.25% per the Safe Drinking Water Act (Section 1417) as amended January 4, 2011.

B. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3rd Party Certified.

1.04 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are indicated in subsequent paragraphs.

2.02 SHOCK ARRESTORS

A. Acceptable manufacturers:

1. Josam
2. Wade
3. Jay R. Smith
4. Precision Products
5. Zurn
6. Sioux Chief

B. Arrestor shall be piston type, polycarbonate with two EPDM O-rings, lubricated with FDA-approved Dow Corning #111 silicone compound in Type L or K copper body, suitable for 200 psig minimum pressure at 200 degrees F.

C. Arrestor shall be ANSI/ASSE 1010 Certified and be maintenance free with no access panel required.

2.03 THERMOMETERS AND PRESSURE GAUGES

A. Acceptable manufacturers: Trerice, Winters, Dwyer or approved equal.

B. Thermometers shall have a 9" aluminum case with 3.5" or 6" stem, fully adjustable, organic filled (non-mercury), +/- 1% accuracy, lead free brass or stainless steel thermowell, dual scale, 30 degrees F to 200 degrees F range.

C. Pressure gauges shall have a 4" white aluminum dial with type 304 SS case, lead free brass socket, glycerin filled with accuracy of +/- 1.5 % of full scale to 150 degrees F; dry type to 200 degrees F. Install with lead free gauge cock.

2.04 DOMESTIC WATER SERVICE CONNECTION

A. Provide tapping sleeve and valves for connection to existing water mains.

B. Provide domestic water meters, gate valves, check valves, bypass feature, and meter pit per local utility company requirements and standards.

2.05 DOMESTIC WATER EXPANSION TANK

A. Acceptable Manufacturers:

1. Amtrol Inc. - THERM-X-TROL
2. Bell and Gossett Series PT
3. Taco PAX Series

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1; rated for working pressure of 150 psig at 200 degrees F; stainless steel connectors; polypropylene liner; flexible FDA approved butyl/EPDM diaphragm or butyl bladder sealed into the tank; with steel legs, stand or saddles. Tank shall meet the requirements of NSF 61 for Lead Free construction and use. Designed for use in potable water systems.

C. Accessories: Pressure gauge, air charging fitting and tank drain fitting. Pre-charge to 40 psig.

D. Capacity: As noted on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION AND TESTING

A. Shock Arrestors:

1. Install shock arrestors at each quick closing valve, solenoid type valve, and flush valve. Size shock arrestors in accordance with manufacturer's instructions.
2. Install shock arrestors within five feet of valve, provide wall access panel as required.
3. Test and certify shock arrestors by Plumbing and Drainage Institute in accordance with ANSI/ASSE 1010.

B. Domestic Water Service Connection:

1. Arrange and coordinate with local utility company for service connection, meter type and manufacturer, fees, permits, etc.
2. Field verify exact location, size, pressure, and elevation of existing water main.
3. Flush system and test at 200 PSI for 24 hours without any leaks.

C. Expansion tanks:

1. Install in locations shown on the drawings and in accordance with the details and manufacturer's requirements.

END OF SECTION

SECTION 22 11 20 FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Natural gas piping

B. Natural gas valves

C. Natural gas pressure regulators

1.02 RELATED REQUIREMENTS

A. Section 22 05 00 - Common Work Results for Plumbing

B. Section 22 05 29 - Hangers for Plumbing Piping

1.03 REFERENCE STANDARDS

A. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

B. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2011 (ANSI/ASME B31.9).

C. NFPA 54 / ANSI Z223.1 - National Fuel Gas Code; National Fire Protection Association; 2015.

1.04 SUBMITTALS

A. Submit product data for review in accordance with the provisions of Division 01 for piping, fittings, valves, and coatings. Submittal data shall include but not be limited to:

1. Manufacturer of pipe.
2. Tests or listing by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
3. Product data for piping, fittings, valves and coatings.
4. Welding procedures for steel pipe.
5. Heat fusion jointing methods.

1.05 QUALITY ASSURANCE

A. Material standards: Applicable ASTM standards for material requirements.

B. Dimensional standard: ANSI B36.10, latest edition.

C. Screw threads: American Pipe Thread Standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Pipe: Schedule 40 black steel ASTM A 53 seamless or continuous weld.

1. Use exposed above ground or within buildings.
2. Use underground with exterior coating as specified herein.

B. Medium-Density Polyethylene (MDPE) Yellow Gas Pipe

1. Acceptable manufacturer: JM Eagle or equal.
2. Sizes: 1/2" through 12"
3. Compliance: meets ASTM D2513, Standard for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
4. Jointing method: Heat fusion jointing by socket fusion or butt fusion.

5. Weather resistance: Provide pipe with UV stabilizer to protect from UV degradation when exposed to direct sunlight for a minimum of 3 years.
6. Use for underground natural gas service only.

C. Fittings:

1. Welded fittings: Factory made fittings, full line size for all branches, elbow, or tee. Use reducers after fittings if dictated by branch pipe size.
2. Screw fittings: Grinnell or approved equal, Class 150, malleable iron.
   a. Joint compound: LACO, Rector-Seal, or WKM Key-Tite.

D. Valves:

1. 2 inches and smaller: AGA or UL approved
2. Provide valves with handle
3. Valves shall be acceptable to local authorities

E. Exterior coating: Republic Steel Corporation's X-Tru-Coat high density polyethylene extruded coating.

F. Lubricated Plug Cocks:

1. For valves 2 inches and less, iron body, threaded, Nordstrom Figure No. 114.
2. Provide visual position indicators on all plug cocks.
3. All valves shall be AGA approved for natural gas service.

G. Valve Connections: Two inches and smaller - threaded; 2-1/2 inches and larger - flanged.

H. Strainers:

1. Acceptable Manufacturers: Armstrong International; Green Country Filter Manufacturing; WEAMCO.
2. Sizes 2 inches and smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
3. Sizes 2-1/2 inches and larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

I. Gas Pressure Regulator Valves:

1. Gas pressure regulator valves shall meet ANSI Z21.80a, CSA 6.22a-2005 as manufacturered by Pietro Fiorentini, Fisher, Maxitrol, or approved equal.
2. Gas regulators for use in systems at 5 psi and 2 psi shall be provided with an AGA approved automatic vent limiting device for indoor use only.
3. All pressure regulators installed in systems that operate above 5 psi shall have a vent piped in accordance with Government and local codes and regulations to the exterior of the building. Provide vent protectors for outdoor applications to protect vents from foreign particles, insects, dust, rain or snow.
4. See drawings, installation section and schedules for location and sizes of gas pressure regulator valves and vent routing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Screwed fittings:

1. May be used in lieu of welded joints for sizes 4 inches and smaller when pressure is 5 psi or less.
2. Install screwed joints to be accessible for repair.
3. Do not install screwed fittings in furred ceilings or chases.

B. Provide a gas valve at each piece of equipment and where indicated and where indicated on drawings.

C. Pipe vents from each natural gas pressure regulator independently to the exterior of the building. Vent sizes shall be connection size and as recommended by the regulator and equipment manufacturer.

D. Underground gas piping shall be of the same metals and meet the same working pressure requirements specified herein, except that it shall be coated and protected as follows:

1. Coat exterior surface of underground gas pipe with high density polyethylene extruded coating.
2. The protective coating shall be factory applied with a fluid mastic undercoat. The polyethylene coating shall be minimum of 0.040 inches thick.
3. Field welds, joints and fittings shall be protected with mastic undercoat and by wrapping with at least two (2) layers (half lap) of “X-Tru-Tape” installed as recommended by the manufacturer or with Raychem “Thermofit” heat shrinkable pipe sleeves applied as recommended by the manufacturer.

E. Concealed piping: Where indicated on drawings or when required by local code authorities, provide an A-53 Schedule 10 black steel pipe sleeve to completely enclose the gas pipe through all chases and concealed areas of the building . Vent sleeve to atmosphere at the top of the building.

F. Underground piping: Before backfilling, electrically test all underground piping, fittings, joints and valves for location of possible defects in the protective coating. Cover breaks in the coating with The Tapecoat Company, Inc., “Tapecoat SP” or equal. Apply Tapecoat in accordance with manufacturer's instructions.

G. Underground MDPE piping shall be properly and continuously bedded and installed in accordance with the manufacturer's written installation instructions. Piping shall be allowed to contract while cooliing prior to backfill.

1. Provide pipe locater tracer wire a minimum of 12" above the piping during backfill so pipe can be properly located after installation.
2. All piping and joints shall be tested for a leak free installation prior to covering or backfill.

END OF SECTION

SECTION 22 13 16 STORM AND SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste and vent piping

B. Storm water piping

C. AC unit condensate drain piping

1.02 RELATED REQUIREMENTS

A. Section 22 05 00 - Common Work Results For Plumbing

B. Section 22 05 29 - Hangers for Plumbing Piping

C. Section 22 13 19 - Sanitary Waste Piping Specialties

1.03 SUBMITTALS

A. Submit product data for review on piping and fittings in accordance with the requirements of Division 01. Submittal data shall include:

1. Manufacturer of pipe.
2. Tests or listing by recognized testing laboratory that certifies material composition is in accordance with ANSI/ASTM requirements.
3. Product data for pipe and fittings to be used on each piping system.
4. Identification of where each pipe type will be used.

1.04 QUALITY ASSURANCE

A. Identify pipe with marking including size, ASTM material classification and ASTM specification.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of the completed system.

PART 2 - PRODUCTS

2.01 CAST IRON PIPE AND FITTINGS

A. Conform to ASTM A-74, A-888, and CISPI 301-12 and CISPI 310-12.

B. Pipe and fittings shall be marked with the collective trademark of Cast Iron Soil Pipe Institute and be listed by NSF International.

C. Standard weight pipe with drainage fittings for:

1. Sanitary waste, vent, and drainage pipe 2 inches and larger above ground.
2. Building storm drains.
3. Rainwater conductors inside building.
4. Drain lines under buildings, and under exterior concrete or other paving. Extend cast iron piping at least 5 feet outside of building.

D. Joints in Cast Iron Pipe:

1. Below grade: Bell and spigot with neoprene compression gaskets
2. Above grade: No-Hub using stainless couplings. Provide 4-band, heavy duty couplings for piping 2" through 10" and 6-band heavy duty couplings for piping 12 inches and larger. Couplings shall comply with ASTM C 1540/ FM-1680 rated no hub bands for all cast iron piping material above slab-on-grade.

2.02 PVC PIPE AND FITTINGS

A. Polyvinyl chloride sewer pipe and fittings (4" to 15" diameters) shall be as manufactured by Charlotte Pipe and Foundry Company or equal.

B. PVC piping and fittings shall be furnished by the same manufacturer.

C. PVC joint cleaner and solvent cement shall be furnished by the same manufacturer.

D. PVC Schedule 40, Type I, DWV, ASTM D-2665, 1120, 160 PSI at 73 degrees F. Solvent cement shall meet ASTM No. D-2564 for (PVC-DWV) plastic and pipe fittings. If permitted by governing code authority, may be used for:

1. Air handling unit condensate drains above grade only if room is not used as return air plenum.
2. Inside gravity, under floor slab sanitary and storm waste drainage systems, with waste temperatures below 140 degrees F.
3. Condensate drains from rooftop units shall be UV resistant where exposed.

E. PVC schedule 40, Type-PSM, Sewer Pipe, ASTM D-3034 with SDR as gasketed slip type joints. Provide coupling with a rubber ring seal for use in each manhole entry to ensure a surface for adherence of concrete to manhole wall. If permitted by governing code authority, may be used for:

1. Outside gravity, underground sanitary sewer drainage piping, from 5'0" outside the building to the connections point to local municipality.

F. Fittings:

1. Permanently identify each fitting in accordance with MSS-SP-2241, and with manufacturer's trademark.
2. Include certification with submittal data that fittings and flanges meet applicable requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. PVC Joints:

1. Make joints in accordance with cement manufacturer's printed instructions.
2. Where PVC piping is used for storm and sanitary below the building slab on grade, extend the PVC pipe up through floor slab prior to the concrete pour. Connect to cast iron no-hub piping above slab with appropriate no-hub band coupling. No part of the PVC piping above slab shall be left exposed.

B. Cast Iron Pipe Joints:

1. Install compression gaskets and No-Hub bands in accordance with CISPI installation methods and manufacturer's instructions.

C. Grading Pipes for Drainage:

1. Uniformly place storm drainage pipes and footing drain pipes at elevations and slopes indicated. If no elevations or slopes are indicated, slope pipes at not less than 1/8" per foot.
2. Uniformly place sanitary sewer pipes at elevations and slopes required by the local codes

D. Bracing Joints:

1. Provide braces and all-thread bridle rods as required to reinforce storm piping joints 6" and larger at each change of direction within the building and where otherwise not direct buried below ground. Bracing and restraints shall be as detailed using socket clamps and bridle rods secured to the pipe entering and leaving the elbow fitting. HOLDRITE #117 Series No-Hub Fitting Restraints using galvanized straps with heavy-duty galvaized or black iron bolted clamps may be used for no-hub cast iron pipe. Stainless steel band clamps in lieu of bolted clamps are not acceptable.
2. The bracing described above does not remove the requirement for four or six band no-hub couplings required elsewhere in these specifications.
3. If mechanical lock type couplings are used, then prepare pipe ends and make joints in accordance with pipe coupling manufacturer's printed instructions.

E. Clean inside of pipe before installation. Keep installed piping clean, and protect ends from foreign matter by capping or plugging them.

F. Do not install piping above electrical equipment such as starters, variable frequency motor controllers, motor control center's, or disconnects. Maintain code required clearance above, below and to sides of electrical equipment.

G. Do not install piping above or passing through any IT rooms, IDF rooms, or service entrance rooms.

H. Run pipes in straight lines and square with building. Install risers plumb. Make offsets only where indicated and where necessary.

I. Piping passing through or under grade beams or through foundation walls shall be provided with a schedule 40 steel pipe sleeve two sizes greater than the piping passing through the sleeve.

J. Identify all waste and vent piping in accordance with and as specified in Section 22 05 53.

END OF SECTION

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes requirements for:

1. Cleanouts
2. Trap primers
3. Manholes
4. Sanitary sewer service connection

1.02 RELATED REQUIREMENTS

A. Section 22 05 00 - Common Work Results For Plumbing

B. Section 22 11 16 - Domestic Water Piping

C. Section 22 13 16 - Storm And Sanitary Waste And Vent Piping

1.03 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are indicated in subsequent paragraphs.

2.02 CLEANOUTS

A. Acceptable manufacturers:

1. Zurn (Zurn model numbers are used below)
2. Josam
3. Wade
4. Jay R. Smith
5. Sioux Chief
6. Watts

B. Exterior: Z1400Z heavy duty cast iron cleanout housing with internal cleanout body and plug.

C. Finished concrete floor: ZN1400 cast iron body with round adjustable polished nickel bronze top, ABS plug and carpet marker where required.

D. Ceramic tile: ZN1400 Series, cast iron body, polished nickel bronze top, 1/2 inch terrazzo recess and closure plug.

E. Vinyl tile floor: ZN1400-X, cast iron body, round nickel bronze top, 1/8 inch tile recess and closure plug.

F. Carpet: ZN1400-CM. Inside caulk round brass scoriated frame and cover and provide carpet marker.

G. Wall: Z1441, cast iron caulking ferrule with stainless round access cover and screws.

H. Access covers: Minimum size 12 inches by 12 inches located for access to valves, shock absorbers, trap primers, wall cleanouts, etc.

I. Furnish cleanouts occurring in waterproof floors with clamping devices.

2.03 TRAP PRIMERS

A. Acceptable manufacturers:

1. Josam
2. Zurn
3. Wade
4. Jay R. Smith
5. Precision Plumbing Products
6. Sioux Chief

B. Provide trap primer of brass construction, with removable operating parts, and integral vacuum breaker.

C. See Plumbing fixture section for specifications.

2.04 MANHOLES

A. Provide manholes covers as manufactured by Neenah Foundry.

B. Provide frame, cover, steps, concrete, masonry, etc., to construct manholes.

C. Manhole may be pre-constructed reinforced concrete as detailed on drawings.

2.05 SANITARY SEWER SERVICE CONNECTION

A. Provide saddle, cut-in wyes, and/or connection to existing manhole per local utility company standard.

PART 3 - EXECUTION

3.01 INSTALLATION AND TESTING

A. Cleanouts:

1. Provide line size cleanouts up to 4 inches; 4 inch cleanout for lines larger than 4 inches.
2. Locate cleanouts at all changes in direction greater than 45 degrees and in straight runs as shown 100 feet outside the building on drawing or spaced not greater than required by applicable Plumbing Code.
3. Extend inaccessible cleanouts up through floor and/or wall to provide easy accessibility.

B. Trap Primers:

1. Install primers in accessible location or as shown on drawings.
2. Trap primers shall be Plumbing and Drainage Institute approved.

C. Manholes:

1. Install such that frame and cover elevation is 1 inch higher than surrounding grade in non-paved areas.
2. Construct manholes per detail on drawings.

D. Sanitary Sewer Service Connection:

1. Arrange and coordinate with local utility company for service connection, fees, permits, etc.
2. Field verify exact location, size, and elevation of existing sewer.
3. Flush system, fill with water and let stand with a minimum 10 feet of head for 24 hours without any leaks.

END OF SECTION

SECTION 22 34 38 WATER HEATER, GAS FIRED – ATMOSPHERIC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gas Fired, Tankless Water Heater

1.02 RELATED REQUIREMENTS

A. Section 22 07 00 - Plumbing Insulation

B. Section 22 11 16 - Domestic Water Piping

C. Division 26: Electrical

1.03 SUBMITTALS

A. Submit product data for review in accordance with the requirements of Division 01.

B. Product data shall include at a minimum:

1. Water heater
2. Materials of construction
3. Venting requirements
4. Accessories and controls
5. Wiring diagrams

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with a minimum of 10 years of experience.

B. Performance: Ensure the products perform to the requirements, ratings and capacity of the equipment scheduled on the drawings.

C. Energy Efficiency: Units shall meet the energy efficiency requirements of ASHRAE Standard 90.1, latest edition.

D. Water heater shall be Factory tested for proper operation of burner, controls, heat exchanger through connection to water for a factory fire test prior to shipping.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hesco Industries, Inc.

B. AERCO International, Inc.

C. A.O. Smith

D. Lochinvar, LLC

E. State Industries

F. Rheem/Rudd

G. PVI Industries

2.02 TANKLESS CONDENSING WATER HEATER

A. Low NOx emission, SCAQMD Rule 1146.2 Compliant.

B. 10-yr warranty on heat exchanger.

C. Electronic Ignition.

D. Primary heat exchanger of copper or stainless steel.

E. Natural gas fired with aluminized stainless steel burner.

F. PVC or stainless steel venting up to 70 feet equivalent (3") or 100 feet equivalent (4").

G. Safety features:

1. Air-fuel ratio sensor
2. Exhaust & Water temperature safety control
3. Overheat cut-off fuse

H. CSA or UL Listed

I. Factory mounted and tested solid state controller

J. Modulating and proportional gas valves

K. Linkable up to 4 units.

L. Drain and condensate drain connection with trap and neutralizing kit.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish factory or manufacturer's service representative to verify system installation and operation of the burner, all controls and heat exchanger.

B. Verify location and clearance per local code requirements.

C. Install in accordance with manufacturer's recommendations and project contract drawings and details.

D. Vent heater to atmosphere in accordance with drawings.

E. Insulation for water and flue connections shall be in accordance with Section 22 07 00.

F. Clean heater and piping and turn over to owner in clean and proper operating condition.

END OF SECTION

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Compliance with the provisions of Section 22 05 00.

B. Plumbing fixtures, trim and related items such as supplies, traps, drains, cleanouts, water closet flanges, bolts, seats and covers, fixture supports and other accessory items.

C. Coordination of fixture requirements by reviewing architectural, structural, and equipment drawings. Install fixtures in accordance with Contract Drawings and manufacturer's rough-in drawings.

D. Installation of water tempering devices at all public lavatories and similar hand washing fixtures and elsewhere noted on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 22 13 19 - Sanitary Waste Piping Specialties

B. Section 22 11 16 - Domestic Water Piping

C. Section 22 05 23 - Valves for Plumbing Piping

1.03 REFERENCE STANDARDS

A. Perform work in accordance with applicable codes and standards enforced by local authorities.

B. All barrier free fixtures shall be installed in accordance with the Americans with Disabilities Act (ADA) Rules and Regulations.

1.04 SUBMITTALS

A. Submit manufacturer's product data: fixtures; fittings; accessories; and supplies for review in accordance with Division 01 requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with a minimum of five years of documented experience.

B. Products requiring electrical connections must be UL or ETL listed and classified suitable for the purpose specified.

C. All fixtures, faucets, trim and accessories must be protected from damage at all times including after installation to prevent unauthorized use.

D. All wetted surfaces of faucets, mixing valves, isolation vlaves, balancing valves and shower valves in potable water systems must be lead free and ASSE 1070 and NSF 61 Certified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fixtures: Kohler, American Standard, Toto, Gerber, Zurn, Sloan.

B. Fixture stops, supplies, faucets, mixing valves, shock absorbers or any devices in the drinking water supply shall be lead free per the "Safe Drinking Water Act."

C. Brass Trim: McGuire, Engineered Brass Company, Kohler, Cambridge Brass, ProFLo.

D. Carriers: Jay R. Smith, Zurn, Wade, MIFAB.

E. Flush Valves: Sloan Royal, Zurn Z-6000-AV with low force handles for ADA compliance.

F. Toilet Seats: Bemis, Church, Kohler.

G. Faucets: T&S Brass, Delta HDF, Water Saver, Chicago Faucet Company, Kohler, Zurn, Symmons, Moen, Speakman.

H. Stainless Steel Sinks: Elkay, Just, Kohler.

I. Mixing Valves: Leonard, Lawler, Powers, Speakman, Watts, Symmons, Bradley, Apolo.

J. Shower Stall: Aquatic/Lasco, Aqua Bath, Aquarius acrylic units only.

K. Shower Valves, thermostatic and/or pressure balancing type: Symmons, Leonard, Powers, Lawler, Speakman.

L. Flow Control Devices: Dole Flow Controls Company.

M. Pre-fabricated insulation on water lines and p-trap under barrier free lavatories and sinks: Trap Wrap TrueBro, Inc. Handi Lav-Guard; McGuire Pro-Wrap; Plumberex-Handishield; Zurn; and Pro-Flo trap wrap. Materials must meet the 25/50 flame and smoke spread ratings.

N. Shower heads, faucets and flush valves shall meet local and state code requirements for water conservation on low consumption fixtures. Provide integral stop-checks for all shower and tub valves.

O. Provide fixtures and trim as a complete unit as required in the individual "P" numbers listed below.

2.02 MATERIALS

A. Countertop Sinks: Furnished complete with mounting rings where required.

B. Fixture Color: White unless specified otherwise.

C. Faucets and Flush Valves: Provide either integral or attached supply stops with nipples.

D. Provide mixing valves per ASSE or CSA Standards as required by the local adopted code. Mixing valves used in drinking water shall be lead free. Mixing valves shall be used to supply tempered water to public hand-washing facilities and shall conform to ASSE 1070 or CSA B125.3.

E. Clamping Device: Provide for drains installed in slabs above grade.

F. Trap Primer: Provide connections for floor drain as shown on drawings.

G. Caulking: General Electric silicon sanitary sealant or equal. Color to match fixture color.

H. Provide FRT wood or metal backing at wall fixtures and fixture trim connections so piping and connecting faucets and valves are rigid to wall.

I. Provide shower and floor drain water proofing membrane for non-prefabricated shower and floor drains located above slab on grade.

J. Wrist Blade Operation:

1. Pull wrist blade to operator to turn on
2. Push toward backsplash to turn off faucet

K. Showers and tubs shall have non-slip walking surface.

L. All fixtures and fittings relating to drinking water shall meet the requirement of ANSI/NSF 61, Section 9. Any faucet for drinking water shall be certified by U.L. to the ANSI/NSF 61, Section 9 standards.

M. Prefabricated insulation kit for lavatory and sink supplies, trap and drain piping shall be Truebro Model 103 (white) or equal.

2.03 PLUMBING FIXTURES

A. P-1A water closet - (wall hung - public - 1.6 /1.1 GPF)

1. Fixture: Zurn Z5615-BWL white elongated bowl
2. Seat: Zurn Z5956SS-EL with self sustaining check hinge
3. Valve: Zurn Z6000AV-WS1-DF, 1.6/1.1 gallon per flush
4. Carrier: Zurn ZN1203-N4 or ZN1204-N4; provide carriers for minimum wall thickness rated for 500 lbs static load.

B. P-1B water closet (wall hung - flush valve - barrier free - 1.6/1.1 GPF)

1. Fixture: Zurn Z5615-BWL, white elongated bowl
2. Seat: Zurn Z5956SS-EL with self-sustaining check hinge
3. Valve: Zurn Z6000PL-WS1-DF, 1.6/1.1 gallon per flush
4. Carrier: Zurn ZN1203-N4 or ZN1204-N4; provide carriers for minimum wall thickness rated for 500 lbs static load.
5. Mounting: 17 inches from finished floor to top of rim

C. P-2A urinal (wall hung - flush valve - 0.5 GPF)

1. Fixture: Zurn Z5755, White, elongated rim
2. Valve: Zurn Z6003AV-EWS, 0.5 gallon per flush
3. Mounting: 24 inches from finished floor to flood rim

D. P-2B urinal (wall hung - flush valve - barrier free - 0.5 GPF)

1. Fixture: Zurn Z5730, White, elongated rim
2. Valve: Zurn Z6003AV-EWS, 0.5 gallon per flush
3. Mounting: 17 inches from finished floor to flood rim

E. P-4A shower (ADA compliant – one piece white Gelcoat)

1. Unit: Aquarius G 3682 BF (36”x36” ID) with 24”x1.5” smooth stainless steel S-bar and 33.5”x18”x1.5” smooth stainless steel L-bar, 32”x21” frameless white HDPE fold-up seat, 1” OD 18 gauge stainless steel curtain rod with rod cups and 42”x72” white nylon weighted curtain.
2. Trim: Symmons #1-100-X single lever valve and shower head, with 2.5 GPM shower head mounted 7'-6" above finish floor; Zurn #ZS-415-BS stainless steel drain with water proofing membrane clamping
3. Trim: Moen #8375, lever handle and shower head; Zurn #ZS-415-BS stainless steel drain with water proofing membrane clamping
4. Trim: Kohler K- T15611-4 trim with single lever and K-304-KS valve with faceplate, handle shower head, arm and flange. Jay R. Smith, 2005-A-CP, 2 inch chromium plate bronze floor drain

F. P-5D lavatory (oval – under counter mount - single lever)

1. Fixture: Zurn ZZ5220, 19 inches by 16 inches.
2. Faucet: Zurn Z7443-XL-FC lead free with 0.5 gpm flow control aerator, braided supplies and grid drain.
3. Trim: Zurn Z8804-XL-LR-Q-PC quarter turn stops and supplies. One Zurn Z8700-PC series 1-1/4 inch semi-cast brass P-trap.

G. P-5E lavatory (oval – under counter mount - single lever - barrier free)

1. Fixture: Zurn ZZ5220, 19 inches by 16 inches.
2. Faucet: Zurn Z7440-XL-FC, lead free with 0.5 gpm flow control aerator and braided supplies.
3. Trim: One Zurn 8700-PC series 1-1/4 inch grid drain and tailpiece. Zurn Z8804-XL-LR-Q-PC quarter turn stops and supplies. Zurn Z8746-PC 1-1/4 inch offset grid drain.
4. Mounting: 34 inches from finished floor to flood rim. Insulate water piping and trap under lavatory.

H. P-6D sink (double compartment - kitchen)

1. Fixture: Just DLX-1933-A-GR, 19 inches by 33 inches by 10-1/2 inches.
2. Faucet: Zurn Z82300-XL-CP8-18M, single lever faucet for 1.5 laminar gpm flow
3. Trim: Two Zurn Z8743-1-PC grid drain with 1-1/2 inch tailpiece. Zurn Z8804-XL-LR-Q-PC quarter turn stops and supplies. One Zurn Z8702-PC series 1-1/2 inch by 1-1/2 inch semi-cast brass P-trap. One Zurn Z8751 continuous waste.

I. P-9 janitor's floor basin

1. Fixture: Stern-Williams terrazzo SB-900, 24 inches by 24 inches by12 inches with stainless steel cap, less tiling flanges
2. Faucet: Zurn Z843M6-CS with vacuum breaker and integral stops, wall brace and check stops.
3. Mounting: Mount faucet 36 inches above finished floor.

J. P-12A water cooler (high-low - barrier free)

1. Fixture: Rectangle arm with bowl, Elkay ERFPM28RAK with stainless steel apron
2. Fixture: Round bowl, Elkay ERPBM28RAK with stainless steel apron
3. Trim: One Zurn Z8802-XL-LR-Q-8860-12-PC supply with quarter turn stop. Two Zurn Z8700-PC series 1-1/4 inch semi-cast brass P-trap
4. Capacity: 8 GPH at 90 degree room temperature
5. Mounting: 36 inches from low bubbler to finish floor

K. P-17A floor drain (regular - general purpose)

1. Fixture: Zurn #ZN415-Y-P cast iron floor with sediment bucket and polished nickel bronze top, adjustable, strainer and flashing clamp device if drain is installed above slab on grade. Provide trap primer connections. Size of drain as shown on drawings.

L. P-20A trap primer (floor drain connection)

1. Fixture: Precision Plumbing Products P-1 & P2 series, sized as required for the number of floor drains served, with trap primer valve and distribution unit.

M. P-20B trap primer assembly (flush valve tube connection)

1. Fixture: Zurn P6000-TPO, exposed trap primer assembly, with flush tube trap primer collar, spud coupling and flange for top spud connection, supply tube and fitting, vacuum breaker, vacuum breaker tube nut and wall escutcheon.

N. P-21A wall hydrant (non-freeze - key operated)

1. Fixture: Zurn Z1321-C, anti-siphon non-freeze wall hydrant, stainless steel face, with integral vacuum breaker. Mounting: 18 inches from center line of hydrant to finished grade.

O. P-22A HOSE BIBB (COLD WATER - TOILETS)

1. Fixture: Zurn Z1341-PC with loose key handle, chrome plated, and vacuum breaker.
2. Mounting: 18 inches above the finished floor

P. P-25 ice maker box

1. Fixture: Water-Tite model number W9701HA water supply box with shock arrestor, 6 inches by 5 inches by 3-1/2 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Connect to plumbing fixtures and equipment provided under this and other sections of specification, architectural drawings, and manufacturer's shop drawings. Provide rough-in connections as shown on drawings.

B. Use schedule and details on drawings and/or manufacturer's shop drawings for connection sizes to fixtures.

C. Connect wall hung urinals to waste piping with red brass nipples.

D. Provide separate p-trap for each fixture, floor drain, and piece of equipment.

E. Provide cast iron p-traps under floor drains.

F. Provide deep seal traps under floor drains in air conditioning unit plenums, walk-in cooler and freezer units, storage rooms, toilet rooms, and elsewhere as indicated on drawings.

