MDOT Use Only
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SM No. CBWO6208240011

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

(STATE DELEGATED)

2
Construction of Gulf Coast Regional Office/First Responders' Building, known as State Project Nos. BWO-6208-24(001) / 502085301 & 302 in Harrison County.
Project Completion: November 20, 2014

NOTICE

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

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

SECTION 900

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

BIDDER CHECK LIST
(FOR INFORMATION ONLY)

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

_____ Expedite bid sheets have been stapled and inserted into the proposal package.

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

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

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

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

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

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

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

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

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

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

_____ ON FEDERAL FUNDED PROJECTS, the Notice To Bidders regarding DUNS Requirements has been completed and included in the contract documents.

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

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

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

(10/2012)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

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SECTION 905 - PROPOSAL,
PROPOSAL BID ITEMS,
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STATE BOARD OF CONTRACTORS REQUIREMENTS,
CERTIFICATION REGARDING NON-COLLUSION, DEBARMENT AND SUSPENSION,
SECTION 902 - CONTRACT FORM, AND SECTION 903 - CONTRACT BOND FORM,

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

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 901 - ADVERTISEMENT

Sealed bids will be received by the Mississippi Transportation Commission in the Office of the Contract Administration Engineer, Room 1013, Mississippi Department of Transportation Administration Building, 401 North West Street, Jackson, Mississippi, until 10:00 o'clock A.M., Tuesday, January 22, 2013, and shortly thereafter publicly opened on the Sixth Floor for:

Construction of Gulf Coast Regional Office/First Responders' Building, known as State Project Nos. BWO-6208-24(001) / 502085301 & 302 in Harrison 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.

Bid proposals must be purchased online at https://shopmdot.ms.gov. Specimen proposals may be viewed and downloaded online at no cost at http://mdot.ms.gov or purchased online. Proposals are available 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 may be acquired on a cost per sheet basis from MDOT Plans Print Shop, MDOT Shop Complex, Building C, Room 114, 2567 North West Street, Jackson, Mississippi 39216, Telephone (601) 359-7460 or e-mail at plans@mdot.state.ms.us or FAX (601) 359-7461. Plans will be shipped upon receipt of 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: 05/03/2004

SUBJECT: Governing Specifications

The current (2004) 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 herein. Copies of the specification book may be purchased from the MDOT Construction Division.

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 1990 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 2004 Edition of the Standard Specifications.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

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

DATE: 05/03/2004

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. 151 **CODE: (IS)**

DATE: 06/18/2004

SUBJECT: Gopher Tortoises

Bidders are hereby advised that the Contractor will be required to make special considerations regarding gopher tortoises on this project. In addition to the normal required documentation associated with borrow pits, the Contractor shall, for each site used to obtain or dispose of materials associated with this project, provide the Engineer with a letter from a qualified biologist certifying that the site was inspected prior to any clearing of vegetation or disposal of project materials and that the site is not inhabited by gopher tortoises, or appropriate avoidance measures have been installed. No individual lacking the proper State or Federal license shall touch or otherwise harass a gopher tortoise.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 640 **CODE: (IS)**

DATE: 09/26/2005

SUBJECT: Fiber Reinforced Concrete

Bidders are hereby advised that synthetic structural fibers meeting the requirements of Subsection 907-711.04 may be used in lieu of wire mesh in some items of construction. Substitution of fibers for wire mesh will be allowed in the construction of paved ditches, paved flumes, paved inlet apron, driveways, guard rail anchors and pile encasements. Substitution in any other items of work must be approved by the State Construction Engineer prior to use.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 883 **CODE: (IS)**

DATE: 04/28/2006

SUBJECT: Payroll Requirements

Bidders are hereby advised that the Contractor and Subcontractor(s) are required to submit payroll information to the Project Engineers on a weekly basis.

On Federal-Aid Projects, CAD-880, CAD-881 and certified payroll submissions are required each week the Contractor or a Subcontractor performs work on the project. This is addressed in Section V, page 6 of Form FHWA-1273.

On State-Funded Projects, CAD-880 is required each week the Contractor or a Subcontractor performs work on the project.