G. Install barrier free fixtures in accordance with rules and regulations of the Americans with Disabilities Act (ADA).

H. Provide outlet devices which limit hot water flow to lavatories and sinks to a maximum of 0.5 GPM, sized as recommended by manufacturer and as required by ASHRAE 90.1-2010 and state and local energy codes.

I. Install lavatories and sinks with a minimum of 4 inches clearance on each side, from a wall or partition.

J. Install water closets with a minimum of 15 inches clearance from the centerline of the bowl to each side, from a wall, partition, divider, or another fixture.

K. Water closets shall have a minimum of 21 inches clearance in front of bowl.

L. Coordinate dimensions required for minimum fixture clearances with other Divisions.

M. Add trap primer connection to floor drain where required. (See drawing for requirement)

N. Provide check valves on hot and cold water supply, on janitor sink faucet or any mixing faucet not equipped with integral check valve.

O. Caulk around joints at fixtures mounted on wall or floor, or backed up to walls.

P. Mount fixtures rigid to walls as shown on drawings or details.

Q. Install a dropped eared "L" fitting, mounted on FRT wood backing for rigid support for all shower heads.

R. Flush valves: Install flush valves on wide side of water closet stall as required for ADA accessibility. Install water closet flush valves no higher than 44" above finished floor. Flush valve handles for urinals shall be mounted between 28" and 44" above finished floor.

S. Provide 12 inches minimum access to fixtures with concealed slip-joint connections.

T. Run connection size cold water line to back of refrigerator and connect with shut off valve at connection point. Field verify exact connections required.

U. Rough-in (floor ice machine, by Owner):

1. Rough-in 1/2 inch cold water with cutoff valve at connection.
2. Provide floor drain under ice machine and run connection size drain from unit to floor drain.
3. Provide 2 inches air gap between drain line and floor drain.

3.02 TESTING AND CLEANING

A. Inspect and test all work to insure that it is installed in accordance with the drawings, specifications and manufacturer's requirements and is functioning as designed and required. Use test procedures and pressures as required under this Division.

B. Correct all deficiencies found and retest.

C. Turn all work over to Owner in a clean, sanitary condition.

END OF SECTION

SECTION 23 05 00 COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Common work results for requirements specifically applicable to Division 23.

B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

1.02 REGULATORY REQUIREMENTS

A. Perform Work specified in Division 23 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Project Engineer / MDOT Architect.

1. NFPA 54: National Fuel Gas Code
2. NFPA 70: National Electrical Code
3. NFPA 72: National Fire Alarm and Signaling Code
4. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems
5. NFPA 101: Life Safety Code
6. NFPA 101B: Standard on Means of Egress for Buildings and Structures
7. NFPA 5000: Building Construction and Safety Code
8. ANSI Handicapped Code-A117.1
9. ASTM E814-08B: Standard Test Method for Fire Tests Penetration Firestop Systems.
10. U.L. Fire Resistance Index.
11. All applicable Occupational Safety and Health Administration (OSHA) Publications, Rules and Regulations.
12. Americans with Disabilities Act (ADA)
13. Special regulations, supplement, and amendments of the State and/or local authorities having jurisdiction.

1.03 REFERENCE STANDARDS

A. AGA: American Gas Association.

B. ANSI: American National Standards Institute.

C. ARI: American Refrigeration Institute.

D. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers.

E. ASME: American Society for Mechanical Engineers.

F. ASTM: American Society for Testing and Materials.

G. NFPA: National Fire Protection Association.

H. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

I. UL: Underwriters' Laboratories, Inc.

J. U.L. Fire Resistance Index

1.04 SUBMITTALS

A. Submit under provisions of Division 01.

B. Incomplete submittals containing unmarked cut sheets or not providing specific detail of what is being proposed will be rejected and will not be reviewed.

C. Include Products as specified in the individual sections of Division 23.

D. Brochures: Submit manufacturer's product data and brochures including:

1. Complete descriptions.
2. Illustrations.
3. Rating data, accessories, dimensional data, and applicable options and features marked for the specific items scheduled on drawings and specified herein.
4. Capacities stated in the terms specified.
5. Performance curves for all air handling units, fans, and pumps.

1.05 FIELD CONDITIONS

A. Layouts indicated on drawings are diagrammatic and intended to show relative positions and arrangement of equipment, ductwork and piping. Coordinate mechanical work with other trades and measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings, using as necessary rises, drops, offsets, transitions, and alternate routings to fit in the available space unless prevented by Project conditions.

B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.

C. Place anchors, sleeves, and supports prior to pouring concrete or installation of masonry work.

D. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

E. Determine sizes and verify locations of existing utilities on or near site.

F. Keep roads clear of materials and debris.

G. Visit site and be informed of conditions under which Work must be performed.

H. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using duct, wall, or ceiling access doors.

I. Install ductwork and piping to leave sufficient space for AHJ inspection of wall construction.

1.06 FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required to perform Division 23 work.

1.07 COORDINATION DRAWINGS

A. Drawings shall not be formally submitted but shall be kept on site for reference. Notify Architect and Construction Manager of conflicts that cannot be resolved.

1.08 COMPLETENESS OF WORK

A. The Contract Documents depict HVAC systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Catalog numbers referenced throughout the Division 23 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

1.09 PRODUCT SUBSTITUTIONS

A. 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.

1.10 RECORD DRAWINGS

A. Provide record drawings that illustrate the work of Division 23 as finally constructed. Deliver record drawings to the Architect in a form suitable for reproduction.

B. Provide record drawings that illustrate the work of Division 23 as finally constructed. Deliver record drawings to the Architect electronic format and also three (3) copies marked in red ink to reflect work as constructed.

C. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.

D. Deliver record drawings to Architect within 30 days of Substantial Completion.

E. Record drawings are to indicate air terminal units, fan coil units, air handling units, fans, control panels, and all other devices and materials to proper scale.

1.11 OWNING AND OPERATING MANUALS

A. Comply with the requirements of Division 01, but provide a minimum of three hard copy sets and an electronic copy.

B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.

C. Copies of final reviewed submittals indicating all model numbers, serial numbers, cut sheets, and all performance criteria on furnished equipment shall be included.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPORTS

A. Structural Steel for Supports: ASTM A36.

1. Use galvanized members installed in fan plenums or areas of high humidity or condensation, and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by apply two coats of cold-galvanizing.
2. Use hot dipped galvanized members installed in fan plenums or areas of high humidity or condensation, in tunnels and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by applying two coats of cold-galvanizing.
3. Furnish other members with shop coat of primer.
4. Retouch primer after field welding.

2.02 FLASHINGS AND COUNTERFLASHINGS

A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for ductwork and piping.

B. Materials:

1. Sheet metal: 24 gage minimum ASTM A525, Class G90.
2. Sheet lead: 3 pounds per square foot.

3. Stainless steel: Minimum 20 gage.
4. Sheet copper: 24 OZ/SF.

2.03 WALL AND CEILING ACCESS PANELS

A. Style and type as required for material in which installed.

B. Size: 24 inches by 24 inches minimum, as indicated, or as required to allow inspection, service and removal of items served.

C. 14 gage minimum sheet metal for doors, 16 gage frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.

D. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.

E. Prime painted or rust inhibitive paint finish.

F. UL labeled when in fire-rated construction, 1-1/2 hour rating.

G. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are fire and/or smoke dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.

H. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.

I. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.

1. For masonry and drywall construction: Milcor Style M.
2. For plastered masonry walls and ceiling: Milcor Style K.
3. For ceramic tile or glazed structural tile: Use stainless steel panels.

2.04 SLEEVES

A. Materials:

1. Concrete floors, concrete and masonry walls: 18 gage galvanized steel sheet metal or Schedule 10 galvanized steel pipe.
2. Drywall partitions: 18 gage galvanized steel sheet metal or Schedule 10 galvanized steel pipe.

B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2 inch. Provide larger annular space if required by firestopping product installation instructions or water proofing seal in exterior wall penetration.

C. Sleeves supporting riser piping 4 inches and larger shall have three 6 inches long reinforcing rods welded radially at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab.

D. Exterior wall and floor penetrations shall be sleeved and sealed with a Link Seal Modular Seal by GPT Industries or Flexicraft Industries.

1. Exterior wall and floor penetrations: Install Link Seal Modular Seal by GPT or Flexicraft Industries. Seal shall be suitable for use in direct ground contact, water or atmospheric condiditons with EPDM seal element. Provide Nitrile rubber seal element where subject to oils and fuel. All bolts, nuts and fasteners shall be Steel with 2-part Dichromate corrosion inhibiting coating or Type 316 Stainless steel.

2.05 ESCUTCHEON PLATES

A. Provide B & C No. 10 or equal chrome plated escutcheon plates where pipes penetrate partitions or ceilings in finished areas.

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING

A. Contractor shall review Division 31 and shall perform excavation and backfilling in accordance with the most stringent requirements. Contractor shall request clarification before proceeding if there are conflicting instructions.

B. Contract Documents show the approximate location of underground utilities known to exist in the area of construction. Contractor shall determine the exact location of utilities.

1. Locate and uncover existing utilities which require new connections before trenching in the vicinity of indicated utility connection.
2. Clear all vegetation and other objectionable material from the area required for the excavation and backfill operations. Disposal of material removed by the clearing operation shall be approved by the Owner's Representative.

C. Provide trenching, excavating, and backfilling necessary for performance of work indicated in Contract Documents.

D. Excavate to depths indicated on the drawings or as necessary to permit the installation of pipe, bedding, backfill, structures or appurtenances. Provide a firm, undisturbed, uniform surface in the bottom of trenches. Where excavation exceeds the required depth, bring the excavation to proper grade through the use of an approved incompressible backfill material. Store excavated material and dispose of surplus excavated material.

1. Excavate trench to sufficient depth to permit a minimum of 36 inches of cover over the top of the pipe unless otherwise required by pipe elevations indicated on the Drawings. The trench width shall be 18 inches plus the diameter of the pipe and/or the largest bell.

E. Trenching and excavation shall be unclassified. No extra will be paid in the event that rock is encountered.

1. Should rock excavation be required, use only experienced personnel for blasting.
2. Exercise extreme care when blasting with signals of danger given before firing any charge.
3. Conform to and obey all public authority regulations for the protection of life and property.

F. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches an their grades in proper condition and to meet applicable codes.

G. Provide a minimum of 6 inches of No. 67 crushed stone or clean sand bedding, or equal, in the bottom of the trench to maintain the required grade and continuous support of the bottom quadrant of the pipe. On bell and spigot piping, dig bell holes so bottom of bells do not support pipe.

H. Upon completion of excavation, and prior to the laying of the pipe, the trench bottom shall be brought up to the required elevation with min. 6 inches pipe bedding. Pipe bedding shall be select material deposited in the trench, and shall be compacted, leveled off, and shaped to obtain a smooth compacted bed along the laying length of the pipe. Material for pipe bedding shall comply with local codes. In absence of local code requirements the bedding shall be bank sand or select back fill material approved by the Architect. Any material used shall pass a 1/4 inch screen.

I. Clean and inspect pipe for defects before lowering into trench for assembly. Install pipe in accordance with provisions of Contract Documents and with the recommendations of the pipe manufacturer.

1. Ensure pipe is of proper strength and classification for specified service. Discard damaged or defective pipe discovered during pipe laying operations.
2. Maintain alignment and grade during layout operation. Use acceptable method for maintaining grade and alignment to produce desired results.

J. Where crushed stone backfill is required, use No. 67 stone, clean sand or equal.

K. After bedding has been shaped and the pipe assembled, place crushed stone carefully around the pipe and to a point 12 inches above the pipe. Backfill above this point shall be as described below:

1. Backfill areas of vehicular traffic shall consist entirely of crushed stone and compacted crusher run material.
2. Backfill for shoulders of roadways, sidewalk, and slab on grade structures shall consist entirely of crushed stone.
3. Backfill areas not subject to vehicular traffic may consist of suitable excavated material as described above.

L. Where crushed stone is not required, suitable excavated material may be utilized. This includes fine, dry earth or a mixture of earth and shot rock. Rocks larger than 6 inches in any dimension may not be included in any portion of the backfill material.

M. Trenches shall be backfilled only after piping has been inspected, tested, and approved by the Project Engineer/MDOT Architect. All backfill material shall be placed in the trench either by hand or by approved mechanical methods. The compaction of backfill material shall be accompanied by tamping, with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling, or by any combination of the three. The method of compaction shall be approved and all compaction shall be done to the satisfaction of the Project Engineer/MDOT Architect. Backfill completely around pipe, including 18 inches above the pipe, with suitable bank sand, tamped in 4 inches layers under, around, and over pipe. Water down backfill as required. The remainder of the backfill shall be select backfill material tamped at intervals of no more than 12 inches depths. All materials to be used as selected material backfill shall be approved by the Project Engineer/MDOT Architect. If, in the opinion of the Project Engineer/MDOT Architect, the excavated material does not meet the requirements of selected material, the Contractor shall be required to screen the material prior to its use as selected material backfill. Material used in the upper portion of the backfill or subgrade shall not contain stone, rock, or other material larger than six inches in its longest dimension. No wood, vegetable matter, or other material which, in the opinion of the Project Engineer/MDOT Architect, is unsuitable shall be included in the backfill. The upper 24 inches of backfill may be water jetted, if desired. Backfill shall be brought up to finish grade identified on the Architectural Drawings, including additional backfill required to offset settlement during consolidation.

3.02 CUTTING AND PATCHING

A. Repair or replace damage caused by cutting or installation of work specified in Division 23.

B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.03 FLASHING AND COUNTERFLASHING

A. Counterflash ducts and pipes where penetration of roofs and outside walls occur.

3.04 CONNECTION TO EQUIPMENT FURNISHED BY OWNER

A. Connect and/or install equipment shown on mechanical drawings that requires mechanical connections.

B. Provide piping, isolation valves, unions, and other piping appurtenances required for a complete installation.

C. Provide steam strainers, steam traps, and pressure reducing valves in steam lines.

3.05 DELIVERY, STORAGE, AND PROTECTION

A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.

B. Store items in a clean, dry place, and protect from damage. Mechanical equipment may not be staged or stored outdoors unless intended for outdoor use.

C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.

D. Protect valves and piping from damage. Cover equipment during work of finishing trades.

E. Keep dirt and debris out of pipes and ducts.

F. Repair, restore, and replace damaged items.

G. Cover factory finished equipment during work of finished trades, such as fan coils, fin tubes, etc.

H. Protect cooling and/or heating coils with temporary filter media during construction.

3.06 SLEEVES

A. Floors: Sleeve all pipe penetrations including mechanical equipment rooms and other wet areas. Extend sleeve 2 inches above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.

B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.

C. Drywall partitions: Sleeve all pipe penetrations.

D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.

E. For all fire rated walls, floors and partitions install piping, insulation and sleeves in strict accordance with applicable U.L. floor or partition assembly instructions. Coordinate installation and fire stop material with Division 07 Firestop manufacturer's installation instructions.

F. Clearance between sleeve and pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping or as otherwise dictated by U.L. Fire Resistance Directory.

G. Penetrations not Sleeved or Firestopped:

1. Seal voids between pipe and partition. Seals shall be airtight.

3.07 ESCUTCHEON PLATES

A. Provide chromium plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in "finished" spaces. Mechanical rooms, store rooms, electric closets, and janitor closets are not considered "finished" spaces.

3.08 EQUIPMENT GUARDS

A. Use suitable structural frames with minimum 12 gauge, 3/4" galvanized mesh, or expanded metal mesh. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.

B. At belts, provide opening for measuring RPM.

C. Provide at all belts, couplings, moving machinery and equipment.

D. Design for easy access to belts and other items requiring replacement.

E. Comply with OSHA Regulations.

3.09 CLEANING HVAC SYSTEMS

A. General Cleanup:

1. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, old materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Project Engineer/MDOT Architect. See Division 01 of specifications for further requirements.
2. Seepage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.

B. Factory Finishes:

1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.

C. Ducts and Apparatus:

1. Thoroughly clean ducts and apparatus casings before fans and filters are operated.

3.10 OPERATION OF HVAC SYSTEMS DURING CONSTRUCTION

A. Install all specified filters prior to system operation. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame. Change roughing filter as necessary to minimize dust collection on specified filters.

B. Cover return and exhaust air grilles with temporary filter media. Attach media to avoid damage to grille or ceiling. Change temporary media as required to protect against dust buildup on ductwork. Remove temporary media from grilles after flooring is installed, walls are sanded and painted and other dust generating construction has been completed.

C. During periods of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles to prevent dust from accumulating in ductwork.

D. If outside air source contains less dust than building air, adjust A/C unit dampers to operate with as much outside air as possible without causing a freezing condition for coil or exceeding capacity of coil to adequately condition supply air.

E. Furnish and install a new set of specified filter media prior to start of system test and balance. Furnish a new, clean set of the specified media and turn over to Owner's Representative.

3.11 TESTING MECHANICAL SYSTEMS

A. Test all systems and equipment installed to demonstrate proper operation.

B. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

C. Correct and retest work found defective when tested.

D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.

E. Ductwork Pressure Testing: Refer to Section 23 31 13 for required pressure testing for ductwork.

F. System Balance and Testing: Prepare to assist test and balance firm by assuring systems are complete and operational.

G. Records of Testing: Maintain records of system testing and results thereof. Deliver results as part of project closing file and on an intermediate basis as requested by Architect.

END OF SECTION

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

C. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring

B. Section 26 29 13 - Enclosed Controllers

C. Section 26 29 23 - Variable Frequency Motor Controllers

1.03 REFERENCE STANDARDS

A. Each motor, controller and all components shall be designed, manufactured and tested in accordance with the following applicable standards:

1. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
2. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.
3. IEEE Standard 112, Test Method "B"; 1996.
4. IEEE Standard 444 (ANSI C34.3); 1992.
5. IEEE Standard 519; 1992.
6. NEMA MG 1 - Motors and Generators; 2014.
7. NEMA MG1, Part 31 - Definite Purpose, Inverter Fed Motors; 2012.
8. NEMA - ICS-3-303
9. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
10. Energy Policy Act of 1992

B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for it's intended use on this Project.

1.04 SUBMITTALS

A. See Division 01 for submittal procedures.

B. Submit motor information with submittals and shop drawings for Division 23 equipment.

C. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Division 01 for additional warranty requirements.

B. Provide two year manufacturer warranty from the date of substantial completion for motors smaller than 20 horsepower.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Baldor, General Electric, Gould, Lincoln, MagneTek/Century, Marathon, Reliance, Siemens, Toshiba, U.S. Motors, and Westinghouse.

B. Substitutions: 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 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Motors 1/2 HP and smaller: 208 volts, single phase, 60 Hz.
2. Motors larger than 1/2 Horsepower: 208 volts, three phase, 60 Hz.

B. Windings and Insulation:

1. All motors shall have copper windings.
2. Motors shall be equipped with Class B, 80 deg. C rise or Class F, 105 deg. C rise insulation suitable for use in a 40 deg. C ambient temperature.
3. Motors used for cooling tower applications shall be equipped with Class F, 105 deg. C insulation suitable for use in a 40 deg. C ambient temperature. Windings shall be treated with an epoxy varnish to inhibit the moisture absorption.

C. Bearings:

1. Single phase, fractional horsepower motors shall be equipped with quiet operating, all angle babbitt lined sleeve bearings.
2. Polyphase motors shall be equipped with deep groove type ball bearings, generously sized for the loads to which applied and for severe duty application. Provide the necessary seals on the shaft to keep the bearing system free of contamination and moisture. Lubricant shall be high temperature, nonbleeding grease.
   a. Provide inlet and outlet plugs on poly phase motors so that grease fittings can be easily inserted for bearing lubrication except as otherwise specified. The end shields shall be carefully machined to add extra grease capacity. Lower outlet plugs shall be equipped with combination breather/drains on TEFC and TEAO motors.

D. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment.

E. Motors specified with variable frequency motor controllers shall comply with NEMA MG1, Part 31 for Definite Purpose, Inverter Fed motors including insulation meeting the requirement for 1600 Vpk at 0.1 uS rise time. In addition to compliance with MG1, Part 31, motors also shall be designed for starting across the line and specifically designed to reduce inrush current.

1. To protect motor bearings and shafts from damage due to induced electrical currents along the motor shaft, provide Aegis shaft grounding ring (SGR), conductive microfiber motor shaft grounding ring on the driven end of all inverter fed motors. For inverter fed motors 100 HP and larger, also provide either an insulated motor bearing or a ceramic bearing on non-driven end of motor. Comply with manufacturer's installation instructions and with NEMA MG1, Part 31 for inverter fed motor bearings.

F. Sound power levels shall not be greater than recommended in NEMA M61-12.49. Inverter duty rated motors shall not increase by more than 3 dB when operating on a variable frequency motor controller.

G. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned and balanced.

H. Motors exposed to the weather shall be weather protected.

I. Install premium efficiency electric motors for motors 1 horsepower and above. Premium efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel cage motors rated 1 through 150 horsepower shall be tested by dynamometer method B. The efficiency shall be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

1. HP:3/4 Eff:80.0 percent
2. HP:1 Eff:84.0 percent
3. HP:1 1/2 Eff:86.5 percent
4. HP:2 Eff:86.5 percent
5. HP:3 Eff:89.5 percent
6. HP:5 Eff:89.5 percent

J. Motors shall be specifically designed for quiet operation and for severe duty. Standard open drip proof motors shall be equipped with aluminum or stainless steel stamped nameplates. Totally enclosed fan cooled and air over motors shall be equipped with stainless steel stamped nameplates with either zinc or cadmium plated hardware. Motor nameplates shall clearly indicate manufacturer's name and model number, frame size, horsepower, frequency, voltage, RPM, starting torque class, insulation class, full load amps, locked rotor amps, service factor, power factor, efficiency and winding material.

K. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C. Three phase motors for fans and other HVAC equipment: Squirrel cage type.

D. Motors located in outdoors: Totally enclosed weatherproof epoxy-treated type.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

2.06 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Manufacturers:
1. US Motors, a brand of NIDEC Motor Corporation; _____: www.usmotors.com.

B. Applications:
   1. Residential/Commercial:
      a. Geothermal Heat Pumps:
         1) Operating Mode: Constant cfm.
         2) Input: Motor manufacturer to coordinate control requirements with the control board of the geothermal heat pump and/or specified sequence of operation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install base mounted motors securely on firm foundation.

C. Align motors on direct drive equipment using dial type gauges.

D. Check line voltage and phase and ensure agreement with nameplate. Test motor for proper rotation under Division 26.

3.02 ADJUSTMENTS

A. Motors, together with driven equipment, shall be dynamically and statically balanced. Imbalance shall be reduced to minimum specified by equipment manufacturers.

END OF SECTION

SECTION 23 05 29 HANGERS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hangers for HVAC piping

1.02 RELATED REQUIREMENTS

A. Section 23 07 00 - HVAC Insulation

B. Section 23 21 13 - HVAC Piping

1.03 SUBMITTALS

A. Submit product data and information in accordance with the provisions of Division 01.

B. Indicate where each type of hanger will be used, what piping service and if pipe system will be insulated and with what thickness.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Anvil, B-Line, Carpenter and Patterson, Fee and Mason, Michigan, Reliable, and Viking. Anvil numbers are used for reference.

B. Substitutions: 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 HANGERS

A. Anvil Powerstrut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with trapeze hangers.

B. Except for copper hangers, all other hangers and supports shall be hot-dipped galvanized.

2.03 HANGER RODS

A. Provide mild steel all-thread rods with maximum loads as follows:
   1. 3/8 inch - 300 lbs
   2. 1/2 inch - 600 lbs
   3. 5/8 inch - 1,200 lbs
   4. 3/4 inch - 2,000 lbs
   5. 1 inch - 5,000 lbs

2.04 CLAMPS

A. C-Clamps: Anvil Figure #92, MSS Type 23.
   1. Use these for attaching hangers to steel beams. Do not weld hanger rods to structural steel members.

B. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30: Use these for attaching hangers to bar joists. Attach clamps to top chord of bar joists only. Confirm with structural engineer for maximum loading and restrictions.

PART 3 - EXECUTION

3.01 PIPE HANGERS

A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight or stresses from vibration and swaying of pipe. Support pipe risers at regular intervals in pipe shafts at least once at each floor level or a maximum of 12'-0" apart. Do not use perforated metal, strap iron, or band iron. Do not make offsets in hangers.

B. Maximum allowable spacing of pipe hangers is listed below. Space hangers and brackets at closer intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging or swaying of pipe.

C. Copper Pipe - Water

1. 1/4 inch to 1-1/4 inch - 5'-0" on center.

D. Copper Pipe - Vapor

1. 1/4 inch to 1 inch - 5'-0" on center.

E. Sway Bracing

1. Provide sway bracing and additional supports to meet the seismic bracing requirements.

END OF SECTION

SECTION 23 05 48 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vibration isolators.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.

D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2011.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc; 2011.

G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.03 SUBMITTALS

A. Submit product data, drawings and related information in accordance with the requirements of Division 01.

B. Product Data:

1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Kinetics Noise Control, Inc: www.kineticsnoise.com.

B. Mason Industries: www.mason-ind.com.

C. Vibration Eliminator Company, Inc: www.veco-ny.com.

D. Amber Booth

E. Vibration Mountings & Controls, Inc.

F. Korfund Company

G. Substitutions: 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 PERFORMANCE REQUIREMENTS

A. General:

1. Steel springs to function without undue stress or overloading.
2. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
3. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.

2.03 VIBRATION ISOLATORS

A. Non-Seismic Type:

1. All Elastomeric-Fiber Glass Pads:
   a. Configuration: Flat or molded.
   b. Thickness: 0.25 inch minimum.
   c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
2. Elastomeric Mounts:
   a. Material: Oil, ozone, and oxidant resistant compounds.
   b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
3. Elastomeric Hangers:
   a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
   b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.

B. Seismic Type:

1. Coil Springs Consisting of Single Elements:
   a. Housing: Manufactured from cast iron material.
   b. Ductile Material: Designed and rated for seismic applications.
   c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
   d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
   e. Resilient Pad: Located in series with spring.
   f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
   g. Finish: Suitable for the application.
2. All Directional Elastomeric:
   a. Material: Molded from oil, ozone, and oxidant resistant compounds.
   b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.

c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

2.04 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:

1. ASHRAE Handbook - HVAC Applications
2. FEMA 412
3. FEMA 413
4. FEMA 414
5. FEMA E-74
6. SMACNA - Seismic Duct Restraint Manual

B. All Directional External:

1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:

1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

E. Horizontal Single Axis External:

1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

2.05 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:

1. ASHRAE Handbook - HVAC Applications
2. FEMA 412
3. FEMA 413
4. FEMA 414
5. FEMA E-74
6. SMACNA - Seismic Duct Restraint Manual

B. Cable Restraints:

1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:
   a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
   b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:

1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

3.02 INSTALLATION - SEISMIC

A. Comply with:

1. ASHRAE Handbook - HVAC Applications
2. FEMA 412
3. FEMA 413
4. FEMA 414
5. FEMA E74
6. SMACNA - Seismic Duct Restraint Manual

B. Seismic Snubbers:

1. Provide on all isolated equipment, piping and ductwork.
2. Provide minimum of four seismic snubbers located close to isolators.
3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.

C. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:

1. Install equipment anchorage items designed to resist seismic design force in any direction.
2. Where concrete floor thickness is less than required for expansion anchor installation, install through bolt in lieu of expansion anchor.

D. Suspended Mechanical Equipment:

1. Provide supports and bracing to resist seismic design force in any direction.
2. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.

E. Wall mounted Mechanical Equipment:

1. Provide support and bracing to resist seismic design force in any direction.
2. Install backing plates or blocking as required to deliver load to primary wall framing members.

F. Piping:

1. Provide seismic bracing in accordance ASC 7.
2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
3. Brace resiliently supported pipe with cable bracing or alternate means designed to prevent transmission of vibrations and noise to the structure.
4. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
   a. Provide transverse bracing at spacing not more than 40.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.

5. Piping Explicitly Exempt from Seismic Bracing Requirements:
   a. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
   b. Provide swing restraints as required to control potential impact due to limited space between subject components.
6. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

G. Ductwork:

1. Provide supports, braces, and anchors to resist gravity and seismic design forces.
2. Independently support in-line devices weighing more than 20 pounds.
3. Independently support and brace all in-line devices weighing more than 75 pounds.
4. Provide unbraced piping attached to braced in-line equipment with adequate flexibility to accommodate differential displacements.
5. Positively attach dampers, louvers, diffusers and similar appurtenances to ductwork with mechanical fasteners.
6. Install duct supports designed to resist not less than 150 percent of the duct weight.
7. The use of power driven fasteners is prohibited in the hanging of ducts weighing over 10 pounds per lineal foot for seismic design categories D, E, and F.

3.03 SCHEDULE

A. Pipe Isolation Schedule.

1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.

END OF SECTION

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Painting and Markers.

D. Printed Labels / Ceiling Markers / Tacks

E. Control Diagrams.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.04 SUBMITTALS

A. See Division 01.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical systems identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Samples: Submit samples of nameplates and pipe markers.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Major HVAC equipment including, but not limited to fans and refrigerant branch controllers: Nameplates.

B. Air Terminal Units: Nameplates

C. Control Panels and major control components: Nameplates.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.

F. Unitary Equipment: Nameplates.

G. Thermostats: Printed Labels.

2.02 ACCEPTABLE MANUFACTURERS

A. Brady Corporation, Kolbi Pipe Marker Company, Marking Services, Inc., MIFAB, Inc., or Seton Identification Products

B. Substitutions: 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.

2.03 NAMEPLATES

A. Rigid plastic with engraved lettering.

B. Fasteners: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. If equipment surface does not allow for direct attachment, use copper or brass rings to attach tags.

C. Use names, numbers, and abbreviations appearing in schedules on Contract Drawings or as otherwise directed by the Owner.

D. Letter Color: White.

E. Letter Height: 1/2 inch.

F. Background Color: Black.

G. Plastic: Conform to ASTM D709.

2.04 CONTROL DIAGRAM FRAMES

A. Provide printed diagrams for all major HVAC equipment. Mount diagrams on walls in conspicuous, easily accessible places in each separate equipment room housing the equipment which the individual diagrams are applicable. Diagrams shall be laminated and represent as-built conditions. Lettering to be no smaller than 10 point font.

B. The following diagrams are required:

1. Graphic control diagram indicating relative device locations and labels.

C. Provide and install mounting hardware to secure each diagram to the wall. If adequate wall space is not available adjacent to the associated equipment, coordinate an alternate mounting location with Owner.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic pipe markers in accordance with manufacturer's instructions at no less than 25 foot intervals, at valves, and at least once in each separate space through which the pipe passes.

C. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 25 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

D. Label ductwork at no less than 25 foot intervals, on both sides of barriers and rated wall penetrations, and at all ductwork penetrations into and exiting from enclosed chases.

END OF SECTION

SECTION 23 05 93 Testing, Adjusting, and Balancing for HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. HVAC systems testing and balancing requirements.

1.02 REFERENCE STANDARDS

A. AABC - Associated Air Balance and Control

B. NEBB - National Environmental Balancing Bureau

1.03 SCOPE OF WORK

A. Perform test and balance in accordance with AABC or NEBB Standards.

B. The air balance procedure followed and forms used shall agree with AABC or NEBB Standards.

C. The Architect, Engineer, Owner, or Owner's Representative may request a recheck, resetting, or verification of an air or water related item within 90 days of the completion of work. The work shall be provided at no additional cost.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROCEDURES

A. On completion of work, submit three copies of the complete report to include the following:

1. Current certification documentation of all TAB equipment used.
2. Current certification of TAB personnel responsible for the work.
3. Dates, time, all personnel, and operating status of cooling and heating systems.
4. A description of the procedure used for air and water balance.

3.02 AIR SYSTEMS

A. Balance supply, return, and exhaust air outlets within 10% of design while still maintaining required pressure relationships.

B. On each fan system, measure and report:
1. Design and actual fan RPM. Fan suction and discharge pressure. Fan total static pressure, and pressure drop across components. Design and actual supply, return, exhaust, and outside air CFM.
2. Actual and motor nameplate voltage and amperage on fans.
3. Design and actual entering and leaving air temperatures, heating and cooling (dry bulb and wet bulb) of the supply, return, exhaust, and outside air.

C. For diffusers and grilles, measure, adjust, and report:

1. Design and actual CFM at each supply, return, and exhaust outlet.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe insulation

B. Ductwork insulation

1.02 RELATED REQUIREMENTS

A. Section 23 05 53 - Identification for HVAC Piping and Equipment

B. Section 23 23 00 - Refrigerant Piping System

C. Section 23 31 13 – Sheet metal Ductwork

1.03 DEFINITIONS

A. Exposed - Equipment, ducts and piping in areas which will be visible without removing ceilings or opening access panels.

B. Concealed - Installed above ceiling, in walls or chases.

C. Outdoors - Exposed to the weather or ambient conditions.

D. Underground - Buried.

1.04 REFERENCE STANDARDS

A. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

B. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2013.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2013.

F. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.05 SUBMITTALS

A. Provide product data and required information under the provisions of Division 01.

B. Submit manufacturer's product data and installation procedures for review. Product data shall identify specific thermal characteristics, list of materials and thickness for each service.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001-2000 certified.

B. Fire-Test Response Characteristics: Testing in accordance with ASTM E84. Insulation and related materials, adhesives, coatings, sealers, jackets and tapes, shall have a fire-test response characteristic of: Flame spread rating of 25 or less; Smoke development of 50 or less.

C. Materials shall meet the requirements of NFPA 90A.

PART 2 - PRODUCTS

2.01 PIPE AND EQUIPMENT INSULATION

A. Materials for Pipe and Equipment: Provide factory premolded insulation for pipe, pipe fittings, and valves.

B. Fitting insulation: Same thickness and material as adjoining pipe insulation.

C. Flexible Tubular Elastomeric:

1. Provide fire-retardant closed-cell slip-on flexible type; with a "K" value of 0.245 BTU-in/hr-ft2-degree F at 75 degrees F.
2. Acceptable manufacturers: Aeroflex "Aerocel", Armacell "AP/Armaflex", or K-Flex "Insul-Tube".
3. Use on the following services:
   a. Moisture condensate drains: 1/2 inch thick.
   b. Refrigerant lines: 1-1/2 inch thick (2 layers of 3/4 inch thick).

D. Fiberglass Pipe Insulation:

1. Acceptable manufacturers: Johns-Manville "Micro-Lok 850, CertainTeed, Knauf, or Owens Corning.
2. Jacket: ASJ fiberglass reinforced kraft paper with aluminum foil; minimum R value of 3.6.
3. Use on the following services:
   a. Drain bodies, traps and horizontal drain lines receiving cold condensate: 1/2 inch thick.
   b. Condensing boiler exhaust vent system - 1-1/2 inch thick.

2.02 DUCTWORK INSULATION

A. Blanket Type Duct Insulation:

1. Acceptable manufacturers: CertainTeed, Johns-Manville, Knauf, or Owens Corning.
2. Provide with Foil Reinforced Kraft (FSK) vapor barrier, providing the minimum "R" value and pound per cubic foot (PCF) density shown below.
3. Use on the following:
   a. Unlined supply air ductwork in an unconditioned space, including concealed above ceiling: 2.2 inches, 0.75 PCF, installed "R" value of 6.0.
   b. Unlined, exposed supply air ductwork: 2.2 inches, 0.75 PCF, installed "R" value of 6.0.
   c. Unlined ductwork supplying outside air: 2.2 inches, 0.75 PCF, installed "R" value of 6.0.
   d. Unlined return air ductwork installed in an unconditioned space, including concealed above ceiling: 2.2 inches, 0.75 PCF, installed "R" value of 6.0.
      1) Insulation may be omitted from exposed low pressure return air ductwork in area served by the ductwork, except where the exposed ductwork is in rooms with doors/openings to the exterior.

2.03 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

A. For pipe fittings, valves, strainers, and other irregular surfaces, in refrigerant systems operating below 60 degrees F, when inside building or in equipment rooms, cover insulation with white colored woven glass fabric embedded in white vapor barrier coating, Foster 30-35 or equal.

B. Elastomeric adhesives and finishing:

1. Adhesive shall be the insulation manufacturer's reccommended contact adhesive, Armaflex 520, Armaflex 520BLV or equivalent.
2. Insulation finish shall be the insulation manufacturer's recommended finish--WB Armaflex finish and shall be paintable.
3. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and not detract from any of the system reatings as specified.
4. Where exposed to view inside buildings, the painted finish color shall be as selected by the MDOT Architect.

2.04 JACKETS

A. Canvas Jacket: UL listed 6oz/sq. yd. plain weave cotton fabric treated with dilute fire retardant lagging adhesive compatible with insulation.

B. PVC Jacket: One piece molded type fitting covers and sheet material, off-white in color, 15 mil thickness, 0.002 perm inch maximum in accordance with ASTM E96. Adhere with pressure sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Deliver and store insulation materials in manufacturers containers and keep free from dirt, water, chemical and mechanical damage.

B. Complete piping and ductwork pressure testing prior to applying insulation.

C. Apply insulation in workmanlike manner by experienced, qualified, workmen.

D. Surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish specifically requires a wetted surface for application.

E. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state and not diminish or void the specified flame spread and smoke developed ratings.

F. Stop duct coverings, including jacket and insulation, at fire penetrations of fire or smoke rated partitions, floors above grade and roofs. "Fan-out" or extend jacketed insulation at least 2 inches beyond angle frames of fire dampers and secure to wall. Maintain vapor barrier.

3.02 BLANKET TYPE DUCT INSULATION

A. Apply jacketed blanket type glass fiber covering to ducts pulled snug but not so tight as to compress corners more than 1/4 inch. Use insulation having 2 inches tab, or cut insulation long enough to allow for "peel-off" of insulation from jacket to effect a minimum overlap of 2 inches. Staple lap with flare type staples on 1 inch centers. Cover standing seams, stiffeners, and braces with same insulation blanket, using 2 inches jacket lap and staple lap as herein before outlined. Cover and seal all staples with Foster 30-80 reinforced with glass cloth. Do not use pressure sensitive tape.

B. Secure jacket to covering using equivalent of Foster No. 85-20 or Childers CP-82 adhesive.

3.03 CALCIUM SILICATE INSULATION

A. Apply calcium silicate covering to ducts and breaching in 2 inches thick layers with blocks tightly butted, joints broken. Secure with 16-gauge copper wire and/or stainless steel bands. Finish with wire mesh and hard coat of hydraulic setting cement. Apply same insulation and thickness to all duct or breaching hangers at least 12 inches up or to supporting structure. Double insulate duct or breaching when passing through floor or roof slab.

3.04 FLEXIBLE SHEET ELASTOMERIC INSULATION

A. Prior to application of flexible sheet elastomeric insulation, thoroughly clean all metal surfaces, making sure that all dirt, scale, loose paint, plaster, and oil has been removed and that surfaces are dry. If surface has been primed, test a two square foot section using adhesive equivalent to Armaflex 520 in order to determine whether solvent in adhesive will loosen or lift the primer. If primer is loosened, then remove it. When testing proves acceptable, adhere insulation with smooth side out, using thin but adequate coating of same adhesive. Follow manufacturer's instructions. Coat all butt edges of each sheet. Stagger all joints. Insulate all standing seams or flanges with same thickness of insulation material as that used on main surface.

3.05 INSTALLATION OF PIPE AND EQUIPMENT COVERING

A. Where glass fiber or flexible tubular elastomeric insulation is used on piping, insert a section of foamglass or calcium silicate insulation, at hanger or support points, between pipe and metal shield for full length of shield, to prevent crushing of insulation. Insulation shall pass through pipe hangers and across trapeze supports, 12 inches long metal saddles shall be used. Insulation thickness to be same as adjoining glass fiber insulation. On cold pipe, vapor barrier should be carried through the hanger and sealed. Saddles shall be used where rigid foamglass inserts are not acceptable. Pipe saddles shall cover 180 degrees of the pipe.

B. Foamglass insulation shall be strictly applied as follows:

1. Both the circumferential and longitudinal joints shall be buttered with fire-resistive pliable sealer. Voids and cracks shall be filled with sealer. Mastic shall be Foster 30-80 or equal. Secure insulation with ¾ inch wide x 0.010 inch thick aluminum bands on 8 inch centers.
2. The circumferential joints shall be staggered.
3. Fittings, valves, flanges, traps, and air vents shall be insulated with the same thickness of insulation using factory fabricated fitting sections or pre-molded insulated fittings.
4. Block type insulation shall be adhered by stick-clips or bands, in addition to the sealer, as required to provide support for the insulation.
5. Finish above furred ceilings and in chases shall be the bare insulation.
6. Finish in equipment rooms and elsewhere where exposed-to-view shall be white ASJ.
7. Finish on underground insulation shall be Pittsburgh Corning Pittwrap as recommended by manufacturer.

C. Apply flexible tubular elastomeric insulation to pipe and fittings with all joints tightly fitted and sealed with adhesive.

END OF SECTION

SECTION 23 08 00 COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to Division 23.

B. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. The Commissioning Authority directs and coordinates the day-to-day commissioning activities as well as the overall commissioning process. The start-up, testing, support for commissioning, and demonstration of the equipment and systems operation to be in accordance with the contract documents is the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions or work in a satisfactory and fully operations manner.

C. Work of Division 23 includes:

1. Testing and start-up of the HVAC equipment.
2. Assistance in functional testing to verify equipment/system performance.
3. Providing qualified personnel to assist in commissioning tests, including seasonal testing.
4. Completion and endorsement of Pre-functional Construction Checklists provided by the Commissioning Authority to assure that Division 23 equipment and systems are fully operations and ready for functional testing.
5. Providing equipment, materials and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
6. Providing operation and maintenance information and as-built drawings to the Commissioning Authority for review prior to distribution.
7. Providing assistance to the Commissioning Authority to develop, edit and document system operation descriptions.
8. Providing training for the systems specified in this Division.

1.02 SUBMITTALS

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" Designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Equipment and System Submittals to include, at minimum, the following:
   a. Manufacturer's printed Installation Instruction sheets for all system components & devices
   b. Performance data
   c. Manufacturer's pre-startup checklists
   d. Manufacturer's start-up checklists
   e. Cut Sheets
2. Shop drawings (including any resubmittals required by the A/E)
3. Ductwork - Supply one copy of the duct leakage test results for each test section.
4. Piping - Supply one copy of all of the hydrostatic pressure test results.
5. Initial Pre-startup and start-up plan
6. Completed Prefunctional checklists

7. Operational and maintenance documentation
8. Training plan and training materials
9. As-built documentation.
10. BAS point lists and tables

1.03 RELATED WORK

A. All installation, testing and start-up procedures and documentation requirements specified within Division 23.

B. Section 01 91 00 COMMISSIONING.

C. Commissioning Functional Test Procedures that required participation of the Division 23 Contractors.

D. Cooperate with the Commissioning Authority in the following manner:

1. All testing and start-up procedures and documentation requirements specified within Division 1 and Division 23 and related portions of this project.
2. Allow sufficient time before final completion dates so mechanical systems start-up, test and balance, and commissioning can be accomplished.
3. Provide labor and material to make corrections when required without undue delay.
4. Put all heating, ventilation and air conditioning systems and equipment into full operation and continue the operation of the same during each working day of the testing, balancing and commissioning.
5. Include the costs of the dampers, replacement sheaves and belts, as required, to obtain satisfactory system performance as requested by the text and balance contractor of the Commissioning Authority.
6. Provide test holes in ducts and plenums where directed or necessary for pilot tubes for taking air measurements and to balance the air systems. Test holes shall be provided with an approved removable plug or seal. At each location where ducts or plenums are insulated, test holes shall be provided with an approved extension with plug fittings.
7. Provide pressure/temperature taps where directed or necessary for taking measurements to test and balance systems.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Standard test equipment for commissioning will be provided by the Contractor.

B. Division 23 Contractor shall provide standard and specialized test equipment as necessary to test and start up the HVAC systems.

C. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use and assist the Commissioning Authority in the commissioning process.

D. The contractor shall provide all equipment, software and all test programming support as necessary to start up, calibrate, debug and verify proper function of the control/facility management system. This equipment and software shall be provided for use by both the test and balance contractor and Commissioning Authority.

PART 3 - EXECUTION

3.01 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so the systems can be energized, started, tested and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are functional. This includes the complete installation of all equipment materials, raceways, wire, terminations, controls, etc., per the Contract Documents and related directives, clarifications, change orders, etc.

B. A commissioning Plan will be developed by the commissioning Authority. Upon request of the commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor-initiated system changes have been made that alter the commissioning process, the Commissioning Authority will notify the Architect and the Contractor may be obligated to compensate the Commissioning Authority to test the revised product or confirm the suitability/unsuitability of the substitution or revision.

C. Specific pre-commissioning responsibilities of Division 23 are as follows:

1. Normal start-up services required bringing each system into a fully operational state. This includes motor rotational check cleaning, lug tightening, control sequences of operation, etc. The Commissioning Authority will not begin the commissioning process until each system is complete, including normal contractor start-up and debugging.
2. The Contractor shall perform pre-functional construction checklists on the systems to be commissioned to verify that all aspects of the work are complete in compliance with the plans and Specifications. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
3. Provide written notification to the Contracting Officer and Commissioning Authority when systems are ready for functional testing a minimum of seven (7) days prior to start of testing.

D. Commissioning is to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is approved by the Contracting Officer. Commissioning activities and schedule will be coordinated with the Contractor. Start of Commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

3.02 PARTICIPATION IN COMMISSIONING

A. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. Provide skilled technicians to start up and debug all systems within this division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, times required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments and/or problem resolutions.

B. System problems and discrepancies may require additional technician time, Commissioning Authority time, redesign and/or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item or equipment, system and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representative does not constitute the availability of a qualified technician for purpose of this work.

D. The test, adjust and balance subcontractor shall provide a preliminary TAB report with final test measurements to the Commissioning Authority and shall provide qualified technicians and instruments needed for balancing to demonstrate a sample up to 10 percent of measurements until specified results are achieved.

3.03 WORK TO RESOLVE DEFICIENCIES

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under direction of the architect, with input from the Contractor and Contracting Officer, equipment supplier and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate and work out problems, the Architect/ Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance.

3.04 ADDITIONAL COMMISSIOING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers and Commissioning Authority shall include a reasonable reserve to complete this work as part of the standard contractual obligations.

B. The cost of compensation of the Commissioning Authority for repeat testing or troubleshooting due to systems that do not meet specified performance shall be borne by the Contractor.

C. Corrective work shall be completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely to the commissioning process, the Commissioning Authority will notify the Contracting Officer indicating the nature of the problem, expected stems to be taken and the deadline for completion of activities. If the deadline passes without resolution of the problem, the Government reserves the right to supplementary services and equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.05 SYSTEMS TO BE COMMISSIONED

A. All new HVAC systems, including control's graphics and trending

B. Building Automation Systems, including linkages to remote monitoring and control sites

C. Air handling units

D. Terminal units

E. Air-cooled condensers and condensing units

F. Exhaust, fume hoods, and other specialty fans

G. Ductwork

H. HVAC interface to fire alarm.

3.06 SOFTWARE

A. This Contractor shall supply the Commissioning Authority with two (2) debugged printouts of all facility management systems software, including all user's programming and engineering manuals required to interpret the software. Included in the printouts, though not limited to, shall be the following:

1. Point data base
2. All custom control programs written in the BAS control language
3. All parameters required for proper operation of BAS control and utility firmware such as start/stop routines, etc.
4. System graphics

B. The software printout shall be fully documented for ease of interpretation by the Commissioning Authority and Government without assistance from the Contractor. English language description shall be either integrated with or attached to the BAS printout. The following shall be specifically documented:

1. All point names, I/O and virtual.
2. All BAS programming language commands, functions, syntax, operators and reserved variables.
3. Use of all BAS firmware.
4. The intended actions, decisions and calculations of each line or logical group of lines in the custom control program(s). Sequences of operations alone are not sufficient.

5. Complete descriptions of and theories explaining all software an firmware algorithms. The algorithms to be described include, but are not limited to, PID, optimum start/stop, demand limiting and chiller and boiler optimization.
6. A table of contents to the documentation that locates the sections of the documentation and describes which programs or program sections are for each piece of controlled/monitored equipment.
7. Flow charts using IEEE symbol nomenclature that demonstrates the software's algorithms and flow logic.

3.07 TRAINING

A. Per the specifications, the Contractor will be required to participate in the training of the Government's operation and maintenance staff for each system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom aids, or in the field with the specific equipment. The type of training will be per the Government's option. Refer to Section 01 79 00 Demonstration and Training, Section 01 91 13 General Commissioning and Division 23 for additional requirements.

END OF SECTION

SECTION 23 09 13 INSTRUMENTATION AND CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide input and output control devices to integrate with direct digital control and building automation system.

B. Furnish instrumentation control devices as an integral part of the Building Automation Section specified in Section 23 09 23.

1.02 RELATED REQUIREMENTS

A. Section 23 05 00 - Common Work Results for HVAC

B. Section 23 09 23 - Building Automation and Direct Digital Controls

C. Section 23 23 00 - Refrigeration Piping System

D. Section 23 31 13 – Sheet metal Ductwork

E. Division 26: Electrical

1.03 SUBMITTALS

A. Submit product data and schedules for all input/output devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products and components by manufacturers listed. Where manufacturers are not listed, provide component that complies with specifications.

B. Manufacturers listed must meet performance and material specifications of product or component. Listing of a manufacturer as an acceptable manufacturer does not grant permission to deviate from the specification requirements.

2.02 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. Acceptable Manufacturers: Automated Logic, Johnson Controls, Setra, or Siemens.
   a. Substitutions: Refer to Division 01.
2. General Requirements:
   a. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
   b. Accuracy values indicated include errors associated with the sensor, lead wire, and analog to digital conversion.
3. Room Temperature Sensors
   a. Refer to schedules, floor plans, and control sequences for specific room temperature sensor requirements in each zone.
   b. Room sensors shall be constructed for either surface or wall box mounting.
   c. Room sensors shall have the following options when specified:
      1) Local setpoint adjustment providing a +/- 3 degree (adjustable) range.

2) Timed override request push button with LED status for activation of after-hours operation.
3) Integral LCD display and keypad with the following capabilities:
(a) Display room setpoint.

4. Stand Alone Thermostats
   a. Stand alone, heavy-duty electric thermostats shall be provided for room temperature control, when equipment is not indicated to be connected to the BAS. Thermostats shall be provided with exposed adjustment and function to cycle the equipment fan, electric coil, and/or control valves as applicable to maintain the space temperature setpoint. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.
5. Outside Air Sensors
   a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
   c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
6. Duct Mount Sensors
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
   b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
   c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
7. Low Limit Temperature Sensors
   a. Provide vapor charged sensing element that reacts to coldest 14" of sensor length.
   b. Sensor shall have field adjustable setpoint.

C. Humidity Sensors

1. Acceptable Manufacturers: Johnson Controls, Mamac, or Veris Industries.
   a. Substitutions: Not permitted.
2. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
3. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
4. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
5. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
6. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
7. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

D. Refrigerant Monitor

1. Acceptable manufacturers: General Analysis Corporation, Haloguard, Johnson Controls, MSA Instruments, Toxalert, Trane, or Yokogawa.
   a. Substitutions: Refer to Division 01.
2. Provide calibrated, refrigerant monitor, for specific refrigerant used, capable of detecting concentrations of 10 ppm for low level detection.
3. Provide monitor with audible and visual alarms that activate at a valve corresponding to the TLV of the refrigerants in use. The alarm system shall annunciate visual and audible alarms inside the machinery room and outside each entrance to the room.
4. Monitor shall have the capability of detecting, alarming and controlling from 0-50 ppm. Digital display accuracy shall be within 1 ppm.
5. Monitor shall require only minimum maintenance:
   a. Recalibration no more than once every five years
   b. Zeroing no more than once every week
6. Monitor shall be capable of operation in ambient temperatures from 40 to 105 F.
7. The refrigerant leak detector shall be a standalone device and shall provide a SPDT output to directly energize the refrigeration room exhaust ventilation fans. The detector shall include a sensor or sensors connected to a control panel. Two relay contacts at the control panel shall provide trouble and alarm indication to the Building Automation System. The alarm relay contact shall also directly energize the exhaust fan(s).
8. Multiple sensors shall be required to detect different refrigerants and/or provide proper sensing coverage for the area of the refrigeration room.

E. Smoke Detectors

1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 28. for installation under Division 23. All wiring for air duct detectors shall be provided under Division 28, Fire Alarm System. Coordinate interface with BAS and Fire Alarm System.

2.03 MISCELLANEOUS DEVICES

A. Local Control Panels

1. All control panels shall be factory constructed, incorporating the BAS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch. Provide common keying for all new panels and match keying when existing panels are present.
2. Control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices-such as relays, transducers, and so forth-that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A 120 VAC duplex convenience receptacle and required transformers shall be provided in each enclosure.

B. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75 percent of the rated capacity of the power supply.
2. Input: 120 VAC plus10 percent, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: plus 0.05 percent for 10 percent line change.
5. Load Regulation: plus 0.05 percent for 50 percent load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to each power supply.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Actuation / Control Type

1. Terminal Equipment:
   a. Terminal Units (ATU, UV, etc.) shall have electric damper and valve actuation.
   b. All Terminal Units shall be controlled with HVAC-DDC Controller.

B. HVAC Input Devices - General

1. All Input devices shall be installed per the manufacturer recommendation.
2. Duct Temperature Sensors
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. The sensor shall be mounted to suitable supports using factory approved element holders.
3. Space Sensors
   a. Mounted per ADA requirements.

C. HVAC Output Devices

1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, air flow stations, pressure wells, etc.

3.02 TRAINING

A. The BAS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

END OF SECTION

SECTION 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The HVAC building automation system (BAS) shall consist of a BACnet communications based network of DDC controllers and a Web-based Ethernet 10BaseT operator interface. The system shall have the capability to integrate seamlessly with a BACnet system, communicating on a BACnet IP LAN at up to 10Mbps. Provide system controllers as required to achieve sequence of operation.

B. The system shall utilize on-board flash memory that is non-volatile to power cycles. Application program, graphics and controller parameters must be stored in flash in case of a power outage.

C. Installing, integrating and configuring a network of building controllers including DDC controllers furnished with ground source heat pumps, rooftop dedicated outside air units, and all other equipment shown on drawings and specified herein. Creating HMI graphic interfaces for all DDC controllers installed for the project.

1.02 RELATED WORK

A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Division 26: Electrical

1.03 REFERENCE STANDARDS

A. All work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards
2. National Electric Code (NEC) and applicable local Electric Code
3. Underwriters Laboratories (UL) listing and labels
4. International Building Code
5. NFPA 70 - National Electrical Code
6. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems
7. American National Standards Institute (ANSI)
8. National Electric Manufacturer's Association (NEMA)
9. American Society of Mechanical Engineers (ASME)
10. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
11. Air Movement and Control Association (AMCA)
12. Institute of Electrical and Electronic Engineers (IEEE)
13. American Standard Code for Information Interchange (ASCII)
14. Electronics Industries Association (EIA)
15. Occupational Safety and Health Administration (OSHA)
16. American Society for Testing and Materials (ASTM)
17. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices
18. Americans Disability Act (ADA)
19. ANSI/ASHRAE Standard 195-2004 (BACnet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.04 SUBMITTALS

A. Shop Drawings, Product Data, and Samples

1. At a minimum, submit the following:
   a. BAS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.
   c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
   d. Details of all BAS interfaces and connections to the work of other trades.

1.05 WARRANTY

A. Standard Material and Labor Warranty:

1. From date of substantial completion for the BAS system, provide a one-year labor and material warranty on the BAS.
2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BAS Supplier/Installer at the cost of the BAS Supplier/Installer.

PART 2 - PRODUCTS

2.01 GENERAL

A. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

B. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.02 ACCEPTABLE MANUFACTURERS

A. Automated Logic - WebCTRL, Johnson Controls - Metasys, or Siemens Building Systems - APOGEE.

B. Substitutions: Refer to Division 01.

2.03 OPERATOR INTERFACE

A. Operation. Graphical User Interface shall have full Client-Server capabilities. Server PC shall reside on the data network and be accessible from building intranet or Internet as specified by building owner by a standard Web browser.

1. No other software or data files will be required on client PCs other than a standard Web browser with Java enabled.
2. Server shall be able to connect to remote buildings via telephone modem links and via intranet or Internet across firewalls.
3. Only one Server PC shall be required in the event Owner wants to expand system to future facilities.
4. In the event of failure, the Server PC will not be required to run for normal operation of the DDC system.

B. Communication. Server PC and Building Controller network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer using TCP/IP protocol. GUI software shall have the capability to connect to remote sites via intranet, Internet or over standard telephone lines without the need for supervisory software at remote sites.

C. BACnet Communication. GUI software to provide access to BACnet devices. GUI shall map BACnet devices in the system, enabling consistent supervision tasks between devices. GUI shall allow values from the BACnet devices to be included in schematic pages, and also enable users to make adjustments to and receive alarms from those devices.

D. Hardware. Server PC shall be an industry standard PC and consist of the following as a minimum:

1. Processor: Intel Dual-Core min. 3.0 GHz processor.
2. Memory: 4 GB
3. Hard Drive: 200GB hard disk
4. Network Card: Ethernet network card 100Mb/s.
5. PCI slots: 1 standard size for Ethernet card.
6. Graphics card: Capable of 1280 x 1024 resolution and 8bit/256 colors.
7. USB ports: 1 for alarm printer.
8. Mouse, keyboard and 17 inches flat panel color monitor.
9. Printer: HP Color Laser
10. Operating System: Windows 7 Professional

E. Web Interface

1. The Web server shall gather data from the system and generate Web pages accessible through a conventional Web browser. Each mechanical system shall be depicted by a point-and-click graphic. Operators shall be able to perform all normal operator functions through the Web browser interface.
2. Web Interface functionality shall include as a minimum:
   a. Security and access. Once a valid username and password is entered, user shall have access to all areas of functionality and graphics supported by their security level.
   b. Security and access. Once a valid username and password is entered, user shall have access to all areas of functionality and graphics supported by their security level.
   c. Graphics functionality. Color animated graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters as created on the server from the Web browser.
   d. Data log functionality. User shall have the ability to view multi-trace color graphs and data logs from a Web browser.
   e. Schedule management functionality. Users shall be able to edit time schedules and add, edit or delete exceptions from a Web browser.
   f. Alarm handling functionality. Users shall be able to action and filter any incoming alarms to the system from a Web browser.

2.04 BUILDING CONTROLLER

A. General: Provide Building Controllers (BC) as required to achieve sequence of operation. Provide BCs for HVAC equipment, exhaust fans, and for integrating heat pumps and DOAS units into BAS.

B. Stand-Alone Operation. Each BC on the BAS system shall be of true stand-alone operation. All schedules, data logs, time-clock, alarms graphics and program application shall reside in the controller. BCs that require global or master controllers or devices are not acceptable. Each BC shall be able to broadcast data from one to another or globally throughout the system in a true peer-to-peer way, any data value within the controller to any other controller, specified group of controllers, or globally around the system. Controllers shall build LAN and Internetwork communications across data networks and routers and report communications loss to Operator Interface.

C. Hardware Design. BCs must be modular in design and be mounted on standard DIN Rail for ease of replacement and expansion. Every input or output shall have 2-part connectors provided to facilitate commissioning and replacement. BCs shall have a minimum of 16 IO points and be capable of expanding to a total of 128 input-output points through a series of plug in input-output modules. Input-output modules shall be connected to the BC by a CAN network bus and have the capability of being mounted up to 33 feet from controller.

D. Hardware. Controllers shall be powered by 24VAC or DC and shall be protected by a self-resetting solid state circuit breaker and bus communications shall be protected by a multifuse. Controllers shall be rated to operate at plus or minus 15 percent. Each BC shall have LED status indication of network, bus, power and controller failure.

E. Memory. BC must have flash memory that is non-volatile to power cycles. Application program and controller parameters must be stored in flash in case of a power outage. Controllers using batteries to store program or parameters are not acceptable. A minimum of 16MB of SDRAM and 8MB of Flash memory shall be employed at each controller.

1. Network communication. Each BC shall have a minimum of one 10BaseT Ethernet port as its primary network communications connection and communicate directly on the buildings TCP/IP data network without the need for master control panels. Each BC shall have an on-board Web server that will allow local or remote system control, monitoring and configuration via a standard Web browser.

F. BACnet Communication. Each BC shall be native BACnet and integrate seamlessly with a BACnet system, communicating on a BACnet IP LAN at up to 10Mbps.

G. Real Time Clock. Each BC must have a Real Time Clock. In case of a power outage the time-clock must be maintained for 6 days by a capacitor. Any BC shall have the ability to act as the system time-master. System timemaster will automatically adjust to Daylight Savings Times.

H. Sequencing. BC shall execute all program sequences independent of program size once per second. Controller shall execute all program and mathematical functions and PID Loops as described in Section 2.4.E.

I. Scheduling. BC controllers shall provide the following schedule options as a minimum. All schedule, exception or holiday changes shall be configurable from the Web browser interface or the Operator Interfaces.

1. Optimized start-stop. One optimum start-stop function shall be assigned to any schedule within the controller. Optstart functions shall be self-learning and shall have operator adjustable start-stop limits.

J. Data Logs. Each BC shall be able to log any data within a controller at one second, 1 minute, 5 minute, 10 minute, 15 minute, 20 minute, 30 minute, 1 hour, 6 hour or 24 hour intervals. 1000 points of data must be held in data log until last value is overwritten. Multiple data logs with differing intervals shall have the capability of being attached to any data point. Any data log shall be viewed from the browser or Operator Interfaces. Data logs shall be viewed in graphical or text format by the operator.

K. Alarms. BCs shall generate alarms configured by the programming tool. Alarms shall be sent to the operator interface workstation. In event that operator workstation is off-line for any reason, alarms shall be sent to the system Display Panel, via email or cell phone text message directly from the controller across the data network to any internal or external email or cell phone email address. Alarms shall have the capability of being sent to different locations depending on schedule status or operator defined alarm group. An internal alarm log shall record the last 50 alarms generated by controller. Alarm log shall be viewed from the browser or Operator Interfaces.