When no work is performed on either Federal-Aid and State-Funded Projects, the Contractor should only submit CAD-880 showing no work activities.

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 full week of the month for the estimate period in order for the Project Engineer to process an estimate.

Bidders are advised to review the requirements regarding payroll submissions in Section 110 of the Standard Specifications.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1405 **CODE: (IS)**

DATE: 03/15/2007

SUBJECT: ERRATA AND MODIFICATIONS TO THE 2004 STANDARD SPECIFICATIONS

Page	Subsection	Change
101	201.01	In the second sentence of the first paragraph, change “salvable” to “salvageable”.
107	202.04	In the fourth sentence of the fourth paragraph, change “yard” to “feet”.
107	202.05	In the list of units measurements for 202-B, add “square foot”.
132	211.03.4	In the second sentence of the second paragraph, change “planted” to “plated”.
192	306.02.4	In the first line of the first paragraph, delete the word “be”.
200	307.03.7	In the fourth sentence of the second paragraph, change “lime-fly ash” to “treated”.
236	401.01	Change the header from “Section 403” to “Section 401”.
242	401.02.3.2	In the first sentence of the third full paragraph, add “1/8” in the blank before the inch mark.
250	401.02.6.3	In the second sentence of the first paragraph on page 250, change “rutting over ” ” to “rutting over 1/8" ”.
253	401.02.6.4.2	In the paragraph preceding the table, change “91.0” to “89.0”.
259	401.03.1.4	In the first paragraph, change “92.0 percent” to “the specified percentage (92.0 or 93.0)”.
269	403.03.2	In the table at the top of page 269, change the PI requirement from “ = ” to “ ≤ ”.

278	404.04	In the second sentence, change the subsection from "401.04" to "403.04".
283	409.02.2	Change "PG 64-22" to "PG 67-22".
294	413.02	In the first sentence of the second paragraph, change "707.02.1.3" to "Subsection 707.02.1.3".
340	511.04	In the second sentence of the second paragraph, change "412" to "512".
349	601.03.3	In the first sentence, change "804.03.2" to "804.03.5".
355	603.02	Change the subsection reference for Joint mortar from "707.03" to "714.11".
369	604.04	In the first sentence, change "601.04" to "Subsection 601.04".
427	619.04	Delete the second paragraph.
442	625.04	In the third paragraph, change "626.04" to "Subsection 626.04".
444	626.03.1.2	Delete the third sentence of the first paragraph.
464	631.02	Change the subsection reference for Water from "714.01.0" to "714.01.1".
570	682.03	Change the subsection number from "682-03" to "682.03".
575	683.10.4	Change the subsection number from "683.10.4" to "683.04".
575	683.10.5	Change the subsection number from "683.10.5" to "683.05".
596	701.02	In the table under the column titled "Cementations material required", change Class F, FA" to "Class F FA,".
603	702.11	In the first sentence, change "702.12" to "Subsection 702.12".
612	703.04.2	In the fifth paragraph, delete "Subsection 703.11 and".
616	703.07.2	In the Percentage By Weight Passing Square Mesh Sieves table, change the No. 10 requirement for Class 7 material from "30 - 10" to "30 - 100".

618	703.13.1	In the first sentence of the first paragraph, change "703.09" to "703.06".
618	703.13.2	In the first sentence, change "703.09" to "703.06".
671	712.06.2.2	In the first sentence, change "712.05.1" to "Subsection 712.05.1".
689	714.11.2	In the first sentence, change "412" to "512".
709	715.09.5	In the first sentence of the first paragraph, change "guage" to "gauge".
717	717.02.3.4	In the top line of the tension table, change "1 1/2" to "1 1/8" and change "1 1/8" to "1 1/2".
741	720.05.2.2	In the last sentence of this subsection, change "720.05.2.1" to "Subsection 720.05.2.1".
827	803.03.2.3.7.5.2	In the first sentence of the second paragraph, change "803.03.5.4" to "803.03.2.3.4".
833	803.03.2.6	In the first sentence, change "803.03.7" to "803.03.2.5".
854	804.02.11	In the last sentence of the first paragraph, change "automatically" to "automatic".
859	804.02.13.1.3	In the last sentence, change Subsection "804.02.12.1" to "804.02.12".
879	804.03.19.3.2	In the first sentence of the third paragraph, change "listed on of Approved" to "listed on the Approved".
879	804.03.19.3.2	In the last sentence of the last paragraph, change "804.03.19.3.1" to "Subsection 804.03.19.3.1".
962	814.02.3	In the first sentence, change "710.03" to "Subsection 710.03".
976	820.03.2.1	In the first sentence, change "803.02.6" to "803.03.1.7".
976	820.03.2.2	In the first sentence, change "803.03.9.6" to "803.03.1.9.2".
985	Index	Change the subsection reference for Petroleum Asphalt Cement from "702.5" to "702.05".