L. Graphics. Each BC shall be capable of containing graphics pages of the connected mechanical equipment as well as the application program. Dynamic data points shall be shown on graphical backdrops representing all hardware and software points within the controller. Graphics pages shall contain links to other graphics pages within the controller, other building controllers on the BAS system, any intranet or Internet Website and any valid email address. Controller shall have the ability to add any user defined text to any graphics page. Graphics pages shall be accessible from any standard Web browser on the intranet or Internet.

M. Controller Input-Outputs. All controller inputs and outputs may be overridden on-off or by any analog value of the operator's choice via a standard Web browser. In addition an override timer may be initiated to switch all inputs-outputs to automatic operation after user has logged out.

1. Controller inputs shall all be Universal Inputs and be selectable by moving a jumper for the required input type. Controller shall support thermistor, 0-10vdc voltage and 0-20 or 4-20mA current inputs with 12-bit resolution. All digital inputs shall be volt free contacts capable of pulse counting up to 30 pulses per second. When input is selected for digital, LED shall indicate when contact is closed. All sensor scaling and curves shall be software configurable.
2. Controller shall have analog or Form C relay outputs. Analog outputs shall be modulating 0-10Vdc and current limited to 20mA as required to properly control output devices. All analog outputs shall have modulating LED's to indicate output voltage. Analog outputs shall have 11-bit resolution as a minimum. Form-C relay outputs shall have common, normally-open and normally-closed contacts. All relay outputs shall have LED's to indicate relay status.
3. Protection. All input and outputs shall have over-voltage protection built-in to protect main board from failure.

N. PID Loops. Loops shall have the capability to be sequenced once per second and switched between occupied and unoccupied setpoints. In addition, a manual override and level may be initiated and implemented in logic. PID Loops shall support drift-limit alarm and controlled input alarms. Should controlled input fail or alarm, one of the following actions shall be initiated:

1. Maintain output at level when sensor failed and return to normal operation on alarm clear.
2. Automatically go to pre-defined controlled input value and return to normal operation on alarm clear.

3. Automatically go to pre-defined loop output level and return to normal operation on alarm clear.
4. Automatically go to pre-defined loop output level and stay there until a alarm clears and a manual override is initiated by operator.

O. Web Browser. In addition, the Web browser interface shall support the following functions on the building controller other than outlined above:

1. Configuration and editing of any function or programming module stored within the controller.
2. Operator override of any function module or software point within the controller in addition to the physical input-outputs.
3. Support of navigation through logic flow diagram to support commissioning via the browser.
4. Display lists of each type of function or programming module within the controller in numerical order and highlight any current alarm points in flashing red format.
5. Operation will be mouse driven point and click between views, graphics and modules. Values shall be changed by drop-down menus or by clicking and typing in open fields.

2.05 BACNET UNITARY CONTROLLERS

A. Provide fully programmable BACnet VAV controllers with or without an on-board actuator. Both shall include a built-in airflow sensor and a pressure transducer. BACnet VAV controllers shall have a pre-loaded strategy and also shall be fully programmable.

B. Provide fully programmable BACnet unitary controllers with universal I/O for terminal equipment control of RTU's, HP, FCU, UV, and others.

C. Network Communication. As a BACnet controller, the unitary controllers shall integrate seamlessly with the building control system, communicating at up to 76.8Kbps on a BACnet MS/TP LAN.

D. Hardware Design. BACnet VAV controller actuator shall be left or right mountable with ability to set actuator to clockwise or counter-clockwise rotation. BACnet unitary controllers shall be DIN-rail mounted and have software-configurable inputs and outputs allowing for compatibility with a wide range of HVAC and other control and monitoring applications.

PART 3 - EXECUTION

3.01 BAS REQUIREMENTS

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system including each ground source heat pump and DOAS unit with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library. Provide a floor graphic of each area of the building with capability to see temperature and humidity of each space or system and allow penetration to individual heat pumps, VAV boxes, etc. from the graphic floor plan.
2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

B. Custom Reports:

1. Provide custom reports as required for this project

C. Actuation / Control Type

1. Primary Equipment:
   a. Controls shall be provided by equipment manufacturer as specified herein.
2. Terminal Equipment:
   a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
   b. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.02 INSTALLATION

A. BAS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Supplier/Installer unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Supplier/Installer. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Supplier/Installer, the Supplier/Installer shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BAS Line Voltage Power Source
1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BAS Raceway
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2 inch..
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Project Engineer/MDOT Architect.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide UL rated fire stopping for all penetrations used by dedicated BAS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using UL approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BAS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

F. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

G. BAS Panel Installation

1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BAS Supplier/Installer shall be responsible for coordinating panel locations with other trades including work specified under Divisions 23 and 26.

3.03 TRAINING

A. The BAS Supplier/Installer shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

END OF SECTION

SECTION 23 23 00 REFRIGERATION PIPING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping, valves and fittings for refrigerant piping systems shown on drawings.

1.02 RELATED REQUIREMENTS

A. Section 23 05 00 - Common Work Results for HVAC

B. Section 23 05 29 - Hangers for HVAC Piping

C. Section 23 07 00 - HVAC Insulation

1.03 REFERENCE STANDARDS

A. Comply with the requirements of ANSI B9.1, Code for Refrigerant Systems.

1.04 SUBMITTALS

A. Submit for review manufacturer's product data for refrigerant piping system components.

1.05 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. Refrigerant: R-410A as defined in ASHRAE Std 34.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Piping: Type "L" ACR hard copper, ASTM B280.

B. Fittings: Wrought copper.

C. Solder: Silver solder, or phos-copper solder having a melting point of 1125 degrees F or higher.

D. Valves:

1. Manufacturers: Flomatic, Hanson Technologies Corp., or Henry Technologies.
2. Diaphragm Packless Valves:
   a. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
3. Packed Angle Valves:
   a. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

4. Ball Valves:
   a. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.
5. Service Valves:
   a. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

E. Solenoid Valves:

1. Manufacturers: Flow Controls (Emerson Climate Technologies), Parker Hannifin, or Sporlan Co.
2. AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi. Suitable for the type of refrigerant used.

F. Refrigerant Filter Dehydrator and Moisture Indicator

1. Dehydrator: Sporlan Co. Catch-All, or equal, with replaceable core, type, of size recommended by manufacturer for maximum design tonnage.
2. Moisture Indicator: Sporlan Co. See-All, type SA-125, or equal.

G. Pressure Regulators

1. Manufacturers: Hansen Technologies Corp., Parker Hannifin, or Sporlan Co.
2. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

H. Pressure Relief Valves

1. Manufacturers: Hansen Technologies Corp., Henry Technologies, or Sherwood Valve/Harsco Corp.
2. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

I. Expansion Valves

1. Manufacturers: Flow Controls (Emerson Climate Technologies), Parker Hannifin, or Sporlan Co.
2. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.
3. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

J. Electronic Expansion Valves

1. Manufacturers: Flomatic Valves, Parker Hannifin, or Sporlan Co.
2. Valve:
   a. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.

3. Evaporation Control System:
   a. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.
4. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

K. Receivers

1. Manufacturers: Henry Technologies, Parker Hannifin, or Sherwood Valve/Harsco Corp.
2. Internal Diameter 6 inch and Smaller:
   a. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.
3. Internal Diameter Over 6 inch:
   a. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

L. Flexible Connectors

1. Manufacturers: Circuit Hydraulics, Ltd., Flexicraft Industries, or Penflex
2. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

M. Check Valves

1. Manufacturers: Hansen Technologies Corp., Parker Hannifin, or Sporlan Co.
2. Globe Type:
   a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.
3. Straight Through Type:
   a. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

N. Strainers

1. Straight Line or Angle Line Type:
   a. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

O. Pipe Supports:

1. Pipes subject to vibration: Isolation type brackets
2. Pipes not subject to vibration: Anvil No. CT-95 or equal
3. Riser clamps: Anvil CT-121 or equal

P. Escutcheons: Chrome plated escutcheons sized for pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Make solder joints with carbon dioxide or nitrogen passing through joints being soldered. Insure a clean, tight system. Pull a clean rag through each piece of tubing after cutting or reaming.

B. Route piping in orderly manner, parallel or perpendicular to building structure, and maintain gradient.

C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

E. Install refrigeration specialties in accordance with manufacturer's instructions.

F. Insulate piping and equipment.

G. Install pipe and hangers in accordance with hanger manufacturer's printed instructions.

3.02 LEAK TESTING

A. Test for leaks by use of carbon dioxide or nitrogen and a liquid soapsuds solution. Correct leaks found.

B. Pressurize system, with carbon dioxide or nitrogen, to 300 psig on the high side, and 200 psig on the low side, and test for leaks. Then test for leaks using a Halide leak detector. Correct leaks found.

C. Evacuate system and charge with specified refrigerant until the manufacturer's recommended operating presssure is reached.

3.03 SAFETY CODE

A. System shall be in accordance with ANSI B9.1 Code for Refrigeration Systems.

END OF SECTION

SECTION 23 31 13 SHEET METAL DUCTWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rectangular Metal Ducts

B. Round Ducts

C. Duct Sealant Material

1.02 RELATED REQUIREMENTS

A. Division 07 - Firestopping

B. Division 09 - Painting and Coating

C. Section 23 01 30.51 - HVAC Air Duct Cleaning

D. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

F. Section 23 07 00 - HVAC Insulation

G. Section 23 31 14 - Sheetmetal - Special Ductwork

H. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE STANDARDS

A. ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

E. SMACNA 1966 - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

F. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

H. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

I. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Submit material/product data in accordance with the provisions of Division 01.

B. Coordinated Shop Drawings shall be completed for all areas prior to installation of the major trades. The coordinated shop drawings are not required to be submitted except as noted above. A coordinated shop drawing attempt shall be submitted with any request to the owner or design team to assist with overhead coordination conflicts.

C. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA standards. For each sheet metal system furnished on the project include:

1. Duct material
2. Duct gauge
3. Rod diameter and type
4. Sealant type and material by pressure classificaiton
5. Attachment method

D. Field Conditions

1. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturer.
2. Maintain temperature within acceptable range during and after installation of duct sealants.

1.05 QUALITY ASSURANCE

A. Provide an installed duct system which will supply the air quantities indicated by the drawings and have the lowest possible friction loss with the least possible leakage loss. System static pressure loss for each system shall not exceed that which is indicated in the equipment schedule as external static pressure or in the fan schedule as static pressure and shall include the losses of all accessories. Friction losses shall be minimized by reduction in the number of offsets and elbows by pre-planning the duct system installation and coordination with other trades to prevent interferences. Maintain access to accessories requiring maintenance, service, and inspection. Radius elbows are preferred for turns to minimize friction, noise, and vibrations.

B. Provide and/or construct materials, ductwork, joints, transformations, splitters, dampers, and access doors as specified herein for the sheet metal ductwork as shown on drawings.

C. SMACNA Manual: Sheet Metal Tradesman shall have access on the construction site to "HVAC Duct Construction Standards". Comply with applicable provisions of the SMACNA Manual and more stringent requirements of this specification.

D. Quality control involves not only the general performance requirements for air ducts, but also quality workmanship which includes layout pre-planning so that offsets, rises, falls, elbows, fittings, etc., are minimized or eliminated. General performance requirements for ducts include:

1. Dimensional stability (shape deformation and strength)
2. Containment of the air being conveyed (leakage control). See Part 3 of this specification for leakage testing.
3. Vibration (fatigue and appearance)
4. Noise (generation, transmission, or attenuation)
5. Exposure (to damage, weather, temperature extremes, flexure cycles, wind, corrosive atmospheres, biological contamination, flow interruption or reversal, underground or other encasement conditions, combustion, or other in-service conditions)
6. Support (alignment and position retention)
7. Seismic restraint
8. Thermal conductivity (heat gain or loss and condensation control)

E. Provide galvanized duct materials which meet applicable requirements of local and state codes, whichever is the most stringent.

F. Support ductwork in accordance with applicable requirements of local and state codes and details on drawings.

G. Emboss fittings with material gauge, manufacturer, and type material.

H. Sealers, liners, pre-insulated jackets and flexible ducts shall comply with a flame spread rating of 25 or less and a smoke developed rating of not over 50.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Sheet metal ductwork, angles, bar slips, hangers, and straps: Galvanized, prime quality steel sheets.

B. Screws: Cadmium plated.

C. Joint and Seam Sealers:

1. Acceptable Manufacturers:Carlisle Hard Cast Duct Sealants; Design Polymerics; Ductmate Industries; Childers (HB Fuller Construction Products).
2. Meets Seal Class A.
3. Water resistant, mold and mildew resistant
4. Suitable for indoor use and outdoor use with UV inhibitors.
5. Surface burning characteristics: Flame spread of zero and smoke developed of zero when tested in accordance with ASTM E84.
6. UL Listed and Labeled to UL181.
7. Suitable for metal duct, duct fabric and flex duct.
8. For Pressure Classifications 2" and less, indoors, use Carlisle Flex-Grip 550 for joints and seams.
9. For active live air flow systems, use Carlisle Aluma-Grip AFT-701, heavy-duty rolled mastic sealant on joints and seams.
10. Pressure sensitive foil tape is not acceptable and shall not be used as a duct joint sealer.

D. Duct Sealing:

1. All longitudinal and transverse joints, seams, taps, spin-ins, branch connections, access doors, access panels, duct connections to equipment and duct sidewall penetrations, regardless of pressure classification, shall be sealed with duct sealer. Follow SMANCA Table 1-2, Seal Class A for all supply, return, exhaust, and make-up air ductwork.
2. See Leakage Testing of Installed Systems requirements in Part 3.

E. Sheet metal and air duct accessories: As specified in Section 23 33 00.

2.02 PRESSURE CLASSIFICATION

A. Ductwork where maximum dimension is less than 97" shall be constructed based on applicable pressure classification in accordance with SMACNA Manual including sheetmetal gauge, reinforcement gauge and spacing.

B. Construct the following for 1 inch pressure classification, Table 1- 4:

1. Supply ductwork downstream of air terminal units
2. Low pressure supply ductwork to reheat coils
3. Low pressure supply, return, and outside air ductwork at fan coil units

C. Construct the following for 2 inches pressure classification, Table 1- 5:

1. Return ductwork
2. Exhaust ductwork
3. Make-up air ductwork

2.03 RECTANGULAR DUCTWORK

A. Transverse Joints:

1. "S" and drive construction for 1 inch and 2 inches w.g. pressure classification.
   a. Provide duct gage and reinforcing angles in accordance with Table 1-11
2. Duct Connection System: Connection system as manufactured by Ductmate or Nexus shall incorporate gasketed joints, metal cleats and bolted corners. Minimum metal gauge shall be 24 gage. Connection systems may be used for all pressure classifications.

B. Longitudinal Seams: Pittsburgh Lock

C. Transitions:
1. Do not exceed 1 inch in 7 inches of slope for increase-in-area transitions.
2. Do not exceed 1 inch in 4 inches of slope for decrease-in-area transitions, 1 inch in 7 inches is preferable.
3. Do not exceed 45 degrees on the entering or leaving side for angle of transitions at connections to equipment without the use of approved turning vanes.

D. Elbows:

1. Fabricate ells using one of the following specifications: The fabrication methods are listed in order of preference. Use radius elbows where ever possible. Use square elbows only when available space prevents the use of radius elbows.
   a. Unvaned, long radius elbow with the throat radius equal to 3/4 of the width of the duct and with a full heel radius.
   b. Six inch throat radius with full radius, single thickness vanes and full heel radius. Maximum unsupported length of vanes shall be 36". Securely fasten vanes to runners. Secure vanes in stable position. Construct vane edges to project tangents parallel to duct sides.
   c. Square elbows with airfoil, double thickness turning vanes.
2. Turning vanes:
   a. Acceptable manufacturers: Aero Dyne
   b. Substitutions: Refer to Division 01.
   c. True airfoil design; smoothly-rounded entry nose with extended trailing edge. Generated sound power level shall not exceed 54 decibels in band 4 at 2000 FPM in a 24 inches by 24 inches duct.
   d. Fabricate assemblies with Aero Dyne Co. side rails; install vanes on design centers of 2.4 inches across the full diagonal dimension of the elbow.
   e. Submit Aero Dyne product and performance data for review.
      1) As a possible VE substitution only, submit, for owner and engineer review, proposed alternate vane manufacturer's data including independent performance test data for pressure loss and generated sound power levels. Generally, alternate vanes, including SMANCA shop vanes, will not be accepted unless performance and generated sound power levels meet or exceed the Aero Dyne vane.

E. Branch Connections:

1. Pressure classification 2 inches and less:
   a. Rectangular branch from rectangular main: 45 degree entry with all corners closed as shown in Figure 2-8
   b. Round branches: Spin-in fitting without scoop.
   c. Parallel flow branches: See Figure 2-7.
   d. Space duct joints to avoid cutting them for branch take offs and outlet collars.

2.04 ROUND DUCTWORK

A. Applicable for pressure classification above 2 inches..

B. Round Duct (Spiral Pipe) and Fittings:

1. Manufactured from galvanized steel meeting ASTM A653/A653M. Construction shall be in accordance with SMACNA HVAC Duct Construction Standards.
2. Use appropriate seams made to eliminate leakage based on pressures for which system has been designed. Longitudinal seam duct to have fusion welded butt seam.
3. Fittings and couplings shall have minimum gauges specified by SMACNA Manual.
4. Fittings shall have continuous welds along all seams. Divided flow fittings shall be manufactured as separate fittings, not as tap collars welded into spiral duct sections.
5. Ninety degree tees (conical) and 45 degree laterals (wye) up to and including 12 inches diameter tap size to have radiused entrance into the tap, produced by machine or press forming. Entrances to be free of weld build-up, burrs, or irregularities.
6. Elbows in diameters 3 inches thru 8 inches shall be two section stamped elbows. Other elbows shall be gored construction with all seams continuous welded. Fabricate to center line radius of 1.5 times the cross sectional diameter. Elbows, not die-stamped, shall be fabricated as follows:
   a. Less than 30 degree angle: minimum 2 gores
   b. Between 30 thru 60 degrees: minimum 3 gores
   c. Over 60 degrees: minimum 5 gores
7. Two piece mitered elbows shall not be used.
8. Tees shall be conical. Saddle taps or straight tees shall not be used.
9. The leading edge of all vanes in ducts over 20 inches diameter shall be hemmed with 1/2 inch foldback. Turning vanes in ducts over 24 inches shall be reinforced by stays or sectional construction to limit unsupported length to 24 inches. Vanes shall be a minimum of 20 gage.
10. Reduction of divided flow fittings to conical span section in the 36 common reductions in sizes 4 inches thru 22 inches.
11. Spun bellmouth connections are to be used at each round take-off from plenum.
12. Galvanized areas damaged by welding to be coated with corrosion resistant aluminum paint.

C. Couplings for Round Medium-Pressure Duct (over 2 inches w.g.):

1. Pipe-to-pipe joints shall be sleeve couplings, reinforced by rolled beads.
2. Pipe-to-fitting joints shall be slip-fit of projecting collar fitting into pipe.
3. Insertion length of sleeve coupling and fitting collar shall be 2 inches minimum.

PART 3 - EXECUTION

3.01 INSTALLATION, APPLICATION, ERECTION

A. Do not exceed 45 degrees for easement transition angle.

B. Seal all transverse and longitudinal joints and seams and duct wall penetrations with approved sealer in accordance with manufacturer's directions regardless of pressure class.

C. Counterflash ductwork penetrating roof.

D. Support round ducts from building structure with galvanized steel hangers in accordance with SMACNA. Secure hangers to masonry portion of building by means of inserts or other acceptable anchors.

E. Secure hangers to steel structure members by means of C-clamps. Vertical risers, and other duct runs where methods of support specified above are not applicable, shall be supported by angle brackets as shown in SMACNA manual.

F. Where appropriate based on duct weight, support rectangular ducts by minimum, 1 inch by 18 gage, galvanized band iron or minimum 3/8" galvanized rod hangers attached to reinforcing angles and spaced same as reinforcing angles. Design hangers, reinforcing angles and other components to support weight of duct and insulation. Secure hangers to concrete beam or slab by adequately sized inserts, anchor shield and bolt, toggle bolt, or expansion bold.

G. Attach hangers to ductwork using sheet metal screws.

H. Space hangers approximately 8 feet along the duct for ducts under 60 inches. For ducts over 60 inches and larger and heavier sections, such as welded duct and sound absorbers, space hangers at approximately 4' -0” intervals.

I. Hangers and bracing used with ductwork shall be galvanized.

J. Provide smooth insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. Provide metal collar equivalent in depth to insulation thickness. Access door locks and damper handles shall be free from mastic or sealant.

K. In addition to the requirements above, add supplemental bracing as necessary to prevent sagging and drumming, and/or vibration.

3.02 CLEANING

A. Clean mechanical system thoroughly to assure all foreign matter and dirt is removed.

3.03 AIR MOVING EQUIPMENT OPERATION DURING CONSTRUCTION

A. The use of new or existing air handling units, fans, or other permanent air moving equipment during construction is prohibited unless approved by the owner in writing. If approved for use during construction, the following procedures shall be followed:

1. The contractor shall protect the interior of all ductwork, air handling units, and other equipment from the accumulation of dirt and dust and other contaminants. If the permanent equipment cannot be adequately protected, temporary air moving/ conditioning equipment and distribution systems shall be utilized as required for finishing trades.
2. Provide all specified filters in equipment to be operated as well as temporary filters on all return and exhaust air grilles, open ductwork, and transfer openings in the work area.
3. The contractor shall remove all filters used during construction and replace them with new filters prior to test and balance work and prior to substantial completion.

4. If the ductwork and/or equipment is found to be contaminated at any point during construction, an independent NADCA certified contractor shall be retained to clean the ductwork and/or equipment at the contractors expense. Refer to Section 23 01 30.51.
5. System operating temperatures shall be maintained to avoid condensation on ductwork and equipment surfaces. New or existing insulation found damaged shall be replaced.
6. Coordinate use of air handling equipment with ICRA plan, if applicable. Maintain required pressure relationships in construction areas adjacent to occupied areas.

3.04 LEAKAGE TESTING OF INSTALLED SYSTEMS

A. Test duct for leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Use prescribed test kit containing test blower, two U-tube manometers and calibrated curve attached to the orifice tube assembly.

B. Pressure testing shall include taps/take-offs to air terminal units in medium pressure ductwork and taps/take-offs to air devices in supply, return, and exhaust ductwork.

C. Pressurize all installed duct systems for each pressure class to maximum pressure for fabrication classification. The leakage amount shall not exceed the allotted amount for the pressure class or the allotted amount for that portion of the system as follows:

1. 1 inch Pressure Class - Leakage Class 6; Max. Leakage Factor - 6.0 CFM/100 SF
2. 2 inch Pressure Class - Leakage Class 6; Max. Leakage Factor - 9.4 CFM/100 SF

D. All ductwork shall be leak tested first before being enclosed in a shaft or above other inaccessible areas.

E. Correct leaks found in excess of allowable limits. Retest until acceptable leakage is witnessed.

F. Have test results available for review on a progressive and final basis. Include all test results in project closing file along with name, signature, and date of independent witness to testing. Test results shall show preliminary and final test results and include all calculations used to determine system compliance with the maximum specified leakage rate.

3.05 AIR TEST AND BALANCE

A. Prepare the system for tests as specified in Section 23 05 93 and correct deficiencies found by the Test and Balance firm.

B. Duct dimensions shown on drawings indicate inside clear dimensions. Make calculation allowances for duct requiring internal sound lining, or insulation to provide "inside clear" (IC) dimensions.

END OF SECTION

SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.

B. Duct test ports.

C. Fire dampers.

1.02 RELATED REQUIREMENTS

A. Division 07: Firestopping.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 31 13 – Sheet Metal Ductwork.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

B. SMACNA 1966 - HVAC Duct Construction Standards; 2005.

C. UL 181 - Factory-Made Air Ducts and Air Connectors; 2013.

D. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

F. AMCA 511 - Certified Ratings Program-Product Rating Manual for Air Control Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Division 01 for submittal procedures.

B. Product Data: Submit manufacturer's product data for review. Include electrical characteristics and connection requirements where applicable.

C. Project Record Drawings: Record actual locations of volume dampers, rated dampers, access doors, and test holes.

PART 2 - PRODUCTS

2.01 FIRE DAMPERS

A. Acceptable manufacturers: Air Balance, Greenheck, Ruskin, or Nailor.

1. Substitutions: Refer to Division 01.

B. Fabricate in accordance with NFPA 90A, UL 555, and as indicated.

C. Material: Galvanized steel or 304 stainless steel to match adjacent ductwork.

D. Dampers shall be curtain or multi-leaf type, 1-1/2 hour rated, suitable for horizontal or vertical mounting. Blades for curtain type dampers shall be stored out of the airstream.

E. Dampers shall meet Class 1 leakage rates and be dynamic rated for closure against airflow up to 2000 FPM in low pressure systems and up to 4000 FPM in medium pressure systems.

F. Dampers shall have a UL 555 differential pressure rating of 4 in. wg.

G. Provide damper with fusible link causing the damper to lock in the closed position at 165 degrees F.

H. Provide manufacturer's round to horizontal duct adapter as required.

I. Maximum pressure drop shall be as follows:

J. Damper pressure drop shall not exceed 0.05 in. wg. at 1500 FPM or 0.10 in wg. at 2000 FPM.

K. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance in accordance with AMCA 511.

2.02 SLEEVES FOR RATED DAMPERS

A. Unless otherwise required by the authority having jurisdiction, sleeves for fire dampers, smoke dampers and combination fire and smoke dampers shall be provided by the damper manufacturer and be of rigid type construction recommended in Schedule 2 of SMACNA Publication for "Fire Damper and Heat Stop Guide for Air Handling Systems". Use 16 gage for ducts 24 inches or less in diameter or either rectangular dimension and 14 gage for ducts over 24 inches. Provide minimum 18 inches long sleeves. Coordinate required length with wall thicknesses.

B. Install 1-1/2 inch by 1-1/2 inch by1/8 inch angle bar on four sides of sleeves and both sides of wall. Fasten angles to sleeve only. Do not fasten to the wall.

2.03 DUCT ACCESS DOORS

A. Acceptable manufacturers: Ruskin, SEMCO, Greenheck, Ward Industries, or DuctMate.

1. Substitutions: Refer to Division 01.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

C. Duct Access doors shall have a leakage classification ratings of 3 inches w.g. positive and 2 inches w.g. negative for duct construction of 2 inches and less. Duct access doors shall have a leakage classification rating of 10 inches w.g. positive and 10 inches w.g. negative for duct construction of 4 inches w.g. and greater.

D. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, provide minimum 1 inch thick insulation with minimum 24 gauge sheet metal cover on each side.

1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Latches shall permit easy removal of access door while maintaining positive closing and minimum leakage. Provide continuous sponge rubber gaskets for all doors.

E. Provide insulated doors in ductwork for access to service equipment such as airflow measuring stations (each side), casing mounted coils (each side), control dampers, duct mounted coils (each side), duct mounted smoke detectors, humidifiers, rated dampers, and elsewhere as noted on drawings.

F. Size access doors as follows:

1. Duct sizes under 12 inches Door sized sufficient to service equipment or replace fusible link.
2. Duct sizes 12 inches to 20 inches: 12 inches by 12 inches door size.
3. Duct sizes 20 inches to 36 inches: 18 inches by 18 inches door size.
4. Duct sizes above 36inches: 24 inches by 24 inches door size.

G. Provide reinforced wire glass view windows (min. 12 inches by 12 inches) in access doors at humidifiers.

H. Mount doors in rigid frame of at least 22 gage formed galvanized steel or aluminum.

I. Use angle iron bracing as required to make the door frame a rigid assembly.

J. In accordance with NFPA 90A, identify each access door with minimum 1/2 inch high printed or stenciled letters as 'Fire Damper', 'Smoke Damper', or 'Combination Fire/Smoke Damper'.

2.04 DUCT TEST PORTS

A. Temporary Test Port: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps. Repair insulation and vapor barrier.

B. Permanent Test Port: Factory fabricated, air tight flanged fittings with screw cap equal to Carlisle PTP-1. Provide extended neck fittings to clear insulation.

2.05 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction equal to Carlisle Dynair Duct Protection Film. Use to cover all open ends of stored or hung ductwork during construction.

1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation before break: 325 percent, minimum.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories in locations specified and as shown on drawings in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 23 31 13 for duct construction and pressure class.

B. Provide insulated doors in ductwork for access to service equipment such as airflow measuring stations (each side), casing mounted coils (each side), control dampers, duct mounted coils (each side), duct mounted smoke detectors, humidifiers, rated dampers, and elsewhere as noted on drawings.

C. Provide insulated access doors in kitchen exhaust ducts for cleaning and inspection in accordance with NFPA 96.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at all points on supply, return, and exhaust systems where branches are taken from larger ducts.

H. Where diffusers or grilles and registers are not provided with volume dampers, install spin-in fitting with balance damper in duct run-out.

I. Provide all screws, bolts, nuts, inserts, and material required for attaching sheetmetal to duct, walls, floors, and ceilings.

3.02 TESTING

A. Check work for satisfactory installation and performance.

B. Insure that adequate access does in fact exist for rated dampers, that damper blade movement is not restricted, and that damper operator motors are not hindered in operation by proximity to walls or other objects.

C. Check duct connections at access doors for air leakage or condensation. Correct deficiencies found.

END OF SECTION

SECTION 23 34 16 CENTRIFUGAL IN-LINE FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Forward curved or backward inclined type in-line centrifugal fans.

B. Ceiling and cabinet in-line fans

1.02 RELATED REQUIREMENTS

A. Section 23 05 00 - Common Work Results for HVAC

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 23 05 48 - Vibration Isolation

D. Division 26: Electrical

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

C. AMCA 211 - Certified Ratings Program - Product Rating Manual for Fan Air Performance

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans

E. AMCA 301 - Methods of Calculating Fan Sound Ratings From Laboratory Test Data

F. ANSI/ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings

1.04 SUBMITTALS

A. Submit manufacturer's product data for review in accordance with the provisions of Division 01.

B. Fan curves shall include entire range of RPM curves, scheduled operating point, brake horsepower, motor horsepower, and sound performance data.

1.05 QUALITY ASSURANCE

A. Certify fans performance in accordance with AMCA Certified Air and Sound Rating Criteria, Standard 210, 211, and 301.

B. Sound Power data: Rated in accordance with AMCA 300.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data as specified in Division 01.

B. Include instructions for lubrication, motor, spare parts list, and wiring diagrams.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acme, Twin City, Greenheck, Loren Cook, PennBarry, or Trane.

B. Substitutions: Refer to Division 01.

2.02 IN-LINE CENTRIFUGAL FANS

A. Wheels and Housings: Wheel diameters and outlets areas sized in accordance with AMCA Standards. Fans shall be statically and dymanically balanced. Housing shall contain two access doors or removable access panels for maintenance. Housing shall be insulated with 1" matt-faced non-eroding duct liner or fibre-free liner.

B. Drive arrangements: Belt driven and conform with AMCA Standard 2404, and as shown on drawings. Sheave shall be adjustable, cast iron, machined, keyed, securely attached and sized for 150% of the brake horsepower at its rated maximum speed.

C. Housing Construction: Galvanized steel with square duct mounting collars. Rivet blades to galvanized steel shroud.

D. Painting: Factory applied, rust-resistant paint. Provide standard factory color unless noted otherwise.

E. Shaft: Solid hot rolled steel, ground and polished mounted in permanently sealed lubricatable pillow block ball bearings. The first critical speed shall be at least 25 percent over the maximum operating speed.

F. Mount relubricable anti-friction, self-aligning pillow block ball bearings on Class I fans and spherical roller type bearings on Class II and III fans. Position bearing supports to directly oppose drive belt tensions and transmit loads to the fan base.

G. Bearings shall be factory tested and have a minimum L-10 life in excess of 100,000 hours at maximum operating speed.

H. Motor: Adjustable slide rail on a steel isolation base mounted out of the air stream. Provide NEMA-1 disconnect switch, factory wired to motor. Provide EC motor where scheduled, including transformer, remote dial, constant pressure control.

I. Provide fan type, capacity, direction of rotation, discharge direction, and arrangement as shown on drawings. Provide steel fan base for Arrangement 9 and 10 fans. Provide fan base for Arrangement 3 fans under Section 23 05 48 - Vibration Isolation. Prime-coat paint bases.

J. Provide spark-proof constructed fans with explosion proof motors where scheduled.

K. Provide OSHA approved expanded metal or removable solid steel belt guards with aligned opening for checking fan shaft speed.

2.03 CEILING AND CABINET FANS

A. Acceptable manufacturers: Greenheck, Loren Cook, Acme, PennBarry

B. All fans shall bear the AMCA Certified Ratings program Sund and Air Performance seal and be UL Listed.

C. Construction: Heavy gauge galvanized steel with a 1/2 inch acoustical insulation liner.

D. Fan: Forward curved centrifugal type, polypropylene or galvanized construction; dynamically balanced.

E. Motor: Direct drive, mounted on vibration isolators. Disconnect shall be internal of the plug-in type.

F. Inlet Grille: High-impact non-yellowing polystyrene or aluminum.

G. Outlet collar: Adaptable for horizontal or vertical discharge with aluminum backdraft damper.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fans in locations shown on drawings and in accordance with manufacturer's instructions.

B. Connect fans to inlet and outlet ductwork with flexible connections.

C. Fans for outdoor mounting shall be completely weatherproofed, with a fan motor and drive weather cover, and receive a second factory coat of paint.

3.02 TEST AND ACCEPTANCE

A. Start-up and checkout fan for proper motor phasing, alignment, and vibration free operation. Improperly aligned fans to be connected. Change unmatched belts.

B. Test fans in accordance with Section 23 05 00.

C. Demonstrate system operation to Owner's maintenance personnel and instruct them in operational requirements.

D. Verify that, where applicable, fans are interlocked with supply (and exhaust) fans as required by control drawings.

END OF SECTION

SECTION 23 81 35 VARIABLE REFRIGERANT FLOW SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant flow system including:

1. Outdoor condensing units
2. Indoor evaporator units (fan coil units)
3. Branch selector units
4. Refrigerant piping
5. Control panels and wiring

1.02 RELATED REQUIREMENTS

A. Section - 23 23 00 Refrigerant Piping and Specialties

B. Section - 23 31 13 Sheetmetal Ductwork

C. Section - 23 07 00 HVAC Insulation

D. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

B. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings

C. NFPA 70 - National Electrical Code

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section. Require attendance of all affected installers and trades.

1.05 SUBMITTALS

A. Submit product data and manufacturers information in accordance with the provisions of Division 01.

B. Include at a minimum:
1. Performance data
2. Product data
3. System layout
4. Pipe routing and sizing
5. Refrigerant type
6. Cooling and Heating capacities
7. Electrical requirements and wiring diagrams
8. Equipment efficiencies
9. Weights and dimensions
10. Controls and options
11. Fan curves
12. Installer Certificates of Manufacturer's Qualifications

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

C. The VRF system is produced in an ISO 9001 and ISO 14001 facility. The system is factory tested for safety and function.

1.07 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

1.08 WARRANTY

A. The units shall have a manufacturer's warranty for a period of one (1) year from date of substantial completion.

B. The compressors shall have a labor warranty of six (6) years from the date of substantial completion.

C. The equipment shall include a parts warranty for 10 years including the compressor.

D. All warranty work shall be performed by a manufacturer's factory trained service personnel.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin, Mitsubishi, LG or approved equal.

B. Daikin product model numbers are used to establish product type, configuration and quality - not to limit competition. Manufacturer is responsible for pipe sizes, routing and configuration.

C. Contractor is responsible to furnish all parts, accessories and adidtional systems required for a completely operational and functioning system.

2.02 SYSTEM DESCRIPTION

A. A variable capacity, heat recovery/heat pump air conditioning variable refrigerant volume type split system. The system shall consist of multiple evaporators using PID control, connected to a single condenser unit or multiple condenser units but not to exceed what is permitted by local code or manufacturer system allowances. The condenser shall be a direct expansion (DX), air-cooled heat recovery/heat pump air-conditioning system, variable speed driven compressor multi zone split system, using R-410A refrigerant. The condensing unit may connect an indoor evaporator capacity up to the manufacturer's maximum condensing unit capacity. All indoor units are each capable of operating separately with individual temperature control.

B. For outside air system operation, the fan coil unit shall be capable of either cooling or heating, and demumidification of the outside air stream. The fan coil assembly shall be able to provide set temperature and humidity level independently via a local remote controller, an individual controller, or a BAS interface.

C. Branch selector (BS) boxes, if utilized by the system manufacturer, shall be located as shown on the drawing. The branch selector boxes shall have the capacity to control multiple units downstream of the BS box. The BS box shall consist of a 3-way valve, refrigerant control piping and electronics to facilitate communications between the BS box and main processor and the BS box and fan coils. The BS box shall control the operational mode of the subordinate fan coils. Use of multi-port branch selector boxes is acceptable as indicated.

2.03 SYSTEM FEATURES AND BENEFITS

A. A single system shall provide for multiple zones with limitations as defined by the system manufacturer.

B. Each fan coil shall use a dedicated electronic expansion valve for independent control.

C. Each condensing unit shall use a high efficiency, variable speed "inverter" compressor coupled with inverter fan motors for superior part load performance.

D. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads.

E. Indoor fan coil units shall use PID control to control superheat to deliver a comfortable room temperature condition.

F. Control wiring shall be 18 AWG, 2 conductor, stranded, non-shielded and non-polarized cable with daisy chain configuration.

G. Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.

H. Each system shall have at least one remote controller and shall control multiple fan coil units.

I. Each system shall integrate with open protocol BACnet building automation systems (BAS).

J. Each system shall use indoor and outdoor units with quiet operation.

2.04 CONDENSING UNIT

A. General: The condensing unit shall be designed specifically for use with other components by the same manufacturer.

1. The condensing unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, copper condensing coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and liquid receivers.
2. Discharge pressure gas line, liquid and suction lines must be individually insulated between the condensing and indoor units.
3. The connection ratio of indoor units to condensing unit shall be permitted up to the manufacturer's limitations. Each condensing system shall be able to support the connection of multiple indoor units dependent on the model of the condensing unit.
4. Install refrigerant-grade ball valves on the downstream connection point of each BS unit.
5. The sound pressure level standard shall be that value as listed in the engineering manual for the specified models at 3 feet from the front of the unit.
6. The system will automatically restart operation after a power failure and shall not cause any settings to be lost, and not require reprogramming.
7. The condensing unit shall be modular in design and should allow for side-by- side or a stacked installation with minimum spacing.
8. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
9. Provide sub-cooling on each circuit to ensure the liquid refrigerant does not flash when supplying to the various fan coil units.
10. Oil recovery cycle shall be automatic and shall be utilized for all systems.

B. Unit Cabinet:

1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Compressor:

1. The scroll compressors shall be variable speed Pulse Amplitude Modulation (PAM) inverter controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.
2. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll "G- type."
3. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
4. Oil separators shall be standard with the equipment together with an intelligent oil management system.
5. The compressor shall be spring mounted to avoid vibration transmission to the structure or building components.
6. Units sized 5-7 ton shall contain 1 compressor, 8 to 11 tons shall contain 2 compressors, 12-14 ton units shall contain a minimum of 2 compressors and 18-21 ton units shall contain a minimum of 3 compressors. In the event of compressor failure the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address and control this condition.
7. In the case of multiple condenser modules, joint operation hours of the compressors shall be balanced to ensure sequential starting of each module at each start/stop cycle or every 8 hours.

D. Electrical:

1. The power supply to the outdoor unit shall be as shown on drawings. Provide line voltage disconnect at each unit.
2. The control voltage between the indoor and outdoor unit shall be 16VDC through a non- shielded, stranded 2 conductor cable. A control circuit transformer for this control voltage shall be provided with this unit.
   a. The control wiring shall be 18 AWG, two-wire multiplex transmission system, allowing connection of multiple indoor units to one outdoor unit with one 2 conductor cable.
   b. The control wiring lengths shall be in accordance with manufacturer's recommendations.

E. Performance:

1. The condensing unit shall perform as scheduled and as shown on drawings.

2.05 REFRIGERANT PIPING

A. The system shall utilize differing refrigerant piping lengths, heights, traps, and distances relative to other pieces of equipment per the manufacturer's requirements.

B. Refrigerant piping shall be Type 'L' ACR hard copper, ASTM B280. Type 'K' soft copper may be used downstream of the branch selectors to the fan coil units.

C. The installing contractor must be manufacturer-certified and must follow all manufacturer recommendations and guidelines in the piping and equipment installation.

D. Insulate all refrigerant piping with 1" thick Armaflex insulation in accordance with the insulation manufacturer's written instructions.

E. The contractor must follow the refrigerant pipe sizing, routing, and installation requirements of the manufacturer.

F. Provide all required refrigerant piping devices, valves, filters, driers, sight glasses and related items as required and as specified in Section 23 23 00.

2.06 BRANCH SELECTOR UNIT (BOX) FOR VRV HEAT RECOVERY SYSTEM

A. Selector boxes shall be factory assembled, wired, and piped.

B. Branch controllers must be run tested at the factory.

C. Selector boxes must be mounted indoors.

1. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling solenoid valve.
2. The number of connectable indoor units shall be based on manufacturer's recommendations and design instructions.

D. Unit Cabinet:

1. Units shall have a galvanized steel plate casing.
2. Each cabinet shall house multiple refrigeration control valves and a liquid gas separator.
3. The cabinet shall contain a tube in tube heat exchanger.
4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.

E. Refrigerant Valves:

1. The unit shall be furnished with a 3-way refrigerant valve to control the direction of refrigerant flow.
2. Electronic expansion valves shall be used to control the variable refrigerant flow.
3. The refrigerant connections shall be of the flare or brazed type.

F. Drainage:

1. Provide a condensate drain if required by the manufacturer.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz, or as indicated on the drawings.
2. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
3. The minimum circuit amps (MCA) shall be 0.2 and the maximum fuse amps (MFA) shall be 15.
4. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded 2 conductor cable.

2.07 VRF INDOOR UNITS

A. General:

1. Indoor units shall be type as shown on drawings.
2. Completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an adjustable external static pressure switch.
3. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

4. Both refrigerant lines shall be insulated from the outdoor unit to the indoor unit.
5. The indoor units shall be equipped with a condensate pan and condensate pump unless noted otherwise on the drawings.
6. Control shall be by a space sensor unless otherwise noted..
7. The indoor unit will be separately powered as noted on the drawings.
8. Disconnect and switch box shall be reached from the side or bottom for ease of service and maintenance.
9. Unit Cabinet:
    a. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
    b. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
    c. High efficiency air filters shall be available for each model unit. See drawings for filter requirements.
    d. Fan:
        1) The fan shall be direct-drive type fan with ECM motor where scheduled, statically and dynamically balanced impeller with high and low fan speeds available or as scheduled.
        2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 62W to 130W.
        3) The airflow rate shall be available in high and low settings.
        4) The fan motor shall be thermally protected.
10. Filter:
    a. The return air shall be filtered by means of a washable long-life filter with mildew proof resin for cassette type units, MERV 8 filters for console type units or as scheduled on drawings.
11. Coil:
    a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
    b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
    c. The coil shall be a 2 or 3-row cross fin copper evaporator coil with maximum 14 FPI design completely factory tested.
    d. The refrigerant connections shall be flare connections of appropriate size.
    e. A condensate pan shall be located under the coil with a 1" drain connection.
    f. A condensate pump shall be located below the coil in the condensate pan with a built in safety shutdown switch and alarm.
    g. A thermistor shall be located on the liquid and gas line.
12. Electrical:
    a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
    b. Control wiring between the indoor and outdoor unit shall be in accordance with the manufacturer's requirements.
    c. Control wiring between the indoor and remote controller shall be in accordance with the manufacturer's requirements.
13. Control:
    a. The unit shall have controls provided by the equipment manufacturer to perform input functions necessary to operate the system.

14. The unit shall be compatible with the BACnet interface for connection to BAS system.
    a. Accessories:
        1) Provide remote wall-mounted "in-room" sensor kit for zone sensors serving public spaces.
        2) Provide a wired controller for zone sensors serving offices and other private spaces with temperature sensor in controller.
        3) Provide an integral return air sensor in each ceiling-mounted unit. Provide a remote return air temperature inside the millwork enclosure and in the return air enclosure for vertical, concealed units and for horizontal, ducted units.

B. 4 Way Ceiling Cassette Unit (2'-0” by 2'-0”) - Model FXZQ

1. General: Shall be a 4-way airflow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with a central return air panel grill. Exposed housing shall be white, impact resistant and washable.
2. Unit face shall fit within a standard 2'-0” by 2'-0” ceiling grid pattern without encroaching on the adjacent ceiling.
3. Supply airflow adjustment via motorized louvers, field modifiable to 3-way or 2-way airflow.
4. Side mount outside outside air duct connection.

C. Concealed Ceiling Ducted Unit (Med. Static) - Model FXMQ
1. General: Shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity.
2. Ducted horizontal discharge and return duct connection; galvanized steel cabinet.
3. External static pressure to 1.1" w.g. with adjustable static pressure switch.

D. Slim Duct Concealed Ceiling Unit - Model FXDQ
1. General: Shall be a Slim, built-in ceiling concealed fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity. ESP to 0.2" w.g max.
2. Ducted horizontal discharge and return duct connection; galvanized steel cabinet.
3. Side or bottom return air with grille.

2.08 CONTROLS

A. Provide VRF controls which are BACnet compliant for interface with the Building Automation System (BAS). Provide VRF vendor network control system with single point BACnet connection. All points visible in VRF vendor's networked system shall be visible in the BAS. The VRF vendor shall provide their standalone touch screen manager to control and view operation of all VRF units including their condensing units. The controls manager shall allow management of alarms, setpoint adjustment, local overrides, editing of unit label/numbering and shall be web accessible.

B. The BACnet communication to the BAS shall include status, mode of operation (heating, cooling or alarm) and supply temperature from each of the VRF units to the BAS.

C. Thermostats:

1. Wall mounted thermostats to be Daikin BRC1E72 navigation controller or approved equal. Thermostats shall have the following features:
    a. On/Off, operation mode, and setpoint adjustment
    b. Fan speed and airflow direction adjustment
    c. Configurable display

d. Capability to disable unused buttons/controls
e. Setpoint range limitation
f. Auto-changeover with dual setpoints
g. 7-day programmability
h. Thermostat face shall display operation mode, setpoint, fan speed, room temperature.
i. Face decal to hide unused buttons
j. Display shall have large numbers/letters for easy viewing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install indoor air units and condensing units in accordance with manufacturer's recommendations and as shown on drawings. Follow SMACNA and AMCA recommendations for fan installations, belt guards, duct connections, etc.

B. Install units with adequate clearances for service and maintenance.

C. Make final duct connections with flexible connectors as described in specification Section 23 33 00. Provide sufficient separation of ductwork, plenum panels, or air handling unit casings from fan assembly to prevent metal-to-metal contact due to start-up torque or operating under specified isolator deflections.

D. Provide sufficient clearances around fans for access and servicing of components. Install fans such that tachometer openings, access doors, motors, belts, lubrication lines, electrical connections, etc. are readily accessible and not obstructed by other installations or structures.

E. 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.

F. Operating Temperature Ranges:

1. Simultaneous Heating and Cooling Range: Minus 4 degrees F to 60 degrees F dry bulb.
2. Cooling Mode Range: 23 degrees F to 110 degrees F dry bulb.
3. Heating Mode Range: 0 degrees F to 77 degrees F dry bulb without low ambient controls or auxiliary heat source.

G. Refrigerant Piping:

1. Adhere to the manufacturer's requirements for maximum piping lengths, heights, oil traps, distances relative to other pieces of equipment and to connected runs of refrigerant piping in the system.

H. Provide refrigerant piping in accordance with manufacturer's specifications and instructions. Install piping in strict accordance with manufacturer's recommendations. Follow manufacturer's instructions for flaring, brazing, purging and charging with refrigerant base on installed lengths of piping.

3.02 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connection to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

B. Disable automatic temperature-control operators.

C. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.

D. Measure and record motor voltage and amperage.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

G. Shut unit down and reconnect automatic temperature-control operators.

H. Refer to Section 23 05 93 for testing, adjusting, and balancing procedures.

3.03 ADJUSTING

A. Adjust damper linkages for proper damper operation.

3.04 CLEANING

A. On completion of installation, internally clean system according to manufacturer's written instructions. Remove foreign material and construction debris.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, touch-up paint and repair damaged finishes.

3.05 COMMISSIONING

A. Commission systems in accordance with commissioning requirements for the project.

3.06 TRAINING

A. Provide eight (8) hours of training for Owner's designated maintenance personnel on system operation and maintenance.

END OF SECTION

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic materials and methods, along with Division 01, General Requirements, that are applicable to Division 26 sections.

B. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification Sections apply to all Division 26 sections.

1.02 RELATED REQUIREMENTS

A. Perform Work specified in Division 26 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.

1. NFPA 70: National Electrical Code (2014)
2. NFPA 72: National Fire Alarm Code (2016)
3. NFPA 101: Life Safety Code (2015)
4. City of Brookhaven, MS Electrical Code
5. State of Mississippi Electrical Code
6. Americans with Disabilities Act (ADA)

1.03 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting

B. Heating, ventilating, and air conditioning equipment

C. Plumbing equipment

D. Cutting and patching for electrical Work, except for errors and omissions under this Division.

1.04 SUBMITTALS

A. Comply with provisions of Division 01.

B. Submit product data, equipment details, capacities, and shop drawings as specified in sections of this Division.

C. Submit fire alarm point-to-point drawings with product data submission.

D. Submit dimensioned equipment room layouts.

1. Show location of all electrical equipment in rooms including but not limited to:
   a. Electrical rooms and closets
2. Draw room layouts to 1/4" scale, with equipment locations shown therein. Clearances shall be in accordance with NEC and local codes. Indicate on drawing the mechanical equipment and mechanical and sprinkler pipe routing.
3. Electrical equipment submittals will be rejected without dimensioned equipment room or equipment location layouts and the completed power systems study.

E. Prepare shop drawings completely independent of the Engineer of Record's CADD files. Should the Contractor or Vendor wish to use the Engineer of Record's CADD files as the basis for developing their shop drawings, a release form, obtainable from the Engineer or Architect, must be signed and a nominal charge of $50.00 per sheet must be made payable to the engineering firm to cover the cost of preparing the drawings for use by others.

1.05 QUALITY ASSURANCE

A. Comply with applicable local, state, and federal codes.

B. Warrant electrical Work against faulty material or Workmanship in accordance with Division 01. If the Project is occupied or the systems placed in operation in several phases at the request of the Owner, then the warranty of each system or piece of equipment used shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.

C. Equipment and material provided under this Division shall be periodically inspected and serviced by competent mechanics. This function becomes the responsibility of the Owner when the system is accepted by the Owner. The one year material and Workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic lubrication and adjustment due to normal use, nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.

D. Turn over electrical equipment provided under this Division to the Owner in lubricated condition. Include instructions on further lubrication in the operating manual.

E. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain premises neat and clean. Protect and preserve access to energized equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. Use only factory supplied paints of matching color and formula. Schedule an off-hour shutdown of all electrical equipment during the 2-week period preceding substantial completion. During this shut down, clean all buses and insulators inside all switchgear, switchboards, bus ducts, collector buses and panelboards located inside or adjacent to the project limits.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Provide manuals in accordance with Division 01.

B. In addition to required submittals, include copies of all test reports required in Part 3, "Execution" of Section 26 05 00.

C. Provide completed warranty certificates for systems and equipment.

D. Digital Manuals:

1. Submit Operations and Maintenance Manuals in digital format as PDF files and PDF file naming convention is to be used. Submit Operations and Maintenance Manuals files as one file with each C.S.I. division bookmarked.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where this is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage. Evidence of damage from water or other contaminants will be cause for rejection.

1.08 PRODUCT PROCUREMENT AND SUBSTITUTION

A. Comply with the provisions of Division 01.

1.09 FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

1.10 RECORD DRAWINGS

A. Comply with provisions of Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.

B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.

PART 3 - EXECUTION

3.01 COORDINATION

A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.

B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.

C. Examine Specifications and Drawings to be familiar with items which require electrical connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.

3.02 TEMPORARY LIGHTS AND POWER

A. Comply with provisions of Division 01.

3.03 DEMOLITION

A. Visit the site to observe existing conditions before submitting a bid.

B. Work in existing buildings shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations. Notify Owner before any circuit is de-energized in occupied areas.

C. Remove abandoned wire and conduit back to source. Splice and terminate in junction boxes as appropriate. Where entire circuit is to be removed, remove conduit and wire back to existing panelboard. Where such work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the work.

D. Where a circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. Ensure proper grounding is maintained.

3.04 CUTTING AND PATCHING

A. Comply with provisions of Division 01

B. Repair or replace routine damage caused by cutting in performance of Work under this Division.

C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.

D. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs between floors shall be properly sealed, fire proofed and water proofed.

E. Holes cut through walls shall be drilled or cut with tools designed for the purpose. All openings, sleeves and holes in walls that extend to underside of floor above shall be properly sealed and fire proofed.

F. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.

G. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect.

3.05 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

A. Comply with provisions of Division 31.

B. Provide trenching, excavation, and backfilling necessary for performance of Work under this Division.

3.06 CONTROL SYSTEMS AND INTERLOCK WIRING

A. Control systems, components and control and interlock wiring for mechanical equipment will be furnished under Divisions 22 and 23. Control devices including, but not limited to, thermostats, fan speed and level control switches, relays and electro-pneumatic switches shall be furnished under Divisions 22 and 23.

B. Under Division 28:

1. Furnish duct mounted smoke detectors.
2. Provide wiring among detectors, fire alarm system, magnetic starters, variable frequency motor controllers, and relays, ATC panels and DDC panels

3.07 UTILITY COMPANY COORDINATION

A. Coordinate with the serving utility company as to all types of work required to be done by the contractor for utility equipment.

B. Confirm exact location of point of common coupling, duct banks, pads, etc.

3.08 TESTING ELECTRICAL SYSTEMS

A. On completion of work, installation shall be completely operational and entirely free from grounds, short circuits, and open circuits. Perform operational tests as required to demonstrate substantial completion of the Work. Balance circuits so that feeders to panels are not more than 10% out of balance between phases with all available load energized and operating. Furnish all labor, materials and instruments for above tests. All ampere readings shall be made with a true RMS reading meter.

B. Perform megger tests of all service entrance circuits, feeder and branch circuits size #4 AWG and larger. Provide a report of all such megger test results.

END OF SECTION

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Metal-clad cable.
C. Wiring connectors.
D. Electrical tape.
E. Heat shrink tubing.
F. Oxide inhibiting compound.
G. Wire pulling lubricant.
H. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:
   a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
   b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
      1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
2. In addition to other applicable restrictions, may not be used:
   a. Where not approved for use by the authority having jurisdiction.
   b. Where exposed to view.
   c. Where exposed to damage.
   d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

H. Manufactured wiring systems are not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Acceptable Manufacturers:

1. Copper Building Wire:
   a. Cerro Wire LLC: www.cerrowire.com.
   b. Encore Wire Corporation: www.encorewire.com.
   c. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN, except as indicated below.
   a. Size 4 AWG and Larger: Type THHN/THWN-2.
   b. Installed Underground: Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Acceptable Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com.
2. Encore Wire Corporation: www.encorewire.com.
3. Southwire Company: www.southwire.com.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 WIRING ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Exposed Cable Installation (only where specifically permitted):

1. Route cables parallel or perpendicular to building structural members and surfaces.
2. Protect cables from physical damage.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
   b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Identify conductors and cables in accordance with Section 26 05 53.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Correct deficiencies and replace damaged or defective conductors and cables.

ND OF SECTION

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
4. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
5. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

E. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing

electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

F. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.

D. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Installer's Qualifications: Include evidence of compliance with specified requirements.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

E. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled by Underwriters Laboratories (UL) as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, low voltage cable tray systems, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Field-Welding (where approved by Architect): Comply with Section 05 50 00.

I. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 26 05 34.

K. Cable Tray Support and Attachment: Also comply with Section 26 05 36.

L. Box Support and Attachment: Also comply with Section 26 05 37.

M. Busway Support and Attachment: Also comply with Section 26 25 01.

N. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.

O. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.

P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

Q. Secure fasteners according to manufacturer's recommended torque settings.

R. Remove temporary supports.

S. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 34 CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquid tight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 37 - Boxes.

G. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

I. Section 31 23 11 - Excavation, Fill, and Grading for Building..

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Project Record Documents: Record actual routing for conduits installed underground.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit.
3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.
2. Within Concrete Walls Above Ground: Use electrical metallic tubing (EMT).
3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

1. Locations subject to physical damage include, but are not limited to:
   a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

M. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquid tight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Motors.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 26 21 00.

C. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

F. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 1/2 inch (16 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com.
2. Electri-Flex Company; _____: www.electriflex.com.
3. International Metal Hose; _____: www.metalhose.com.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com.
2. Electri-Flex Company; _____: www.electriflex.com.
3. International Metal Hose; _____: www.metalhose.com.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit; _____: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company; _____: www.wheatland.com.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
   a. Do not use indenter type connectors and couplings.
4. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. Cantex Inc: www.cantexinc.com.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
3. JM Eagle: www.jmeagle.com.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
   c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.

7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
   a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
10. Use of wire for support of conduits is not permitted.
    a. For securing conduits to studs in hollow stud walls.
    b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

G. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

I. Underground Installation:

1. Provide trenching and backfilling in accordance with Section 31 23 11.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.

J. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Minimum Conduit Spacing: 6 inches
4. Install conduits within middle one third of slab thickness.
5. Secure conduits to prevent floating or movement during pouring of concrete.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding in accordance with Section 26 05 26.

P. Identify conduits in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 37 BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 84 00 - Firestopping.

C. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 34 - Conduit:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

G. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 27 26 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Additional requirements for locating boxes for wiring devices.

I. Section 27 10 00 - Structured Cabling System: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for junction and pull boxes and cabinets and enclosures.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, and cabinets and enclosures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
14. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 27 10 05.
    c. Ceiling Outlets: 4 inch octagonal or square by 2-1/8 inch deep (100 by 54 mm) trade size.
15. Wall Plates: Comply with Section 26 27 26.
16. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
    e. Thomas & Betts Corporation: www.tnb.com.
    f. Substitutions: See Section 01 25 00 – Substitution Procedures and Section 01 60 00 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   a. Indoor Clean, Dry Locations: Type 1, painted steel.
   b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
   b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
   b. Back Panels: Painted steel, removable.
   c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
   b. Communications Systems Outlets: Comply with Section 27 10 05.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 34.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 03 30 00, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 26 05 26.

V. Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Samples:

1. Identification Nameplates: One of each type and color specified.
2. Warning Signs and Labels: One of each type and legend specified.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Panelboards:
      1) Identify power source and circuit number where power originates. Include location when not within sight of equipment.
      2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
   b. Enclosed switches, circuit breakers, and motor controllers (including variable frequency motor controllers):
      1) Identify power source and circuit number where power originates. Include location.
      2) Identify load(s) served. Include location when not within sight of equipment.
   c. Time Switches:
      1) Identify load(s) served and associated circuits controlled. Include location.
2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Motor control centers.
   d. Elevator control panels.
   e. Industrial machinery.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. Equipment Designation: 1/2 inch.
5. Color:
   a. Normal Power System: White text on black background.
      1) 208Y/120 V, 3 Phase Equipment: White text on black background.
   b. Fire Alarm System: White text on red background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 60 LOW VOLTAGE SYSTEM ROUGH-IN REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Comply with the provisions of Section 26 05 00.

B. Provide rough-in including backboxes, backboards, conduit, conduits stubbed up, etc. as required for the following systems being supplied by the Owner or others:
   1. Telephone System.
   2. Information/Data Systems.

C. Telephone utility will provide and install service cable.

D. Provide conduit, outlet boxes and cover plates, and cabinets.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems

B. Section 26 05 29 - Hangers and Supports for Electrical Systems

C. Section 26 05 34 - Conduit

D. Section 26 05 37 - Boxes

E. Section 26 27 26 - Wiring Devices

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Interior systems components provided by Owner/Others will include system equipment, special outlet box receptacles, power unit cabinets, special outlet boxes, and cable.

B. Install outlet boxes with conduit stubbed up above nearest accessible ceiling or to cable tray. Where nearest accessible ceiling does not provide direct access to cable tray or nearest telecom closet, provide associated quantity and size of sleeves in walls and cable supports suitable for cable as required to gain access to cable tray or nearest telecom closet.

C. Install underground service entrance conduit for telephone/CATV service to the main equipment room as shown on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Schedule systems deliveries and installation with Owner and vendor.

B. Receive, inventory, store, and protect equipment and cable furnished by Owner.

C. Install special outlet boxes provided by Owner for dictation, computer, and CATV systems as directed by Owner and vendors.

D. The Contractor shall have the local telephone utility, the systems vendors, and the Owner review the drawings to verify that provisions on the drawings will accommodate the installation of the proposed services and systems. Report discrepancies promptly to Architect.

E. Schedule systems start-up, inspections, and certifications with owner and vendors.

F. Service Entrance Requirements:

1. Provide trenching and backfilling required for installation of service entrance conduits
2. Install a pull wire or rope for installation of service cables.
3. Coordinate service entrance with local service provider.

G. Provide a complete conduit system for cable installation.

H. Install a separate conduit stubbed up and bushed above accessible ceilings to serve each device outlet. Size conduit in accordance with the wiring schematic furnished by the Owner. Install a minimum size of 1 inch conduit, terminated with insulated bushing.

I. Cable concealed in walls or above inaccessible ceilings shall be installed in conduit.

J. Where open cable is run above dropped ceilings and penetrates a smoke or fire rated wall, furnish and install an empty metal conduit sleeve, extending at least 6" on both sides of partition with bushing on both ends. For sleeve or cable penetrations through fire or smoke rated walls or partitions, provide a U.L. 1479 listed "Through Penetration Firestop" system for each sleeve or cable penetration.