985	Index	Change the subsection reference for the Definition of Asphaltic Cement or Petroleum Asphalt from "700.2" to "700.02".
985	Index	Change the subsection reference for Automatic Batchers from "501.03.2.4" to "804.02.10.4".
986	Index	Delete "501.03.2" as a subsection reference for Batching Plant & Equipment.
988	Index	Change the subsection reference for the Central Mixed Concrete from "501.03.3.2" to "804.02.11".
988	Index	Change the subsection reference for the Concrete Batching Plant & Equipment from "501.03.2" to "804.02.11".
999	Index	Delete "501.03.3.3" as a subsection reference for Truck Mixers.
1001	Index	Change the subsection reference for Edge Drain Pipes from "605.3.5" to "605.03.5".
1002	Index	Change the subsection reference for Metal Posts from "713.05.2" to "712.05.2".
1007	Index	Change the subsection reference for Coarse Aggregate of Cement Concrete Table from "703.3" to "703.03".
1007	Index	Change the subsection reference for Composite Gradation for Mechanically Stabilized Courses Table from "703.8" to "703.08".
1009	Index	Delete "501.03.3.3" as a subsection reference for Truck Mixers and Truck Agitators.
1010	Index	Delete reference to "Working Day, Definition of".

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1808 **CODE: (IS)**

DATE: 09/09/2008

SUBJECT: Safety Apparel

Bidders are advised that the Code of Federal Regulations CFR 23 Part 634 final rule was adopted November 24, 2006 with an effective date of November 24, 2008. This rule requires that "All workers within the right-of-way of a Federal-Aid Highway who are exposed either to traffic (vehicles using the highway for the purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel". High-visibility safety apparel is defined in the CFR as "personnel protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage, and that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled American National Standard for High-Visibility Safety Apparel and Headwear". All workers on Mississippi State Highway right-of-way shall comply with this Federal Regulation. Workers are defined by the CFR as "people on foot whose duties place them within the right-of way of a Federal-Aid Highway, such as highway construction and maintenance forces, survey crews, utility crews, responders to incidents within the highway right-of-way, and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way of a Federal-Aid Highway".

You can access this final rule at the following link:

http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/E6-19910.pdf

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1928 **CODE: (IS)**

DATE: 04/14/2008

SUBJECT: Federal Bridge Formula

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

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

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

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

or

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

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 2818 **CODE: (SP)**

DATE: 10/01/2009

SUBJECT: Non-Quality Control / Quality Assurance Concrete

Bidders are advised that the following pay items will not be accepted based on the Quality Control / Quality Assurance (QC/QA) requirements of Section 804 of the specifications. The acceptance of these pay items will be based on sampling and testing at the project site by MDOT forces. The Contractor is required to submit mix designs to accomplish this work in accordance with Section 804 and perform normal Quality Control functions at the concrete plant. Acceptance will be in accordance with the requirements of 907-601, Structural Concrete, and TMD-20-04-00-000. At the discretion of the Engineer, the Contractor may request that the concrete be accepted based on QC/QA requirements.