END OF SECTION

SECTION 26 08 00 COMMISSIONING ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process.

B. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. The Commissioning Authority directs and coordinates the day-to-day commissioning activities as well as the overall commissioning process. The start-up, testing, support for commissioning, and demonstration of the equipment and systems operation to be in accordance with the contract documents is the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions or work in a satisfactory and fully operations manner.

C. Work of Division 26 includes:

1. Testing and start-up of the electrical equipment.
2. Assistance in functional testing to verify equipment/system performance.
3. Providing qualified personnel to assist in commissioning tests, including seasonal testing required after the initial commissioning.
4. Completion and endorsement of Pre-functional Construction Checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operations and ready for functional testing.
5. Providing equipment, materials and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
6. Providing operation and maintenance information and as-built drawings to the Commissioning Authority for review prior to distribution.
7. Providing assistance to the Commissioning Authority to develop, edit and document system operation descriptions.
8. Providing training for the systems specified in this Division.

1.02 SUBMITTALS

A. Government approval is required for submittals with a "G" designation; submittals not having a "G" Designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Equipment and System Submittals to include, at minimum, the following:
   a. Manufacturer's printed Installation Instruction sheets for all system components & devices
   b. Performance data
   c. Manufacturer's pre-startup checklists
   d. Manufacturer's start-up checklists
   e. Cut Sheets
2. Shop drawings (including any resubmittals required by the A/E)
3. Initial Pre-startup and start-up plan
4. Completed Prefunctional checklists
5. Operational and maintenance documentation
6. Training plan and training materials
7. As-built documentation.

8. Electrical coordination study
9. Fire Alarm point lists and tables

1.03 RELATED WORK

A. All installation, testing and start-up procedures and documentation requirements specified within Division 26 and related portions of this project.

B. Section 01 91 00 COMMISSIONING.

C. Commissioning Functional Test Procedures that required participation of the Division 26 Contractors.

D. Cooperate with the Commissioning Authority in the following manner:

1. All testing and start-up procedures and documentation requirements specified within Division 01 and Division 26 and related portions of this project.
2. Allow sufficient time before final completion dates so electrical systems start-up, testing, and commissioning can be accomplished.
3. Provide labor and material to make corrections when required without undue delay.
4. Put all electrical equipment into full operation and continue the operation of the same during each working day of the testing, balancing and commissioning.
5. For specified electrical systems and component testing by a third-party testing Contractor, coordinate with the Commissioning Authority the scope and schedule of that testing for observation by the Commissioning Authority during the actual testing.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. STANDARD test equipment for commissioning will be provided by the Contractor.

B. Division 26 Contractor shall provide standard and specialized test equipment as necessary to test and start up the electrical systems.

C. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use and assist the Commissioning Authority in the commissioning process.

D. The contractor shall provide all equipment, software and all tests programming support as necessary to start up, calibrate, debug and verify proper function of the control/facility management system. This equipment and software shall be provided for use by both the test and balance contractor and Commissioning Authority.

PART 3 - EXECUTION

3.01 WORK PRIOR TO COMMISSIONING

A. Complete all phases of work so the systems can be energized, started, tested and otherwise commissioned. Division 26 has primary start-up responsibilities with obligations to complete systems, including all sub-systems, so they are functional. This includes the complete installation of all equipment materials, raceways, wire, terminations, controls, etc., per the Contract Documents and related directives, clarifications, change orders, etc.

B. A Commissioning Plan will be developed by the Commissioning Authority. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If Contractor-initiated system changes have been made that alter the commissioning process, the Commissioning Authority will notify the Architect and the Contractor may be obligated to compensate the Commissioning Authority to test the revised product or confirm the suitability/unsuitability of the substitution or revision.

C. Specific pre-commissioning responsibilities of Division 26 are as follows:

1. Normal start-up services required bringing each system into a fully operational state. This includes motor rotational check cleaning, lug tightening, control sequences of operation, etc. The Commissioning Authority will not begin the commissioning process until each system is complete, including normal contractor start-up and debugging.
2. The Contractor shall perform pre-functional construction checklists on the systems to be commissioned to verify that all aspects of the work are complete in compliance with the plans and Specifications. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
3. Provide written notification to the Contracting Officer and Commissioning Authority when systems are ready for functional testing at a minimum of seven (7) days prior to start of testing.

D. Commissioning is to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is approved by the Contracting Officer. Commissioning activities and schedule will be coordinated with the Contractor. Start of Commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

3.02 PARTICIPATION IN COMMISSIONING

A. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. Provide skilled technicians to start up and debug all systems within this division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, times required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments and/or problem resolutions.

B. System problems and discrepancies may require additional technician time, Commissioning Authority time, redesign and/or reconstruction of systems and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item or equipment, system and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representative does not constitute the availability of a qualified technician for purpose of this work.

3.03 WORK TO RESOLVE DEFICIENCIES

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under direction of the architect, with input from the Contractor and Contracting Officer, equipment supplier and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate and work out problems, the Architect/ Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance.

3.04 ADDITIONAL COMMISSIOING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers and Commissioning Authority shall include a reasonable reserve to complete this work as part of the standard contractual obligations.

B. The cost of compensation of the Commissioning Authority for repeat testing or troubleshooting due to systems that do not meet specified performance shall be borne by the Contractor.

C. Corrective work shall be completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely to the commissioning process, the Commissioning Authority will notify the Contracting Officer indicating the nature of the problem, expected stems to be taken and the deadline for completion of activities. If the deadline passes without resolution of the problem, the Government reserves the right to supplementary services and equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor’s responsibility.

3.05 SYSTEMS TO BE COMMISSIONED

A. Systems to be commissioned include:

1. Normal Power Systems (Switchgear, Transformers, Panelboards, and Protective Devices)
2. Emergency and Standby Power Systems (Fuel-fired engine Generator Set, Essential Electrical Systems, Automatic Transfer Switches, Switchgear, Transformers, Panelboards, Protective Devices, Fuel Systems, and Interfaces)
3. Lighting and day-lighting control systems
4. Fire alarm and mass notification systems

3.06 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to functional performance testing (FPT) for equipment and systems in this division.

B. The general list of equipment and systems to be commissioned is found in Paragraph 305 A.

C. Objectives and Scope:

1. The objective of (FPT) is to demonstrate that each system is operating according to the owner's project requirements, documented project program, and Contract Documents. FPT facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and function of the systems.
2. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, failures, interlocks, warm-up, safety, etc.) where there is a specified system response. Verifying each sequence in the sequences of operation is required.
3. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
4. The contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. Contractor supplied personnel must be competent with and knowledgeable of all project-specific systems, and automation hardware and software. All training documentation, O&Ms, and submittals shall be at the job site before FPT commences.

D. Development of Test Procedures: The Commissioning Authority develops specific (FPT) procedures and forms to verify and document proper operation of each piece of equipment and system. The Commissioning Authority provides a copy of the test procedures to the A/E, Contracting Officer and installing Sub-Contractor who shall review the tests prior to testing. The A/E and Sub-Contractor(s) shall point out to the Commissioning Authority any specific problems as related to feasibility, safety, equipment and warranty protection.

E. Coordination and Scheduling:

1. The GC shall provide sufficient notice to the Commissioning Authority regarding the Sub-Contractors' completion schedule for the prefunctional checklists and startup of all equipment and systems. The Commissioning Authority will schedule functional tests after written notification from the GC and affected Sub-Contractors. The Commissioning Authority shall direct, witness and document the (FPT) of all equipment and systems. The Sub-Contractors shall execute the tests.
2. In general, (FPT) shall not be scheduled until all hardware and software submittals are approved, Prefunctional checklists are approved, and start-up has been satisfactorily completed. Scheduling of FPT shall be done with a minimum of two weeks notice prior to testing. FPT of the equipment and systems listed in section 305 A. of this specification section shall not be conducted out of the presence of the Commissioning Authority and Contracting Officer, unless specifically approved to do so in writing by the Commissioning Authority or Contracting Officer. Any FPT which occurs outside the presence of the Commissioning Authority or Contracting Officer without written authorization to do so will be required to be re-tested at no expense to the owner.

F. Demonstration, Verification and Validation

1. The electrical systems demonstration, verification, and validation shall include, at minimum, the following:

a. Main Switchboard
   1) Using the short circuit and coordination study, document all adjustable circuit breakers have been set to the values indicated by the engineer. A minimum of 10 or 10% of devices will be validated by the Commissioning Authority.
   2) Document all ground fault settings on circuit breakers have been set to the values indicated by the engineer. The settings will be validated by the Commissioning Authority.
   3) Document all over-current protection devices are energized and operational.
   4) Demonstrate the requirements for the flash hazard, based on the short-circuit current available, have been met.
   5) Perform a complete visual inspection for assembly, fit, anchoring and grounding. Inspect the bus assemblies for deficiencies and torque test all bolted connections to manufacturer's specified values.
   6) Perform insulation resistance test on each bus section, phase to phase, phase to ground, and phase to neutral (Minimum test voltage and insulation resistance shall be 500V DC, 25 ohms (0-250V), 1000V DC, 100 ohms (250-600V), 2500V DC, 1000 ohms (601-5000V), 2500V DC, 5000 ohms (5001-15,000V)).
   7) Perform insulation resistance test on each main feed conductor.
   8) Check for neutral to ground bus connection (bonding strap).
   9) Check the equipment ground and record the number and size of ground bus, and report deficiencies.
   10) Perform a thermographic infrared scan under full load and identify all hot spots and promptly mark and correct sources of heating problems.

b. Panelboards
   1) Inspect equipment and each breaker and/or fused switch and report installation or shipping damage, loose material, shipping blocks, contamination or unfavorable environmental conditions that must be corrected. Check equipment for operation of doors and security of mounting. Report all deficiencies.
   2) Inspect the panelboard bus assembly for deficiencies and torque all bolted connections to manufacturer's specifications. Test insulation of each bus phase-to-phase, phase to neutral and phase-to-ground with a suitable meg-ohm meter. Record values and report deficiencies.
   3) Verify typed and completed circuit directories are installed.
   4) Inspect for proper identification of protective devices.
   5) Verify that all panelboards are appropriately labeled per construction documents and specifications.
   6) Perform a thermographic infrared scan on each panelboard after the panel has been operating with maximum load for at least one hour. Mark all hot spots and promptly correct sources of heating problems.
   7) Molded Case Circuit Breakers - Inspect each circuit breaker, operate manually, and electrically. Test shunt trips and alarm devices manually and electrically. Adjust breaker trips to settings furnished by the coordination study and verify settings of the manufacturer's rating by passing controlled current though the trip devices. Record values and report deficiencies.

c. Electrical Feeders and Branch Circuits (600V or below)
   1) Test for continuity on each circuit to insure correct cable connections.
   2) Physically examine the grounding system installation to ensure that the equipment grounding conductor, grounding electrode conductor, and bonding ground jumpers are properly installed and connected.
   3) Perform torque test for every conductor tested and terminated in an overcurrent device or bolted-type connection (Use a calibrated torque wrench. Torque all connections per manufacturer's recommendations and record test results in an itemized form).
   4) Perform insulation resistance test with megohm meter (Perform 500-volt megohm meter test on each circuit cable rated 300V and below, and a 1000-volt megohm meter test on each circuit cable rated 600V between the conductor and ground. The insulation resistance shall not be less than 2 megohms for circuits under 115V, 6 megohms (between conductor and ground) for 115V-600V circuits that have a total conductor length of 2500 ft or more, and less than 8 megohms for 115V-600V circuits with a single conductor length of less than 2500 ft. If a conductor fails a test it shall be replaced by the Contractor and retested).
   5) Verify that all conductors are either solid or stranded based on specifications.
   6) Verify that all conductors are color coded per specifications and National Electrical Code (NEC) requirements.
   7) Verify that all conductors are identified per specifications (tags at ends with circuit numbers, colored tape, etc).

d. Fire Alarm System
   1) Procedures, methods, documenting and testing of the fire alarm system shall be conducted in accordance with the applicable version of NFPA 72. Operational tests shall be conducted at a time coordinated between the Contracting Officer, GC and Commissioning Authority. The Commissioning Authority will witness all or a percentage of the testing, according to how testing is scheduled and accomplished.
   2) Demonstrate the specified operation of all air-sampling smoke detectors
   3) Demonstrate the specified operation of all fire and smoke dampers.
   4) Submit final testing report per NFPA 72.

e. Grounding System
   1) Perform a three point fall-of-potential tests on main grounding electrode system per IEEE Standard No. 81, Section 9.04. Maximum resistance to ground shall be less than 5 ohms (unless otherwise allowed by Commissioning Authority). If this resistance cannot be obtained with the ground system, notify the Architect immediately for further instruction.
   2) Perform a two-point method test per IEEE Standard 81, Section 9.03 to determine the ground resistance between the main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points. Resistance shall be no greater than 5 ohms (unless otherwise allowed by Commissioning Authority).
   3) Confirm that the neutral is grounded only at the service equipment by removing the service neutral grounding conductor and meggering the neutral bus. Take ground readings as shown on Test Procedure and record for submission as part systems manual with all other testing documentation.

G. Problem Solving: The Commissioning Authority will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Sub-Contractors and A/E.

3.07 TRAINING

A. Per the specifications, the Contractor will be required to participate in the training of the Government's operation and maintenance staff for each system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom aids, or in the field with the specific equipment. The type of training will be per the Government's option. Refer to Section 01 79 00 Demonstration and Training, Section 01 91 13 General Commissioning and Division 26 for additional requirements.

END OF SECTION

SECTION 26 08 50 COMMISSIONING LIGHTING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section outlines the requirements of Division 26 subcontractors to participate in the commissioning process as a commissioning team member as described in Section 01 91 13.

B. Commissioning testing shall be performed by this division Contractor and documented by the Commissioning Authority. The Commissioning Authority directs and coordinates the day-to-day commissioning activities as well as the overall commissioning process. The start-up, testing, support for commissioning, and demonstration of the equipment and systems operation to be in accordance with the contract documents is the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions or work in a satisfactory and fully operations manner.

C. Related Work.

1. Description of Work in Division 26.
2. General Commissioning Process in Section 01 91 00.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. As indicated in Section 01 91 13 and in Division 26.

PART 3 - EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Refer to Section 01 91 13 and related sections for information on meetings, start-up plans, functional testing, operation and maintenance data, training requirements, and other Commissioning activities.

3.02 TESTING REQUIREMENTS

A. Provide a testing plan using the construction documents and the submittal data provided for the equipment installed on the project to the Commissioning Agent for review and approval. The start-up plan will be submitted to the design team and after approval shall be implemented as directed by the Commissioning Agent. Incorporate changes into the testing plan as directed by the Commissioning Agent and design team. Testing of the lighting control equipment will be witnessed by the Commissioning Agent. The testing plan will include the following:

1. Date and time of the test.
2. Procedures for performing the test.
3. A narrative of the observation of the test.

4. Description of any issues or deficiencies.
5. Signatures of the person performing the test and the Commissioning Agent who witnessed the test.

B. Performance Test Requirements:

1. The Electrical subcontractor is to perform the functional testing of all lighting equipment as directed by the Commissioning Agent. The light levels, energy usage, and operation of the lighting system are to be documented and verified as part of the test.
2. Using the plan as submitted by the Electrical Contractor and approved by the Commissioning Agent and the design team, test all components of the lighting system and the lighting controls.
3. Testing Conditions – Occupancy Sensors:
   a. Verify the operation of all occupancy sensors and timer controls.
   b. Verify that sensor durations are set per design documents.
   c. Verify that over-ride features function per design documents.
   d. Verify that the sequences of operation match the design documents.
4. Testing Conditions – Photocells and Controls:
   a. Verify that dimming controls operate during daylight hours when dimming should occur.
   b. Verify and record the amperage change due to dimming.
   c. Verify that minimum light levels achieved with dimming are not lower than specified. Record minimum light level attained.
   d. Confirm that dimming controls are not easily changed or disabled by occupants.
   e. Check location of photo sensor for location regarding lighting to be dimmed.
5. Testing Conditions – Day conditions: Confirm that lights are on or off at the appropriate times.
6. Testing Conditions – Night Operation:
   a. Confirm that lights are off per design schedule.
   b. Confirm that appropriate lights are on when sensors detect movement or if fire alarm is activated during “after hours”, if so designed.
7. Lighting Control Systems:
   a. Demonstrate that all functions of the lighting control systems (dimming system control panels and control stations, occupancy sensors, overrides, contactors, timeclocks, and photocells, etc) meet the requirements of the specifications, submittal drawings, and manufacturer testing and operational procedures for each piece of equipment and component installed.
8. Emergency Lighting System:
   a. Demonstrate that all emergency battery packs operate and are fully functional. Show that required egress lighting is obtained with emergency lighting in operation (i.e., required lighting level along paths of egress with emergency lighting (only) in operation). Demonstrate that any emergency lighting control relays operate emergency lighting in the event of a power outage (i.e., emergency lighting operates even if switched “off” by lighting switch in area).

3.03 TRAINING

A. Provide training to building occupants in accordance with Section 01 79 00 Demonstration and Training, Section 01 91 13 General Commissioning and Division 26 requirements.

B. Provide a training syllabus to the Commissioning Agent for approval at a minimum of ten (10) working days prior to the training.

C. Provide a Training attendance sheet to the Commissioning Agent with names, company names, and contact information of training attendees.

3.04 DOCUMENTATION

A. Provide as-built drawings of the lighting controls to the Owner and to the Commissioning Agent. Electronic format as well as printed copy preferred.

B. Provide Operation and Maintenance documents to the Owner as specified in Division 26, along with one copy of all O&M data to the Commissioning Agent for inclusion in the Systems Manual.

END OF SECTION

SECTION 26 09 23 LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. Outdoor photo controls.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 37 - Boxes.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches and wall dimmers.
   1. Includes finish requirements for wall controls specified in this section.
   2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

E. Section 26 51 00 - Interior Lighting.

F. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. Manufacturers:

1. Hubbell Building Automation, Inc: www.hubbellautomation.com
2. Sensor Switch Inc: www.sensorswitch.com.
3. WattStopper: www.wattstopper.com.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
7. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
   a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
   b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
   a. Description: Low profile occupancy sensors designed for ceiling installation.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on the drawings.

2.03 TIME SWITCHES

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com.
2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC: www.tork.com.

B. Digital Electronic Time Switches:

1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: As indicated on the drawings.
8. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.04 OUTDOOR PHOTO CONTROLS

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com.
2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC: www.tork.com.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
   b. In-Wall Time Switches: 48 inches above finished floor.
   c. In-Wall Interval Timers: 48 inches above finished floor.
2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

1. Do not utilize equipment grounding conductor as a current carrying conductor for electronic switching/dimming/sensor devices.
2. Include a grounded (neutral) conductor with switch leg.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

H. Identify lighting control devices in accordance with Section 26 05 53.

I. Occupancy Sensor Locations:

1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
3. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
4. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Daylighting Control Photo Sensor Locations:

1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
3. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
4. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
5. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

O. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

P. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

Q. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 37 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 01 91 00 - Commissioning for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 77 00 - Closeout Procedures, for closeout submittals.

END OF SECTION

SECTION 26 21 00 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 34 - Conduit.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 24 16 - Panelboards: Service entrance equipment.

H. Section 31 23 11 - . Excavation, Fill and Grading for Building

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:

1. Verify the following with Utility Company representative:
   a. Utility Company requirements, including division of responsibility.
   b. Exact location and details of utility point of connection.
   c. Utility easement requirements.
   d. Utility Company charges associated with providing service.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Scheduling:

1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal requirements.

B. Utility Company letter of availability for providing electrical service to project.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.

1. Obtain Utility company approval of shop drawings prior to submittal.

E. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.
4. The requirements of the local authorities having jurisdiction.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: Entergy.

1. Point of Contact: Clay Carloc.
2. Address: 905 HWY 80 E, Clinton, MS.
3. Phone: 601-925-6506.

D. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Section 31 23 16.13.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 30 00.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 26 05 29.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Analysis: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
   3. Listed series ratings are not acceptable.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 13, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

M. Load centers are not acceptable.

N. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.
2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:

1. 120/208 volts, 3-phase, 4-wire, molded case circuit breaker type.
   a. Eaton Cutler-Hammer type PRL 4b.
   b. General Electric "Spectra" series distribution type.
   c. Schneider Square D "I-Line" series distribution type
   d. Siemens type P4 or P5, depending upon panelboard ampacity
2. Substitutions: Not permitted.

C. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

D. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Aluminum.

E. Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 150 amperes.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 150 amperes and above.

F. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with fully hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:

1. 120/208 volts, 3-phase, 4-wire: minimum 10,000 AIC rating.
   a. Eaton Cutler-Hammer type PRL 1a.
   b. General Electric type AQ.
   c. Schneider Square D type NQ
   d. Siemens type P1
2. Substitutions: Comply with Section 01 25 00 – Substitution Procedures.

C. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

D. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Aluminum.

E. Circuit Breakers: Thermal magnetic bolt-on type.

F. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with fully hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 150 amperes and larger.
   b. Provide interchangeable trip units for circuit breaker frame sizes 250 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.

b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
c. Provide communication capability where indicated: Compatible with system indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

K. Provide grounding and bonding in accordance with Section 26 05 26.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

P. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads listed below:

1. Fire detection and alarm circuits.
2. Intrusion detection and access control system circuits.
3. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and any circuit breakers larger than 225 amperes. Tests listed as optional are not required, except for the following:

1. Perform insulation-resistance tests on all control wiring with respect to ground.
2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 17 EQUIPMENT WIRING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 05 34 - Conduit.

C. Section 26 05 37 - Boxes.

D. Section 26 27 26 - Wiring Devices.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.04 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal requirements

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wiring Devices: As specified in Section 26 27 26.

B. Flexible Conduit: As specified in Section 26 05 34.

C. Wire and Cable: As specified in Section 26 05 19.

D. Boxes: As specified in Section 26 05 37.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 37 - Boxes.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

F. Section 26 27 17 - Equipment Wiring: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal requirements.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.
2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles serving electric drinking fountains.

F. Unless noted otherwise, do not use combination switch/receptacle devices.

G. For flush floor service fittings, use tile rings for installations in tile floors.

H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.03 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc: www.leviton.com.
2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

2.05 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Lutron Electronics Company, Inc; www.lutron.com/sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switches: 48 inches above finished floor.
   b. Wall Dimmers: 48 inches above finished floor.
   c. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

1. Do not utilize equipment grounding conductor as a current carrying conductor for electronic switching/dimming/sensor devices.
2. Include a grounded (neutral) conductor with switch leg.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Identify wiring devices in accordance with Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 32 13 ENGINE GENERATORS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Diesel engine.
2. Unit-mounted sub-base fuel tank.
3. Unit-mounted cooling system.
4. Remote-mounting control and monitoring.
5. Outdoor enclosure.

B. Related Sections include the following:

1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. LP: Liquid petroleum.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Warranty: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

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.

E. Comply with ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.

H. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.08 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet.

1.09 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Caterpillar; Engine Div.
2. Generac Power Systems, Inc.
3. Kohler Co.; Generator Division.
4. Onan / Cummins Power Generation; Industrial Business Group.

2.02 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE

A. Fuel: Natural Gas.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel Supply System:

1. Comply with NFPA 30.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Mechanical.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
   a. Rating: 50-psig maximum working pressure with coolant at 180 deg F., and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.

J. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
   a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
   e. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.04 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
8. Ammeter-voltmeter, phase-selector switch(es).
9. Generator-voltage adjusting rheostat.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

E. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

2.05 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.06 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

2.07 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Space Heater: Thermostatically controlled and sized to prevent condensation.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
5. Hinged Doors: With padlocking provisions.
6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
8. Muffler Location: Within enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

D. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

E. Convenience Outlets: Factory wired. Arrange for external electrical connection.

2.08 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.09 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Piping shall be same diameter as muffler outlet.

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.

D. Connect engine exhaust pipe to engine with flexible connector.

E. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

L. Provide fuel as required to satisfy testing requirements. Turn equipment over to Owner with fuel tank full, complete with additives as recommended by manufacturer.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION

SECTION 26 36 00 TRANSFER SWITCHES

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 transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Remote annunciation systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain automatic transfer switches and remote annunciators through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.07 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Do not proceed with interruption of electrical service without Owner's written permission.

1.08 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   a. Caterpillar; Engine Div.
   b. Generac Power Systems, Inc.
   c. GE Zenith Controls.
   d. Kohler Power Systems; Generator Division.
   e. Onan/Cummins Power Generation; Industrial Business Group.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Battery Charger: For generator starting batteries.

1. Float type.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 2 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.04 REMOTE ANNUNCIATION SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.05 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."

B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.02 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 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. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 51 00 INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 37 - Boxes.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 09 23 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, time switches, and outdoor photo controls.

D. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 101 - Life Safety Code; 2015.

K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

L. UL 1598 - Luminaires; Current Edition, Including All Revisions.

M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

H. Suspended Luminaires:

1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.04 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.05 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00 EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Poles and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 37 - Boxes.

D. Section 26 09 23 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.

E. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

F. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2012.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1598 - Luminaires; Current Edition, Including All Revisions.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

D. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Luminaire Components: UL 8750 recognized or listed as applicable.

2.03 BALLASTS

A. Ballasts/Drivers - General Requirements:

1. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

2.04 POLES

A. All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Pole-Mounted Luminaires:

1. Maintain the following minimum clearances:
   a. Comply with IEEE C2.
   b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
   a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
      1) Install anchor bolts plumb per template furnished by pole manufacturer.
      2) Position conduits to enter pole shaft.
   b. Install foundations plumb.
   c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
   d. Tighten anchor bolt nuts to manufacturer's recommended torque.
   e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
   f. Install anchor base covers or anchor bolt covers as indicated.
3. Embedded Poles: Install poles plumb as indicated.
4. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 05 00 COMMON WORK RESULTS FOR
ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic materials and methods, along with Division 01, General Provisions, that are applicable to Division 28 sections.

B. Drawings and general provisions of the contract, including General Conditions and Division 01 specification Sections apply to all Division 28 sections.

1.02 RELATED REQUIREMENTS

A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.

B. Flashing of conduits into roofing and outside walls.

C. Heating, ventilating, and air conditioning equipment.

D. Fireproofing

E. Cutting and patching for Work, except for errors and omissions under this Division.

1.03 REFERENCE STANDARDS

A. Perform Work specified in Division 28 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Project Engineer / MDOT Architect.

1. NFPA 20: Standard for Installation of Stationary Pumps for Fire Protection
2. NFPA 70: National Electrical Code
3. NFPA 72: National Fire Alarm Code
4. NFPA 101: Life Safety Code
5. International Building Code
6. Americans with Disabilities Act (ADA)
7. ASTM E814-08B: Standard Test Method for Fire Tests of Penetration Firestop Systems.
8. U.L. Fire Resistance Index.

1.04 SUBMITTALS

A. Comply with provisions of Division 01.

B. Submit product data, equipment details, capacities, and shop drawings as specified in sections of this Division.

C. Submit fire alarm point-to-point drawings with product data submission.

D. Prepare shop drawings completely independent of the Engineer of Record's CADD files.

1.05 QUALITY ASSURANCE

A. Comply with applicable local, state, and federal codes.

B. Warrant Work against faulty material or Workmanship in accordance with Division 1. If the Project is occupied or the systems placed in operation in several phases at the request of the Owner, then the warranty of each system or piece of equipment used shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.

C. Equipment and material provided under this Division shall be periodically inspected and serviced by competent technicians. This function becomes the responsibility of the Owner when the system is accepted by the Owner. The one year material and Workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items due to normal use, nor to correct without charge, breakage, maladjustment, and other trouble caused by improper maintenance.

D. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain premises neat and clean. Protect and preserve access to energized equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. Use only factory supplied paints of matching color and formula. Schedule an off-hour shutdown of all electrical system equipment during the 2-week period preceding substantial completion.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Provide manuals in accordance with Division 01.

B. In addition to required submittals, include copies of all test reports required in Part 3, "Execution" of Section 26 05 00.

C. Provide completed warranty certificates for systems and equipment.

D. Provide tabulation of overload heaters, including each motor identified, nameplate data and overload heater part number.

E. Digital Manuals:

1. Submit Operations and Maintenance Manuals in digital format as PDF files and PDF file naming convention is to be used. Submit Operations and Maintenance Manuals files as one file with each C.S.I. division bookmarked.
2. PDF file naming convention is to be as follows: Building # - Architect Project # - OM.PDF (Example: 133-03001.01 - OM.PDF)

1.07 DELIVERY, STORAGE, AND HANDLING

A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where this is not practical, cover items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage. Evidence of damage from water or other contaminants will be cause for rejection.

1.08 RECORD DRAWINGS

A. Comply with provisions of Division 01.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.

B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.

C. If materials and equipment other than specified herein are intended to be submitted, a letter providing a list of all the suggested alternates by section number, brand and series or model shall be submitted to the prime Architect for review and approval. Submit in accordance with Division 01 or 14 days prior to bids or final pricing are to be submitted.

D. Each item of equipment shall be designed and the entire system installed to resist lateral forces using an ICP value of not less than 0.5 and in accordance with the applicable building code.

PART 3 - EXECUTION

3.01 COORDINATION

A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.

B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.

C. Examine Specifications and Drawings to be familiar with items which require system connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.

D. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01 and as called for herein. Coordinate work in full cooperation with persons performing work under other divisions, including but not limited to mechanical, plumbing, fire protection, telecommunication and miscellaneous steel to develop these coordination drawings that will serve as the agreed upon plan for a coordinated installation of work for all trades. Include system equipment, conduit racks and conduits 3" and larger on drawings confirming coordination with other trades. Incorporate the information onto the coordination drawings required under Divisions 01, 21, 22, 23, 26, 27 and 28 to develop master coordination drawings. Account for lighting fixture depths in the coordination. Inform Architect of conflicts that cannot be resolved.

E. Drawings are not to be submitted to Engineer. Submit a copy to the General Contractor and keep a copy on site for references. Notify design professional of conflicts that cannot be resolved.

3.02 FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

3.03 CUTTING AND PATCHING

A. Comply with provisions of Division 01.

B. Repair or replace routine damage caused by cutting in performance of Work under this Division.

C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.

D. Holes cut through floor slabs shall be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs between floors shall be properly sealed, fire proofed and water proofed.

E. Holes cut through walls shall be drilled or cut with tools designed for the purpose. All openings, sleeves and holes in walls that extend to underside of floor above shall be properly sealed and fire proofed.

F. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.

G. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect.

3.04 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

A. Comply with provisions of Division 31.

B. Provide trenching, excavation, and backfilling necessary for performance of Work under this Division.

C. Provide sheathing, shoring, dewatering, and cleaning necessary to keep trenches and their grades in proper condition for Work to be carried on.

D. Trenching and excavation shall be unclassified. No extra will be paid in event that rock is encountered.

3.05 FOUNDATIONS AND PADS

A. Provide concrete foundations and pads for equipment per the requirements Division 03. Locate and size foundations, pads, and anchor bolts as required for equipment in this Division.

END OF SECTION

SECTION 28 23 00 SECURITY CCTV VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 SUMMARY

A. This document covers the installation of a CCTV surveillance system which will also be able to share video information with the MDOT state wide security system.

B. The CCTV surveillance system security access system shall incorporate the following:

1. CCTV Cameras
2. Camera Mounts
3. Power Supplies
4. Communication System
5. Digital Video Recorder

C. The Contractor shall provide and pay for labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.

D. Specification Language: Specifications and notes are written in imperative and abbreviated form. Imperative language of the technical specifications is directed at the Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting “shall”, “shall be”, “the Contractor shall”, and similar mandatory phrases by inference. The words “shall be” shall be supplied by inference where a colon (:) is used within product specifications.

E. Drawings And Specifications

1. Carefully study the Drawings and Specifications, and at once report any error, unforeseen circumstances, inconsistency or omission discovered.

1.02 PROJECT DEFINITIONS

A. General Definitions

1. CCTV: Closed-Circuit Television.
2. DPDT: Double pole double throw switch
3. DVR: Digital Video Recorder
4. I/O: Input/Output.
5. LAN: Local Area Network.
6. NC: Normally closed contacts
7. NO: Normally open contacts
8. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
9. RS-485: TIA/EIA standard for multipoint communications.
10. SPST: Single pole single throw switch
11. TCP/IP: Transport Control Protocol/Internet Protocol incorporated into Microsoft Windows.
12. TPZ: Tilt Pan Zoon
13. UPS: Uninterruptible Power Supply.
14. Windows: Operating system by Microsoft Corporation.

B. Definitions Contract Language

1. Words that are in common use are used throughout the Drawings and Specifications except:
   a. Words which have well-known technical or trade meanings are used in accordance with such recognized meanings.
   b. Whenever the following listed words and phrases are used, they shall be mutually understood to have the following respective meanings:
      1) The words “as indicated.” means: as shown on the Drawings, and in accordance with the Specifications.
      2) The words “as required.” means: as required to provide a complete and satisfactory Work in full conformance with the Drawings and Specifications.
      3) The word “Provide” means: furnish, install, connect, test and make ready for use.
      4) The word “Work”: The Work is the completed construction required by the Drawings and Specifications, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.
      5) The word “Furnish” means: supply item as specified. Item to be installed by others.
      6) Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site.
      7) Project Record Drawings or Record Drawings are drawings that completely record and document all aspects and features of the Work. (Also known as “as-built” drawings.)

1.03 REFERENCES

A. NFPA 70 – National Electrical Code

B. UL 1449 – Surge Protective Devices

1.04 SYSTEM DESCRIPTION

A. This project shall include the installation of CCTV cameras, camera mounts, power supplies, cabling, digital video recorder, and monitors that shall be compatible with the MDOT security standard.

B. The CCTV Surveillance System shall be controlled from the District Security Center with video transfer capability over the MDOT WAN to the MDOT security center in Jackson.

1.05 SUBMITTALS

A. Product Data: Submit nine (9) sets of three binders of manufactures supplied data. Each binder shall contain:

1. Specification/cut sheets for equipment provided
2. Design guides
3. Installation and operating instructions

B. Shop Drawings: Submit nine (9) copies of each submittal.

1. Diagrams of cable layout with system labeling schedule.
2. Wiring diagrams.

C. Field quality-control test report showing all cameras and digital video recorders / devices are installed / tested and are functioning correctly.

D. Project Record Drawings:

1. The purpose of Project Record Drawings is to provide factual information regarding aspects of the Work, to enable future service, modifications, and additions to the Work
2. Project Record Drawings are an important element of this Work. Contractor shall accurately maintain Project Record Drawings throughout the course of this project.
3. Project Record Drawings shall include documentation of Work, including the camera locations, of setup perimeters, equipment, wiring, and cable runs.
4. The contractor will be furnished with two (2) sets of site plans for Contractor's use in preparing Project Record Drawings. One set shall be used as a working set, the other shall be used to prepare the final record set.
5. Project Record Drawings shall accurately show the physical placement of the following:
   a. Cameras, power supplies, and digital video recorders.
   b. Cable runs
   c. Pull box locations.
   d. Project Record Drawings shall show the physical placement of each camera and conduit to be accurate to within one foot (1') of the nearest landmark. Where the site plan conflicts with actual conditions, Contractor shall amend site plan as required. Indicate exact description of conduit runs and cable tray runs
   e. Project Record Drawings shall show wire and cable runs, camera zone numbers, electrical panel/circuit breaker numbers from which equipment is powered, and splice points. Such information may be shown on the site plans.
   f. Upon completion of Work, and prior to Final Acceptance, Contractor shall prepare and submit final record set of Project Record Drawings. This set shall reflect the installed work.
   g. Final Project Record Drawings shall be provided to the MDOT or MDOT’s representative.

6. Closeout Submittals:
   a. Provide a set Project Record Drawings to the Project Engineer including:
      1) Project Record Drawings
      2) Product Data
      3) Installation Manuals
      4) Operating Manuals
      5) Maintenance/Service Manuals

1.06 QUALITY ASSURANCE

A. Contractor Minimum Qualifications

1. Contractor shall be an installation and service contractor regularly engaged in the sale, installation, maintenance and service of CCTV Surveillance System.
2. Contractor shall have five (5) years experience with the installation, start-up and programming of systems of a similar size and complexity to the one proposed.

B. Supervision of Work: Contractor shall employ a competent Foreman to be in responsible charge of the Work. The Foreman shall be on the project site daily during the execution of the Work. The Foreman shall be a regular employee, principle, or officer of the Contractor, who is thoroughly experienced in managing projects of a similar size and type. Contractor shall not use contract employees or Subcontractors as Foremen.

C. Qualifications Of Technicians

1. Electronic systems Work shall be performed by electronic technicians thoroughly trained in the installation and service of CCTV systems.
2. Journeyman Wireman electrical workers may be used to install conduit, raceways, wiring, and the like, provided that final termination, hook-up, programming, and testing is performed by a qualified electronic technician, and that all such Work is supervised by the Contractor's Foreman.
3. Incidental Work, such as cutting and patching, lock hardware installation, painting, carpentry, and the like, shall be accomplished by skilled crafts persons regularly engaged in such type of work. Work shall comply with the highest standards applicable to that respective industry or craft.
4. 120 VAC power wiring and connections are to be performed by a qualified Journeyman Wireman, licensed to perform such Work.

D. Subcontractors

1. Use of any Subcontractor is subject to the approval of the MDOT or MDOT’s representative and shall be identified at the time of Bid submittal.
2. Make no substitution for any Subcontractor previously selected without MDOT approval.
3. Contractor's Foreman shall be on the project site daily during all periods when Subcontractors are performing any of the Work. Contractor's Foreman shall be in responsible charge of Work, including any Work being performed by Subcontractors.
4. By an appropriate written agreement, 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 the terms of the Drawings and Specifications, and to assume toward the Contractor the obligations and responsibilities which the Contractor, by these documents, assumes.

E. Supervision And Construction Procedures

1. Supervise and direct the Work, using best skill and attention. Contractor is solely responsible for construction means, methods, and techniques.
2. Employ a competent foreman who shall be in attendance at the project site during the progress of the Work. The foreman shall represent the Contractor and communications given to the foreman shall be as binding as if given to the Contractor.

F. Regulatory Requirements and Permits

1. Work shall conform to applicable building, fire, and electrical codes and ordinances. In case of conflict between the Drawings / Specifications and codes, the codes shall govern. Inform the MDOT’s representative of any such conflicts.
2. Secure and pay for licenses, permits, plan reviews, engineering certifications, and inspections required by regulatory agencies. Prepare, at Contractor's expense, any documents, including drawings, that may be required by regulatory agencies.

3. Make application for and obtain any permits required by federal, state, county, city, or other authority having jurisdiction over the work.

G. 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.

H. Comply with NFPA 70, "National Electrical Code."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Security of Contractor's Tools and Equipment: The MDOT or the MDOT's representative is not responsible for the care, storage or security of any of the Contractor's tools or equipment.

1.08 PROJECT/SITE CONDITIONS

A. Environmental Conditions

1. Dust Control: Make provisions to control dust, dirt, and foreign material caused by the performance of the Work.
2. Notify MDOT or MDOT's representative immediately of any damage or possible damage to any other equipment.

B. Clean-Up

1. Clean-up, on a daily basis as the Work progresses, dirt, dust and debris caused by Contractor's operations. Clean-up shall be completed by the end of each workday.
2. In the event that Contractor fails to clean-up, the MDOT or MDOT's representative may elect to have cleanup performed by others, with the costs of such clean-up being charged to the Contractor.

C. Construction Aids

1. Definition: Construction Aids are facilities and equipment required by personnel to facilitate the execution of the Work. Construction Aids include scaffolds, staging, ladders, platforms, hoists, cranes, lifts, trenchers, core drillers, protective equipment, and other such facilities and equipment.
2. Provide Construction Aids required in the execution of the Work. Construction Aids that are the property of MDOT or other contractors shall not be used without permission.
3. Storage of Construction Aids shall be coordinated with MDOT or MDOT's representative.

D. Safety

1. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.
2. Comply with local, state, and federal regulations and laws for the safety of the work place.

E. Accident Reports

1. Serious or fatal accidents shall be reported immediately by telephone or radio to the MDOT or MDOT's representative.

1.09 SEQUENCING

A. Description: This implementation plan describes the general approach that shall be followed in order to minimize the time for the CCTV Surveillance System to be operational.

B. Approach: Contractor shall plan and schedule work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order equipment needed and notify any subcontractors to schedule their participation.
2. Insure there are an adequate number of power receptacles available to operate CCTV equipment and coordinate with MDOT or MDOT's representatives to where power is available.
3. Perform system layout work.
4. Provide shop drawings to verify location of equipment, conduit runs, power connections, etc. Submit shop drawings to MDOT or MDOT's representative.
5. Coordinate with MDOT or MDOT's representatives the access to the indicated camera location.
6. Prepare and pre-test all video equipment, set back light compensation to the greatest extent possible.
7. Install equipment.
8. Test and inspect all systems.
9. Perform other Work as required.
10. Perform the Acceptance Test.
11. Provide training.
12. Provide as-built drawings.

1.10 COMMISSIONING

A. After Work is completed, and prior to requesting the Acceptance test, conduct a final inspection, and pre-test equipment and system features. Correct any deficiencies discovered as the result of the inspection and pre-test.

B. Submit a request for the Acceptance test in writing to the MDOT's representative no less than fourteen days prior to the requested test date. The request for Acceptance test shall be accompanied by a certification from Contractor that Work is complete and has been pre-tested, and that corrections have been made.

C. During Acceptance test, demonstrate video equipment and system features to MDOT. Any portions of the Work found to be deficient or not in compliance with the Project Drawing and Specifications may be rejected.

D. Promptly correct deficiencies. Upon correction of deficiencies, submit a request in writing to MDOT or MDOT's representative for another Acceptance Test.

E. Bare the cost for the second acceptance test.

1.11 MAINTENANCE

A. Provide full procedures for testing video quality and alignment.

B. Provide full procedures for any other tasks that must be performed to ensure the warranty remains intact.

PART 2 - PRODUCTS

2.02 EQUIPMENT AND MATERIALS

A. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Provide components needed for complete and satisfactory operation.

B. Products not provided by MDOT shall be new and unused, and shall be of manufacturer's current and standard production.

C. Where two or more equipment items of the same kind are provided, they shall be identical and provided by the same manufacturer.

D. Product Availability:

1. Prior to submitting a proposal, determine product availability and delivery time, and include such considerations into proposed Contract Time.
2. Certain products specified may only be available through factory authorized dealers and distributors. Verify ability to procure the products specified prior to submitting a proposal.

2.03 CAMERAS

A. Available Manufacturers:

1. COHU
2. Hitachi Visual Technologies.
3. Honeywell
4. JVC Professional Products.
5. Panasonic Security Systems Group.
6. Pelco.
7. Philips Communication, Security & Imaging; Philips Electronics N.V.
8. Samsung Opto-Electronics America, Inc.
9. Sensormatic Electronics Corporation.
10. Toshiba Security Products.
11. Vicon Industries, Inc.
12. Watec America Corporation.

B. Color Fixed Camera (All Interior Installations)

1. Type:
   a. Normal Color Camera
   b. Day Night camera with retractable IR cut filter for night operation
2. Imaging Device: 1/3 inch

3. Minimum Picture Elements:
   a. Normal Color Camera: 768 (H) x 494 (V)
   b. Day Night Color Camera: 720 (H) x 540 (V)
4. Scanning System: 2:1 Interlace.
5. Minimum Horizontal Resolution: 504 TV lines.
6. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.
7. Sensitivity:
   a. Normal Camera: .3 lux
   b. Day Night Camera:
      1) Day (color): 0.8 lux
      2) Night (B/W) .08 lux
8. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. The illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with the camera AGC off.
9. Manually selectable modes for backlight compensation or normal lighting.
10. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

C. Color Dome Fixed Camera: (All Exterior Installations)

Assembled and tested as a manufactured unit, containing a dome assembly, color camera, and receiver/driver.

1. Horizontal Resolution: 540 lines.
2. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.With AGC, manually selectable on or off.
3. Sensitivity: Camera indicated shall be combination day/night cameras.
4. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. The illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with the camera AGC off.
5. Manually selectable modes for backlight compensation or normal lighting.
6. Preset positioning: minimum 8 user-definable scenes, each allowing 16-character titles. Controls shall include the following:
   a. In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
   b. Motion detection shall be available at each camera position.
   c. Up to four preset positions may be selected to be activated by an alarm. Each of the alarm positions may be programmed to output a response signal.
7. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

D. Lenses: Optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide lenses for camera manufacture if available.

E. CCTV Camera Mounting:

1. Parapet wall mount – Pelco model PP350 or equal
2. Parapet rooftop mount – Pelco model PP351 or equal
3. Wall mount – Pelco model WM2000 or equal
4. Corner mount adaptor for WM2000 – Pelco model CM100 or equal.

2.04 POWER SUPPLIES

A. Power Supplies: Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera manufacturer.

1. Acceptable Manufactures:
   a. Pelco
   b. Altronix
2. Output Voltage: 24 or 28 Vac selectable
3. Protection Individual camera fuse or circuit barker
4. Enclosure: Power supplies used externally shall be NEMA Type 4X /IP66 rated.
5. Current sized for application with minimal 20% safety factor.

2.05 UTP Transceivers

A. General Requirements:

1. Type: Passive
2. Input:
   a. BNC connector
   b. Impedance: 75 Ohm
3. Output:
   a. RJ-45 connector or screw terminal
   b. Impedance: 100 to 200 Ohm
4. Bandwidth: DC to 8 MHz
5. Max input voltage: 1.1 V p-p
6. Maximum insertion Loss: 2 dB (DC to 8 MHz)
7. Minimum return loss: 15 dB (DC to 8 MHz)
8. Minimum common mode rejection: 40 dB
9. Drive capability:
   a. 24 AWG twisted pair
   b. Impedance: 100 to 200 Ohm
   c. Capacitance: 20 pf/foot

B. UTP Transmitter:

1. Internal to camera UTP 200 ohm output
2. External transmitter: single channel Pelco TW3001P or equal

C. UTP Receivers:

1. Single Channel UTP/Coax Receiver: Pelco TW3001P or equal
2. 8 Channel UTP/Coax Receiver: Pelco TW3008P or equal
3. 16 Channel UTP/Coax Receiver: Pelco TW3016P or equal

2.06 DIGITAL VIDEO RECORDERS

A. Available Manufacturers:

1. Dedicated Micros USA.
2. Everfocus
3. Honeywell
4. Integral
5. JVC Professional Products.

6. Panasonic Security Systems Group.
7. Pelco.
8. Philips Communication, Security & Imaging; Philips Electronics N.V.
9. Samsung Opto-Electronics America, Inc.

B. Requirements:

1. Camera Inputs 16 Analog
2. Video input: 1 V p-p at 75 Ohm
3. Monitor Out: 1 BNC Composite 1 V p-p at 75 Ohm.
4. Video Format: NTSC
5. Recording Rate: 480 FPS (NTSC)
6. Compression: MPEG-4 or MJPEG
7. Storage of 500 GB minimum.
8. Storage External:
   a. SCSI connector
   b. Hot swapping
   c. Capacity Minimum 4 position for 2 TB drives
9. Display Resolution: 720 by 480
10. Display Format: 1, 4 and 8 Multiscreen display.
11. Network Interface: Ethernet RJ-45 network connection
12. Intelligent motion detection with programmable area and programmable sensitivity.
13. Time and Date Generator: Records time (hr:min:sec) and date legend of each frame.
14. Watermark time and date stamp for exported files.
15. Title: Minimum 12 characters for each camera.

2.07 LCD MONITOR

A. Type: Flat panel LCD

B. Size: 19 inches minimum

C. Input: VGA

D. Resolution: Supports up to 1280 X 1024 for SXGA input

E. Brightness: adjustable to 300 cd/m²

F. Minimum Contrast Ratio: 500:1

G. Maximum Response Time: 12 ms

H. Industrial rated for 24 hour x7 days a week operation

I. Power: 120 V ac @ 50 Watts

2.08 WIRE AND CABLE

A. General: Provide wire and cable required to install systems as indicated.

1. Video cable shall be sized to provide adequate video signal at the recording equipment. The maximum cable length are as follows:
   a. RG-59 – 700 feet
   b. RG-6 – 1200 feet
   c. CAT 5e - 300 feet for network applications
   d. CAT 5e - 750 feet for video and TPZ control
2. Wire and cable shall be sized to provide adequate signal for the worst case distance.

B. Cables shall be specifically designed for their intended use.

C. Coax cable with only a foil shield and drain wire shall not be acceptable.

D. Comply with equipment manufacturers recommendations for wire and cable size and type.

E. Comply with all applicable codes and ordinances.

2.09 JUNCTION AND PULL BOXES

A. Interior Boxes: Sheet Metal Outlet Boxes: Sizes to be determined in accordance with code requirements for conductor fill. No box shall be smaller than a single gang 1-1/2” deep. Provide box covers as required.

B. Exterior Boxes: Exterior boxes shall NEMA 4 or NEMA 3R, watertight and dust-tight.

C. Interior and exterior boxes shall have their covers fastened using security screws.

D. Lightning Protection:

1. Provide suitable lightning protection for security panels.
2. Lightning protection equipment shall be UL listed.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

A. Field located security panels where indicated.

B. Mount field camera and power and run connecting cables as indicated.

C. Align cameras as indicted.

D. Set focal length (variable focal length (VFL) lenses) as required to encompass indicated view.

E. Set back light compensation. Use neutral density filters to simulate darkness to set with iris full open.

F. Set focus and depth of field. Set focus to give desired depth of field in lowest light level.

G. Check communication and operation of remote control (PTZ dome camera) Field locate cables form security panel to security work station.

H. Field locate cable and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other adverse conditions affecting installation.

3.02 EXAMINATION

A. Junction and Pull Boxes

1. Interior Boxes: Sheet Metal Outlet Boxes: Sizes to be determined in accordance with code requirements for conductor fill. No box shall be smaller than a single gang 1-1/2 inches deep. Provide box covers as required.
2. Exterior Boxes: Exterior boxes shall be NEMA 4 or NEMA 3R, watertight and dust-tight
3. Interior and exterior boxes shall have their covers fastened using security screws.

B. Lightning Protection

1. The Contractor shall provide suitable surge protection at both the camera and at the recoding equipment for exterior cameras.
2. Camera on poles or exposed in top of buildings shall have air terminals. The air terminals shall be bonded to the existing lighting protection system.
3. Lightning protection equipment shall be UL listed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 CABLING

A. Layout, size, and plan new wire and cable runs as required.

B. Wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.

C. Splices shall be made in junction boxes (except at equipment). Power and CAT 5 splices shall be made with an approved crimp connection. Coax cable splices shall be made by first terminating the cable with a coax connector and then using barrel coax cable connectors to join the coax cables. Wire nuts shall not be used on any low-voltage wiring unless the device.

D. Identify all wire and cable at terminations (both ends) and at every junction box. Identification shall be made with an approved permanent label, Brady or equal.

E. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

F. Install coax cables using techniques, practices, and methods that are consistent with coax video cable and that ensure coax video performance of completed and linked signal paths, end to end.

G. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.

H. Install cables without damaging conductors, shield, or jacket.

I. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

J. Wire and Cable Terminations

1. Identify all inputs and outputs on terminal strips with permanent marking labels.
2. Neatly dress and tie all wiring. The length of conductors within enclosures shall be sufficient to neatly train the conductor to the terminal point with no excess. Run all wire and cable parallel or normal to walls, floors and ground.
3. Install connectors as required by equipment manufacturers.
4. Do not obstruct equipment controls or indicators with wire or cable.
5. Route wire and cable away from heat producing components such as resistors, regulators, and the like.
6. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
7. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

K. Conduit and Raceway Installation

1. Lay-out, size and plan conduit and raceway systems as indicated or as required which ever will allow for the greatest number of cables.
2. Route exposed conduit and raceway parallel and perpendicular to walls and adjacent piping.
3. Maintain minimum six (6) inch clearance between conduit and piping.
4. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
5. Use conduit bodies to make sharp changes in direction, as around beams. Fasten conduits and raceways to structural steel using approved spring clips or clamps.
6. No exposed conduit, raceway, or junction box shall be installed within any populated area.
7. Install boxes, card reader, intercoms and push buttons straight and plumb.
8. Do not support conduit from mechanical, plumbing, or fire sprinkler systems.
9. Do not use flexible conduit in lengths longer than six (6) feet.

L. Penetrations: When penetrating a fire wall for passage of cables and/or conduit, provide a fire-stop system that complies with code and the local authority having jurisdiction.

M. Camera

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Install coax cable form the camera to the DVR where required.

3.04 IDENTIFICATION

A. Label both ends of each cable. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

B. Label each terminal strip and screw terminal or coax cable connector in each cabinet, rack, or panel.

1. Wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

C. At completion, cable and asset management software shall reflect as-built conditions.

3.05 SYSTEM SOFTWARE

A. Provide and install the DVR software and the CCTV software. Configure software to the project requirements. Assign software licenses to MDOT.

3.06 FIELD QUALITY CONTROL

A. Provide wiring diagrams and labeling charts to properly identify all wiring.

B. Provide a screen capture of each CCTV view.

C. If corrections are needed, the Contractor shall perform the needed corrections in a timely fashion.

3.07 DEMONSTRATION - TRAINING

A. Engage authorized service representative to train MDOT's maintenance personnel to adjust, operate, and maintain CCTV camera system.

END OF SECTION

SECTION 28 31 11 FIRE/BURGLARY DETECTION AND ALARM SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Control Panel
2. Associated Equipment

B. Products Installed but not supplied under this Section:

1. Section 26 27 26 - Wiring Devices

1.02 REFERENCES

A. Underwriters Laboratories (UL):

1. UL385 - Grades A, AA Police Connect.
2. UL609 - Grade A Local Mercantile Premises and Mercantile Safe and Vault.
3. UL611/UL1610 - Grades A, AA Central Station.
4. UL684 - Local, Central Station and Remote Station.
5. UL864 - Wireless smoke detectors.

B. Federal Communications Commission (FCC):

1. FCC Part 15
2. FCC Part 68

C. National Fire Protection Association (NFPA):

1. NFPA 72

1.03 SYSTEM DESCRIPTION

A. Provide a Fire and Burglary Alarm System that includes the following capabilities:

1. Commercial UL listed system.
2. Supporting up to 32 zones.
3. Interfacing with: An alpha numeric paging device.
4. Operating with a long-range radio unit.
5. Operating with an integrated security and access control systems.
6. Supporting zones for supervision of peripheral devices.
7. A scheduling capability to allow for automated operations.
8. Monitoring smoke detector maintenances signals.

1.04 SUBMITTALS

A. Submittals shall include manufacturer data sheets for all major system components.

1.05 QUALITY ASSURANCE

A. The alarm manufacture shall be certified as being compliant with ISO9001.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE

A. Control Panel - The Control Panel shall be an 8-partition unit, capable of supporting hardwire, hardwire expansion and wireless zones equal to Honeywell Vista-32FB. Peripheral devices supported by the Control Panel shall include bells, dialers (telephone lines), keypads, RF receivers and relays. The following performance requirements shall be met.

1. Basic Hardwire Zones - A total of 8 style-B hardwire zones shall be capable of supporting the following:
   a. EOLR supervision supporting normally open (N.O.) or normally closed (N.C.) sensors.
   b. Individually assignable to one of 2 partitions.
   c. Up to 16 2-wire smoke detectors on 2 selected zones (32 total).
   d. 4-Wire smoke detectors on any zone.
   e. Up to 50 2-wire latching glass break detectors on one specific zone.
   f. Individually assignable to bell outputs and/or auxiliary relay.
2. Polling Loop Expansion Zones - The Control Panel shall also be capable of supporting up to 24 additional hardwire zones using a built-in, 2-wire, polling (addressable) loop interface. The polling loop shall provide power and data to remote point modules, and constantly monitor the status of all zones on the loop. Maximum current draw shall not exceed 128 mA. The polling loop zones shall be capable of:
   a. Using Remote Point Module (RPM) devices.
   b. Supervision by the Control Panel.
   c. Individually assignable to one of the partitions.
   d. Individually assignable to bell outputs and/or auxiliary relay.
   e. 4,000-foot capability without shielded cable.
3. Wireless Expansion Zones - The Control Panel shall also be capable of supporting up to 32 wireless zones via a radio frequency (RF) receiver. The Wireless zones shall be capable of:
   a. Supervision by the Control Panel for check-in signals.
   b. Individually assignable to notification appliance outputs and/or auxiliary relay.
   c. Tamper protection shall be optional.
   d. Supporting commercial wireless smoke detectors.
4. Partitions - The independent partitions shall provide the following features:
   a. A Common Lobby partition shall be capable of automatic arming, when the last partition sharing the lobby is armed and automatically disarmed when the first partition sharing the common lobby is disarmed.
   b. A Master Partition shall be provided for assigning keypads capable of simultaneously viewing the system status of both partitions.
   c. Both partitions shall be capable of having keypads assigned.
   d. All zones, except fire, shall be assignable to one of 8 partitions.
   e. Both partitions shall be capable of supporting relays.

f. The ability to display fire and/or burglary and panic and/or trouble conditions at all other partition keypads shall be optional.
g. The ability to support selectable options including entry/exit delay and subscriber account information.

5. User Codes - The Control Panel shall accommodate 75 user codes. The following characteristics shall be assigned to each user code.
   a. Authority level.
   b. Partitions operated by the user code.
   c. Global arming capability.
   d. Use of a RF button to arm and disarm the system.
   e. Optional opening/closing central station reporting.
6. Peripheral Devices - The Control Panel shall support up to 16 addressable devices. The devices shall include any combination of keypads, RF receivers, relay modules, notification circuit modules and access control modules. Peripheral devices shall have the following characteristics: Each device shall be:
   a. Physically set to an individual address.
   b. Enables using the Device Programming Mode.
7. Remote Keypads - The Control Panel shall be compatible with remote keypads and allow the user to:
   a. Arm and disarm the system or one partition is a multiple partition system.
   b. Bypass zones.
   c. View messages from the central station.
   d. Display zone descriptors (alarm, trouble, bypass, etc) in the display window.
   e. Individually silence notification circuits and/or reset panel.
8. Notification Output Circuits - The Control Panel shall internally provide two supervised NAC outputs for operating fire and burglar alarm notification appliances it shall also support two additional supervised NAC outputs when using a supervised NAC module. Each NAC output shall be rated 10-14 VDC, 1.7 amp max power limited. Total alarm current draw when using two NAC outputs shall not exceed 2.3 amps for battery independent operation.
9. Auxiliary Relay - A built-in Form C relay shall be provided. The relay contracts shall be rated at 28 VAC/VDC, 2.8 amps maximum. The relay shall support:
   a. Alarm activation.
   b. Trouble/supervisory activation.
   c. Reset of 4-wire smoke detectors.
   d. Battery saving feature.
10. Output Relays - A total of 16 relay outputs shall be accommodated using relay modules. Each relay module shall provide four Form C (normally open and normally closed) relays for general-purpose use or two Y-style supervised bell outputs. The relay characteristics shall be capable of being:
    a. Programmed to activate in response to system events.
    b. Programmed to activate using time intervals.
    c. Used for additional y-style supervised be NAC outputs.
    d. Activated manually using a relay command mode.
    e. Supervised by control panel.
    f. Assigned an alpha descriptor.
11. Addressable Loop Output Relay - A total of 16 Form C (Normally open and normally closed) shall be accommodated using the addressable detection loop single relay module. The relay characteristics shall be capable of being:
    a. Programmed to activate in response to system events.
    b. Programmed to activate using time intervals.
    c. Used for additional y-style supervised be NAC outputs
    d. Activated manually using a relay command mode.

e. Supervised by control panel.
f. Assigned an alpha descriptor.

12. Ancillary Control - The Control Panel shall be capable of being programmed to activate up to 16 control relays which open doors, turn off lights, etc.
13. 12-Volt Power Supply - The Control Panel shall be a 12-Volt power supply transformer. The transformer shall supply a total of 2.3 amps total for both notification circuits and ancillary functions.
    a. Alarm notification appliances, including but not limited to sirens and strobes.
    b. Power for relays, keypad/annunciators, 4 wire smoke detectors, access control devices, etc.
14. Telephone Dialers - The Control Panel shall be equipped with a built-in supervised telephone dialer for communications with the central station. It shall also be capable of supporting a supervised backup dialer for connecting to a second telephone line for commercial fire applications.
15. Trigger Output Connector - The Control Panel shall contain an internal connector equipped for a single input and seven outputs. The outputs shall interface with:
    a. Remote keypad sounder.
    b. UL listed key switch.
    c. LED indicator module.
    d. Auxiliary alarm signaling equipment.
    e. Event logging serial printer.
    f. Computer used to direct wire downloading via a serial module.
16. Keyswitch - Both partitions within the Control Panel shall be capable of supporting a keyswitch.
17. Pager Interface - The Control Panel shall be capable of sending event information to an alphanumeric pager via a pager interface device.
18. Voltage Triggers - The Control Panel shall provide a trigger outputs. The trigger connector pins change state for different conditions in order to interface with equipment such as long range radio equipment (LRR), remote keypad sounders, keyswitch ARMED and READY LEDs, or a system event log printer.
19. Event Log - The Control Panel shall contain a programmable event log capable of the following:
    a. Storing up to 224 events.
    b. Viewable at the keypad.
    c. Printed on a serial printer.
    d. Storing access control system events.
    e. Sending printed events to an alphanumeric pager.
20. Scheduling - The Control Panel shall provide the following automated scheduling capabilities:
    a. Open/Close schedules used to control arming/disarming and reporting.
    b. Holiday schedules, which allow different time windows for open/close schedules.
    c. Timed events which activate relays, auto-bypassing, un-bypassing, auto-arming and disarming.
    d. Access schedules, which limit system access to users, by name.
    e. End User Output Programming Mode shall provide 20 timers for relay control.
21. Communications Formats - The Control Panel shall support the following formats for the primary and secondary central station receivers:
    a. ADEMCO Low Speed (Standard or expanded)
    b. Sescoa/Radionics
    c. ADEMCO Express
    d. ADEMCO High Speed
    e. ADEMCO Contact ID

22. Audio Alarm Verification - The Control Panel shall support a programmable audio alarm verification (AAV) device, capable of operating in conjunction with an output relay, to permit two-way voice dialog between a central station operator and the premises.
23. Cross-Zoning Capability - In order to prevent false alarms, the Control Panel shall prevent a zone from going into alarm, unless its cross-zone is also faulted within 5 minutes.
24. Exit Error False Alarm Prevention - The Control Panel shall be capable of differentiating between an actual alarm and a false one caused by leaving an entry/exit door open. The Control Panel shall be capable of:
    a. Being arming while the faulted entry/exit zone(s) and/or interior zones are bypassed.
    b. Generating an Exit Error report by user and zone.
25. Downloading Features - The Control Panel shall be capable of uploading and downloading at 300 baud. It shall also be capable of uploading ECP devices, their physical addresses, programmed addresses and firmware revision levels.
26. Enhanced Fire Walk-Test Mode - The Control Panel shall provide the installer with the following features:
    a. Automatic test of all integrated remote point module (RPM) devices, equipped with an automatic test feature.
    b. While automatic test is in progress all fire zones that remain untested shall be displayed.
    c. An event log shall be capable of logging the results of tested and untested zones.
    d. The ability to report the result of tested and untested zones to the central station.
27. Built-in User's Manual and Descriptor Review - A built-in User's Manual shall be provided for End User convenience. The following shall be provided:
    a. A brief explanation of keypad functions shall be provided at the keypad alphanumeric display.
28. Access Control
    a. In addition, the Control Panel shall be capable of being connected to an integrated access control systems.
    b. The panel shall be capable of supporting three different methods of weig and access control card readers. These are by use of the ECP bus or the V-Plex addressable loop.

2.02 ENCLOSURE

A. The Control Panel shall be enclosed in a metal cabinet, suitable for wall mounting. The dimensions shall not exceed 18 inches in height, 14.5 inches in width of 4.3 inches in depth.

2.03 ELECTRICAL POWER REQUIREMENTS

A. System Power - The Fire and Burglary Alarm System shall operate using standard 120 volts AC, 50/60 Hz power.

1. Control Primary Power - Transformer power shall be 18 VAC, 17VA.
2. Backup Battery - A rechargeable 12 VDC, gel type, lead acid backup battery shall be provided. The battery shall be rated between 12 and 34-ampere hours (AH).
3. Alarm Power - Maximum alarm output power shall be 12 VDC, 1.7 amps for each NAC output (maximum total for both of 2.3 amperes).
4. Auxiliary Standby Power - Standby power shall be 12 VDC, 1 amp maximum.

5. Total Power - Combined auxiliary standby and alarm currents shall be 2.3 amps.
6. Fusing - The battery input, auxiliary, and bell outputs shall be protected using PTC circuit breakers. All outputs shall be power limited.

2.04 ENVIRONMENTAL CONDITIONS

A. Environmental Conditions - The Fire and Burglary Alarm System shall be designed to meet the following environmental conditions.

1. Storage Temperature - The system shall be designed for a storage temperature of -10°C to 70°C.
2. Operating Temperature - The system shall be designed for an operating temperature of 0°C to 50°C (32°F to 120°F).
3. Humidity - The system shall be designed for normal operation in an 85% relative humidity environment.
4. Electromagnetic Interference - The system shall meet or exceed the requirements of FCC Part 15, Class B devices, FCC Part 68, IEC EMC directive.

2.05 ASSOCIATED EQUIPMENT

A. The following equipment shall be provided as part of the Fire/Burglary/Access Alarm System:

1. Smoke Detectors
2. Heat Detectors
3. Manual Pull Stations
4. Horn/Strobes
5. Strobes
6. Keypad/Annunciators
7. Motion Detectors
8. Addressable Relay Modules
9. Addressable Notification Modules

PART 3 - EXECUTION

3.01 INSTALLATIONS

A. The Alarm System shall be installed in accordance with the Manufacturer’s Installation Manual.

3.02 TESTING

A. The Alarm System shall be tested in accordance with manufacturers recommended procedures by an authorized manufacturer’s representative.

END OF SECTION

SECTION 31 23 11 EXCAVATION, FILLING AND GRADING FOR BUILDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The extent of excavation, filling and grading is shown on the Drawings.

1. Preparation of subgrade for building slabs is included as part of this Work
2. Backfilling for trenches within the building lines is included as part of this Work.

B. Related Sections:

1. Section 01 40 00 – Quality Requirements (For Testing Laboratory Services).
2. Section 01 45 29 – Testing Laboratory Services – MDOT.

1.02 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.03 SUBMITTALS

A. Notification shall be provided to Project Engineer indicating source of borrow material in advance of start of Work and certification provided that proposed soil material is satisfactory for specified use.

1.04 QUALITY ASSURANCE

A. Preexcavation Conference: Conduct conference at Project site.

B. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.

C. Compaction density shall be 95 percent of the maximum dry density value as determined by ASTM D 698 (Standard Proctor Test) of AASHTO T-99.

D. Soils compaction control tests shall be performed as specified herein and under Section 01 40 00 –Quality Requirements. Stability is defined as absence of significant yielding or pumping of soils under compaction effort.

E. Number of Tests: Make test(s) in accordance with AASHTO T-99 for each class of material. Make in-place density tests in accordance with AASHTO T-238 (Nuclear Method) for density tests, as the fill and backfill work progresses. At least one test per lift of any isolated portions and each footing.

F. Work on Non-Tested Areas: Placing permanent construction over fill that has not been tested and approved may require removal of permanent Work, recompacting the fill and replacing the Work at no additional cost to the Owner.

1.05 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

1. Locate existing underground utilities in the areas of Work.
2. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions.
4. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

B. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by Project Engineer and then only after acceptable temporary utility services have been provided.

1. Demolish and completely remove from site existing underground utilities indicated “To Be Removed”.
2. Coordinate with utility companies for shut off of services if lines are active.

1.06 PROTECTION OF PERSONS AND PROPERTY

A. Barricade open excavations occurring as part of this Work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.07 USE OF EXPLOSIVES

A. The use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Backfill and Fill: Select fill shall be an approved select material free from trash, debris, stones larger than 3 inches, roots and other organic matter.

C. Granular Fill:

1. Below existing natural grade line: Sandy clay with a liquid limit less than 45 and PI in range of 10 to 22, or clayey sand with PI not less than 7 and liquid limit not greater than 35.
2. Above existing natural grade under slabs and footings: Silty or sandy clay as above or clayey-sand with LL less than 35 and PI of 3 to 15.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Contractor, in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 EXCAVATION

A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.

B. Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Project Engineer. Unauthorized excavation, as well as remedial Work directed by the Project Engineer, shall be at the Contractor's expense. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Project Engineer.

D. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Project Engineer.

E. Additional Excavation: When excavation has reached required subgrade elevations, notify the Project Engineer who will make an inspection of conditions. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Project Engineer. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work.

F. Stability of Excavations. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

G. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

H. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations.

1. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.03 STORAGE OF SOIL MATERIALS

A. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Dispose of excess soil material and waste materials as herein specified.

3.04 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

3.05 EXCAVATION FOR TRENCHES

A. Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

B. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.

C. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Project Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

3.06 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.07 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.08 COMPACTION

A. Control soil compaction during construction providing minimum percentage of density specified for each area classification.

B. Building Slab: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

3.09 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.10 BACKFILL AND FILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

C. Under buildings use sub-base material, or satisfactory excavated or borrow material, or combination of both. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by Project Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and soil treatment.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork, shoring and bracing, and backfilling of voids with satisfactory materials.
4. Removal of trash and debris.

3.11 GROUND SURFACE PREPARATION

A. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.12 PLACEMENT AND COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

3.13 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 COMPACTION AFTER GRADING

A. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.15 MAINTENANCE

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, re-shape, and compact to required density prior to further construction.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 31 16 TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Soil treatment for control of all species of subterranean termites including Formosan termites.

1.02 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical product data and application instructions prior to application for Project Engineer's approval. Include the EPA-Registered Label for termiticide products.

B. Sample Warranty: Submit sample copies of the Termite Soil Treatment Guarantee form prior to application for Project Engineer's approval.

C. Quality Control: Submit identification of at least 3 projects of similar scope along with name, address, and telephone number of the Architect, Owner and General Contractor.

1.03 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

1.04 QUALITY ASSURANCE

A. In addition to the requirements of these Specifications, comply with manufacturer's instructions and recommendations for the Work, including preparation of substrate and application.

B. Installer Qualifications: Engage a professional pest control operator, licensed by the State of Mississippi, Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry, and in accordance with regulations of governing authorities for application of soil treatment solution.

1. The pest control operator is to have the aforementioned valid license, the company technician is to have a valid identification card for pest control, and the company vehicle is to be clearly marked with the company name.
2. The professional pest control operator specializing in Soil Treatment for Termite Control, with 5 years minimum experience, shall have completed work similar to that indicated for this Project and have a record of successful in-service performance.

C. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

D. Comply with Mississippi Regulations Governing Pest Control Operators in following the labels of the termiticide.

E. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

C. Remove all non-pressure treated wood contacting soil. Remove grade stakes prior to applying horizontal barrier and all form boards, stakes and concrete over pour prior to applying vertical soil treatment.

1.06 WARRANTY

A. Soil Treatment Special Warranty: Furnish 3 copies of written warranty certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites, including Formosan termites, and that termite contractor will re-treat the soil and also repair or replace damage caused by termite infestation WITHOUT EXPENSE to the Owner.

1. Warranty Period: Provide warranty for a period of 5 YEARS from the date of treatment, signed by the Applicator and the Contractor.

1.07 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Final Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

A. Termiticide: Use an emulsible concentrate insecticide for dilution with water specially formulated to prevent infestation by subterranean termites as recommended by the Southern Forest Experiment Station, Forest Insect Laboratory at Gulfport, Mississippi, and registered by the Bureau of Plant Industry for use in structural pest control work. Fuel oil will not be permitted as a diligent. Provide a working solution of one of the following chemical elements:

1. Horizontal Barrier: Cypermethrin, Prevail or Talstar.
2. Vertical Barrier: Fipronil.

B. Other solutions may be used as recommended by Applicator and if acceptable to local and state governing authorities. Use soil treatment solutions that are not injurious to plants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.03 APPLYING SOIL TREATMENT

A. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

B. Prior to each application, the applicator shall notify the Contractor of the intended application and instruct the responsible person to notify construction workers and other site individuals to leave the treated area and not to return until chemical has been installed into the soil.

1. Post warning signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

C. Application: Mix soil treatment termiticide solution to a uniform consistency. Use COLOR DYE MARKING AGENT to insure the area is treated. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.

D. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

1. Allow a minimum of 12 hours for drying after application, before beginning concrete placement or other construction activities.

E. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

F. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-290-1 **CODE: (SP)**

DATE: 01/17/2017

SUBJECT: Flagpole

Section 907-290, Flagpole, is hereby added to and made a part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-290 - FLAGPOLE

907-290.01--Description. This work shall consist of furnishing all materials and erecting a ground set fixed type aluminum flagpole with external halyards and accessories as indicated on the Plans/Drawings, or as established.

907-290.02--Materials.

907-290.02.1--General. Unless otherwise stipulated, the materials used in this construction, in addition to the general requirements of this Special Provision, shall conform to the applicable sections of the Standard Specifications. The flagpole shall be spiral wrapped with protective covering and packed in a protective shipping tube or container. The flagpole and accessories shall be protected on site from damage or moisture.

907-290.02.2--Concrete for Flagpole Footing. Concrete for the flagpole footing shall conform to Class "B" Concrete, meeting the requirements of applicable subsections of Section 804 of the Standard Specifications.

907-290.02.3--Flagpole. The flagpole shall be an approved cone tapered, single section aluminum flagpole, having a nominal 30-foot exposed height when measured from the ground. The pole shall be complete with a 14-gauge, 6-inch diameter aluminum ball with a gold anodized finished finial. The pole shall be cast aluminum with double revolving, stainless steel ball bearings, non-fouling truck assembly, tiedown cleat with matching (material) cover capable of being padlocked in position over the tiedown cleat, two No. 10 (5/16") polypropylene braided white halyards with solid bronze swivel snaps per halyard, and ornamental base collar. Lightning ground rod shall be 18 inches long and have a ¾-inch diameter. Lightning ground cable shall be No.6 AWG copper, soft drawn.

The pole shall be made from 6063T6 extruded aluminum tubing with approximately one inch every five to six feet straight taper, with a butt diameter of approximately six inches and top diameter of approximately three and one half inches and have an approved clear anodized finish.

Performance: Pole without flag shall resist without permanent deformation a 110 miles per hour wind velocity, be non-resonant, and have a safety design factor of 2.5.

907-290.02.4--Descriptive Data. Six (6) copies of material descriptive data, in the form of brochures or shop drawings, shall be submitted for review and approval prior to installation of the materials.

907-290.03--Construction Requirements. The flagpole shall be erected plumb in an approved manner to the satisfaction of the Engineer and in accordance with the manufacturer's details and recommendations. Material excavated in flagpole construction shall be disposed of as directed by the Engineer. The flagpole installation shall be electrically grounded. Foundation plate and centering wedges for the flagpole base set shall be installed in the concrete base and fastened. Foundation tube shall be filled with sand and compacted.

907-290.04--Method of Measurement. Flagpole, complete in place and accepted, will be measured per each. Separate measurement for payment will not be made of any individual unit, operation, or incidental item involved in this construction.

907-290.05--Basis of Payment. Flagpole, measured as provided in Subsection 907-290.04, will be paid for at the contract unit price per each complete unit, which price shall be full compensation for furnishing all materials and supplies, for all excavation, backfilling and disposal of surplus material, and for any other work required to complete the flagpole installation.

Payment will be made under:

907-290-A: Flagpole - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-622-1 **CODE: (SP)**

DATE: 09/12/2018

SUBJECT: Field Office Building

PROJECT: BWO-7145-43(001) / 503007301, BWO-7146-43(001) / 503007302, & LWO-7067-43(002) / 503007303 -- Lincoln County

Section 622, Engineer's Field Office Building, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction, is hereby amended as follows.

907-622.03--Construction Requirements.

907-622.03.1.1--Type 1, Type 2 and Type 3 Field Office Buildings. Delete Subparagraph A of Subsection 622.03.1.1 on page 483, and substitute the following.

A. Dimensions. The dimensions of the building shall be as shown in the plans.

K. Utilities. After the last sentence of the fourth paragraph of Subparagraph K in Subsection 622.03.1.1 on page 485, add the following.

The Contractor shall provide two Cat 6E cables at each data box shown in the plans routed in conduit to the backboard. The Contractor shall also provide a 3-inch conduit from the ground to inside the computer room.

L. Air Conditioning. Delete the sentence of Subparagraph L in Subsection 622.03.1.1 on page 485, and substitute the following.

The air conditioning unit shall be furnished and shall be capable of furnishing sufficient cooling to adequately maintain an inside temperature of 72 to 78°F with 12 occupants.

907-622.05--Basis of Payment. Add the "907" prefix to the first pay item listed on page 487.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-625-2 **CODE: (SP)**

DATE: 05/30/2018

SUBJECT: Painted Traffic Markings – Blue-ADA

Section 625, Painted Traffic Markings, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-625.04--Method of Measurement. After the last paragraph of Subsection 625.04 on page 492, add the following.

Four-inch traffic stripe markings shall be measured in accordance with Subsection 619.04 for temporary stripe.

907-625.05--Basis of Payment. Add the following pay items to the list of pay items on page 492.

907-625-E: Detail Traffic Stripe, Blue-ADA - per linear foot

907-625-F: Legend, Blue-ADA - per square foot or linear foot

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-626-4 **CODE: (SP)**

DATE: 03/06/2017

SUBJECT: Thermoplastic Blue ADA Markings

Section 626, Thermoplastic Traffic Markings, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-626.04--Method of Measurement. After the last sentence of the last paragraph of Subsection 626.04 on page 495, add the following.

Cold Plastic Legend, Handicap Symbol of the color specified will be measured per each as determined by actual count in place.

907-626.05--Basis of Payment. After the last pay item listed in Subsection 626.05 on page 496, add the following:

907-626-H: Thermoplastic Legend, Handicap Symbol, Color - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-702-4 **CODE: (IS)**

DATE: 09/11/2018

SUBJECT: Bituminous Materials

Section 702, Bituminous Materials, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-702.04--Sampling. Delete the sentence in Subsection 702.04 on page 722, and substitute the following.

Sampling of bituminous materials shall be as set out in AASHTO R 66.

907-702.07--Emulsified Asphalt. Delete the last sentence in Subsection 702.07 on page 724, and substitute the following.

Asphalt for fog seal shall conform to the requirements of Subsection 907-702.12, Table V.

907-702.12--Tables. Delete Table V in Subsection 702.12 on page 729, and substitute the following.

TABLE V
SPECIFICATION FOR FOG SEAL

	LD-7		CHPF-1		
Test Requirements	**Min.**	**Max.**	**Min.**	**Max.**	**Test Method**
Viscosity, Saybolt Furol, @ 25°C, Sec.	10	100	-	100	AASHTO T 72
Storage Stability Test, 24 hr, %	-	1	-	1	AASHTO T 59
Settlement, 5 day, %	-	5	-	-	AASHTO T 59
Oil Distillate, %	-	1	-	-	AASHTO T 59
Sieve Test, % *	-	0.3	-	0.1	AASHTO T 59
Residue by Distillation, %	40	-	40	-	AASHTO T 59
Test on Residue from Distillation					
Penetration @ 25°C, 100g, 5 sec	-	20	40	90	AASHTO T 49
Softening Point, °C	65	-	-	-	ASTM D 36
Solubility in trichloroethylene, %	97.5	-	-	-	AASHTO T 44
Elastic Recovery @ 25°C, %	-	-	40	-	AASHTO T 301
Original DSR @ 82° (G*/Sinδ, 10 rad/sec)	1	-	-	-	AASHTO T 111

* The Sieve Test result is tested for reporting purposes only and may be waived if no application problems are present in the field.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-703-1 **CODE: (IS)**

DATE: 06/13/2018

SUBJECT: Gradation

Section 703, Aggregates, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-703.03--Course Aggregates for Hydraulic Cement Concrete.

907-703.03.2--Detail Requirements.

907-703.03.2.4--Gradation. In the table in Subsection 703.03.2.4 on page 734, add 100 for the percent passing by weight on the 1½-inch sieve for Size No. 67 aggregates.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-705-1 **CODE: (IS)**

DATE: 06/13/2018

SUBJECT: Stone Riprap

Section 705, Stone Blanket Protection and Filter Blanket Materials, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-705.04--Stone Riprap. Delete the last sentence of the first paragraph of Subsection 705.04 on page 750, and substitute the following.

Quality requirements for rock to be furnished under these specifications will come from a pre-approved source and be visually approved prior to use.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-711-2 **CODE: (IS)**

DATE: 09/11/2018

SUBJECT: Plain Steel Wire

Section 711, Reinforcement and Wire Rope, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-711.02--Deformed and Plain Carbon-Steel Bars for Concrete Reinforcing.

907-711.02.3--Steel Welded and Non-Welded Wire Reinforcement, Plain and Deformed, for Concrete.

907-711.02.3.1--Plain Steel Wire. Delete the sentence in Subsection 711.02.3.1 on pages 780 and 781, and substitute the following.

Plain steel wire and plain steel welded wire shall conform to the requirements of AASHTO M 336.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-720-2 **CODE: (IS)**

DATE: 09/11/2018

SUBJECT: Acceptance Procedure for Glass Beads

Section 720, Pavement Marking Materials, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-720.01--Glass Beads.

907-720.01.4--Acceptance Procedures. Delete the last sentence of the paragraph in Subsection 720.01.4 on page 841, and substitute the following.

Acceptance sampling and testing of glass beads will be in accordance with the Department's Materials Division Inspection, Testing, and Certification Manual, Section 2.9.2 -- Glass Beads.

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.

Construction of Brookhaven Project Office Building, Equipment Shed & Site Improvements, known as State Project Nos. BWO-7145-43(001), BWO-7146-43(001), & LWO-7067-43(002) / 503007301, 302, & 303 in Lincoln County.

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
				Roadway Items	
0010	201-B001		1	Acre	Clearing and Grubbing
0020	202-B007		2,128	Square Yard	Removal of Asphalt Pavement, All Depths
0030	202-B038		1	Each	Removal of Building
0040	202-B053		1	Each	Removal of Concrete Foundation
0050	202-B080		69	Square Yard	Removal of Concrete Sidewalk
0060	202-B088		242	Linear Feet	Removal of Curb & Gutter, All Types
0070	202-B125		8	Each	Removal of Fence Gate, All Types, All Sizes
0080	202-B126		1,940	Linear Feet	Removal of Fence, All Types
0090	202-B191		120	Linear Feet	Removal of Pipe, 8" And Above
0100	202-B211		1	Each	Removal of Septic Tank, All Sizes
0110	203-A001	(E)	1,509	Cubic Yard	Unclassified Excavation, FM, AH
0120	203-EX042	(E)	5,174	Cubic Yard	Borrow Excavation, AH, FME, Class B9-10
0130	203-G001	(E)	100	Cubic Yard	Excess Excavation, FM, AH
0140	209-A005		9,552	Square Yard	Geotextile Stabilization, Type V, Non-Woven
0150	211-C001	(E)	1	Cubic Yard	Topsoil for Plant Holes, Contractor Furnished
0160	211-D001	(E)	7	Cubic Yard	Topsoil for Plant Pits, Contractor Furnished
0170	213-C001		1	Ton	Superphosphate
0180	216-B002		4,849	Square Yard	Solid Sodding, Centipede
0190	221-A001	(S)	3	Cubic Yard	Concrete Paved Ditch
0200	223-A001		4	Acre	Mowing ($50.00)
0210	226-A001		4	Acre	Temporary Grassing
0220	230-A138		8	Each	Shrub Planting, Loropetalum Chinense 'Peack'
0230	230-A139		10	Each	Shrub Planting, Juniperus Squamata 'Blue Star'
0240	230-B032		5	Each	Tree Planting, Drake Chinese Elm
0250	230-D001		120	Square Feet	Bed Preparation
0260	233-A003		1	Cubic Yard	Tree Bark Mulch, Type III
0270	233-A005		1	Cubic Yard	Tree Bark Mulch, Type V
0280	234-A001		1,950	Linear Feet	Temporary Silt Fence
0290	234-D001		5	Each	Inlet Siltation Guard
0300	235-A001		37	Each	Temporary Erosion Checks
0310	237-A002		363	Linear Feet	Wattles, 20"
0320	246-A002		686	Each	Sandbags
0330	249-A001		21	Ton	Riprap for Erosion Control
0340	307-C004	(M)	5,122	Square Yard	6" Soil-Lime-Water Mixing, Class C

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
0350	307-D001		35	Ton	Lime
0360	307-S001	(A3)	1,417	Gallon	Bituminous Curing Seal
0370	403-A006	(BA1)	1,375	Ton	19-mm, ST, Asphalt Pavement
0380	403-A015	(BA1)	838	Ton	9.5-mm, ST, Asphalt Pavement
0390	403-B012	(BA1)	260	Ton	9.5-mm, ST, Asphalt Pavement, Leveling
0400	406-A002		200	Square Yard	Cold Milling of Bituminous Pavement, All Depths
0410	407-A001	(A2)	913	Gallon	Asphalt for Tack Coat
0420	503-C010		617	Linear Feet	Saw Cut, Full Depth
0430	601-B001	(S)	7	Cubic Yard	Class "B" Structural Concrete, Minor Structures
0440	602-A001	(S)	402	Pounds	Reinforcing Steel
0450	603-CA011	(S)	408	Linear Feet	18" Reinforced Concrete Pipe, Class III
0460	603-CB003	(S)	1	Each	18" Reinforced Concrete End Section
0470	603-PE008	(S)	18	Linear Feet	6" Corrugated Polyethylene Pipe
0480	604-A001		488	Pounds	Castings
0490	604-B001		1,250	Pounds	Gratings
0500	607-B026		1,608	Linear Feet	72" Type I Chain Link Fence, Class I , With Top Guard
0510	607-G058		4	Each	Gate, 12' x 6' Chain Link
0520	607-G098		2	Each	Gate, 16' x 6' Double Chain Link with Top Guard
0530	607-P1018		165	Each	Line Post, 9' x 2" Galvanized Steel
0540	607-P2011		4	Each	Brace Post, 9' 6" x 2 1/2" Galvanized Steel
0550	607-P3009		8	Each	Gate Post, 9' x 3 1/2" Galvanized Steel
0560	608-B001	(S)	346	Square Yard	Concrete Sidewalk, With Reinforcement
0570	609-D008	(S)	1,540	Linear Feet	Combination Concrete Curb and Gutter Type 3A
0580	613-D007		1	Lump Sum	Adjustment of Manholes
0590	619-G5001		25	Each	Free Standing Plastic Drums
0600	620-A001		1	Lump Sum	Mobilization
0610	625-E001		1,680	Linear Feet	Detail Traffic Stripe
0620	625-F002		264	Square Feet	Legend
0630	699-A001		1	Lump Sum	Roadway Construction Stakes
0640	907-258-PP004		4	Each	Bollard, Per Plans
0650	907-258-PP005		39	Each	Car Stop, Per Plans
0660	907-290-A001		1	Each	Flagpole
0670	907-607-PP003		300	Linear Feet	Fencing, Per Plans
0680	907-607-PP005		1	Each	Cantilever Gate, Per Plans
0690	907-622-A001		2	Each	Engineer's Field Office Building, Type 3
0700	907-625-E002		209	Linear Feet	Detail Traffic Stripe, Blue-ADA
0710	907-626-H001		4	Each	Thermoplastic Legend, Blue-ADA Handicap Symbol

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
0720	907-630-PP003		4	Each	Handicap Parking Sign, With Post
0730	907-830-PP002		1	Each	Prefabricated Drain, Per Plans
				ALTERNATE GROUP AA NUMBER 1	
0740	304-F001	(GT)	4,994	Ton	3/4" and Down Crushed Stone Base
				ALTERNATE GROUP AA NUMBER 2	
0750	304-F002	(GT)	4,994	Ton	Size 610 Crushed Stone Base
				ALTERNATE GROUP AA NUMBER 3	
0760	304-F003	(GT)	4,994	Ton	Size 825B Crushed Stone Base
				Building Items Items	
0770	907-242-A001		1	Lump Sum	Construction of Equipment Shed
0780	907-242-A001		1	Lump Sum	Construction of Project Office

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-7145-43(001)/ 503007301000, BWO-7146-43(001)/ 503007302000 & LWO-7067-43(002)/ 503007303000**

in **Lincoln** 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 **BWO-7145-43(001)/ 503007301000, BWO-7146-43(001)/ 503007302000 & LWO-7067-43(002)/ 503007303000**

LOCATED IN THE COUNTY(IES) OF **Lincoln**

STATE OF MISSISSIPPI,
COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the____ day of _____,_____.

_____
Contractor(s)

By_____

Title_____

Signed and sealed in the presence of:
(names and addresses of witnesses)

_____

MISSISSIPPI TRANSPORTATION COMMISSION

By_____
Executive Director

_____
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ____ day of _____,_____, Minute Book No. _____, Page No. _____.

Revised 8/06/2003

SECTION 903
PERFORMANCE AND PAYMENT BOND

CONTRACT BOND FOR: **BWO-7145-43(001)/ 503007301000, BWO-7146-43(001)/ 503007302000 & LWO-7067-43 (002)/ 503007303000**
LOCATED IN THE COUNTY(IES) OF: **Lincoln**

STATE OF MISSISSIPPI,
COUNTY OF HINDS

Know all men by these presents: that we, _____
(Contractor)
_____ Principal, a _____

residing at_____ in the State of _____

and _____
(Surety)
residing at _____ in the State of _____,

authorized to do business in the State of Mississippi, under the laws thereof, as surety, effective as of the contract date shown below, are held and firmly bound unto the State of Mississippi in the sum of _____

_____

($_____) Dollars, lawful money of the United States of America, to be paid to it for which payment well and truly to be made, we bind ourselves, our heirs, administrators, successors, or assigns jointly and severally by these presents.

The conditions of this bond are such, that whereas the said _____

_____

principal, has (have) entered into a contract with the Mississippi Transportation Commission, bearing the date of _____ day of _____ A.D. _____ hereto annexed, for the construction of certain projects(s) in the State of Mississippi as mentioned in said contract in accordance with the Contract Documents therefor, on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

Now therefore, if the above bounden _____
_____in all things shall stand to and abide by and well and truly observe, do keep and perform all and singular the terms, covenants, conditions, guarantees and agreements in said contract, contained on his (their) part to be observed, done, kept and performed and each of them, at the time and in the manner and form and furnish all of the material and equipment specified in said contract in strict accordance with the terms of said contract which said plans, specifications and special provisions are included in and form a part of said contract and shall maintain the said work contemplated until its final completion and acceptance as specified in Subsection 109.11 of the approved specifications, and save harmless said Mississippi Transportation Commission from any loss or damage arising out of or occasioned by the negligence, wrongful or criminal act, overcharge, fraud, or any other loss or damage whatsoever, on the part of said principal (s), his (their) agents, servants, or employees in the performance of said work or in any manner connected therewith, and shall be liable and responsible in a civil action instituted by the State at the instance of the Mississippi Transportation Commission or any officer of the State authorized in such cases, for double any amount in money or property, the State may lose or be overcharged or otherwise defrauded of, by reason of wrongful or criminal act, if any, of the Contractor(s), his (their) agents or employees, and shall promptly pay the said agents, servants and employees and all persons furnishing labor, material, equipment or supplies therefor, including premiums incurred, for Surety Bonds, Liability Insurance, and Workmen's Compensation Insurance; with the additional obligation that such Contractor shall promptly make payment of all taxes, licenses, assessments, contributions, damages,

any liquidated damages which may arise prior to any termination of said principal's contract, any liquidated damages which may arise after termination of the said principal's contract due to default on the part of said principal, penalties and interest thereon, when and as the same may be due this state, or any county, municipality, board, department, commission or political subdivision: in the course of the performance of said work and in accordance with Sections 31-5-51 et seq. Mississippi Code of 1972, and other State statutes applicable thereto, and shall carry out to the letter and to the satisfaction of the Executive Director of the Mississippi Department of Transportation, all, each and every one of the stipulations, obligations, conditions, covenants and agreements and terms of said contract in accordance with the terms thereof and all of the expense and cost and attorney's fee that may be incurred in the enforcement of the performance of said contract, or in the enforcement of the conditions and obligations of this bond, then this obligation shall be null and void, otherwise to be and remain in full force and virtue.

_____	_____
(Contractors) Principal	Surety
By _____	By _____
	(Signature) Attorney in Fact
	Address _____
	_____
Title _____	_____
(Contractor's Seal)	(Printed) MS Agent
	_____
	(Signature) MS Agent
	Address _____
	_____
	_____
	(Surety Seal)
	_____
	Mississippi Insurance ID Number

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 **Construction of Brookhaven Project Office Building, Equipment Shed & Site Improvements, known as State Project Nos. BWO-7145-43(001), BWO-7146-43(001), & LWO-7067-43(002) / 503007301, 302, & 303 in Lincoln 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