Pay Item	Description
221	Paved Ditches
601	Minor Structures - manholes, inlets, catch basins, junction boxes, pipe headwalls, and pipe collars.
606	Guardrail Anchors
607	Fence Post Footings
608	Sidewalks
609	Curb and Gutter
614	Driveways
616	Median and Island Pavement
630	Sign Footings, except Overhead Sign Supports

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 2937 **CODE: (SP)**

DATE: 01/11/2010

SUBJECT: Reduced Speed Limit Signs

Bidders are advised that all black and white speed limits signs that are used to reduce the speed limit through construction zones shall be covered or removed during times when the Contractor is not performing work. If the Contractor has a routine daytime operation and is not working at night, the signs shall be covered or removed during the nighttime when there is no work activity.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 3067 **CODE: (SP)**

DATE: 04/14/2010

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 13, 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. 3612 **CODE: (SP)**

DATE: 08/10/2011

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 GRASSED, 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 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 shall be in place adjacent to the right-of-way line and at least five (5) feet adjacent to stream banks. 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.

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 will be either permanently or temporarily grassed until additional material is made available to complete these sections. All unclassified excavation on the project will still be required to be moved prior to incorporating any borrow excavation on the project. 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. 3980 **CODE: (SP)**

DATE: 07/25/2012

SUBJECT: 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 Monday prior to the letting on Tuesday. Answers to questions will be posted by 6:00 p.m. on Monday prior to the letting on Tuesday. Answers can be viewed by clicking on Q&A link under the Proposal Addenda column.

It shall be the Bidders responsibility to familiarize themselves with the questions and answers that have been submitted on this project.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 4191 **CODE: (SP)**

DATE: **11/27/2012**

SUBJECT: **Contract Time**

PROJECT: **BWO-6208-24(001) / 502085301 & 302 – Harrison County**

The calendar date for completion of work to be performed by the Contractor for this project shall be **November 20, 2014** which date or extended date as provided in Subsection 907-108.06 shall be the end of contract time. It is anticipated that the Notice of Award will be issued no later than be **February 12, 2013** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **April 15, 2013**.

Should the Contractor request a Notice to Proceed earlier than **April 15, 2013** and it is agreeable with the Department for an early Notice to Proceed, the requested date will become the new Notice to Proceed / Beginning of Contract Time date. If an erosion control plan is required, the Contractor's erosion control plan will have to be approved prior to issuing an early Notice to Proceed.

In the event that the Notice to Proceed / Beginning of Contract Time is issued later than **April 15, 2013**, Contract Time will be adjusted accordingly; however adjustment in Contract price will **NOT** be considered.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 4192 **CODE: (SP)**

DATE: 11/20/2012

SUBJECT: Pre-Bid Meeting

PROJECT: BWO-6208-24(001) / 502085301 & 302 – Harrison County

A pre-bid meeting will be held in the Conference Room at the MDOT Project Office Building on Highway 49N in Lyman, Mississippi, in Harrison County, Telephone No. 228-832-0277, at 10:30 A.M. on Tuesday, **January 8, 2013**. The purpose of this meeting is to discuss requirements of the Drawings and Specifications for this Project, to request clarifications or additional information to the Documents, and to visit the Project site.

This pre-bid meeting is a **MANDATORY** pre-bid meeting. Attendance by all prospective bidders will be a prerequisite for submitting a bid proposal for this project. Failure to have a representative of the company present will disqualify the company from having their bid considered and will therefore be deemed a non-responsive bidder. It is suggested that all potential subcontractors and interested parties attend the meeting.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-101-4 **CODE: (IS)**

DATE: 11/05/2008

SUBJECT: **Definitions**

Section 101, Definitions and Terms, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-101.02--Definitions. Replace the following definitions in Subsection 101.02 on pages 3 through 13.

Contract - The written agreement between the Mississippi Transportation Commission and the Contractor setting forth the obligations of the parties thereunder, including but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment.

The contract includes the invitation for bids, proposal, contract form and contract bonds, specifications, supplemental specifications, interim specifications, general and detailed plans, special provisions, notices to bidders, notice to proceed, and also any agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument.

Contract Bonds - The approved form of security, executed by the Contractor and the Contractor's Surety(ies), guaranteeing complete execution of the contract and all supplemental agreements pertaining thereto and the payment of all legal debts pertaining to the construction of the project. This term includes Performance and Payment Bond(s).

Surety - A corporate body, qualified under the laws of Mississippi, which is bound with and for the successful bidder by "contract bond(s)" to guarantee acceptable performance of the contract and payment of all legal taxes and debts pertaining to the construction of the project, including payment of State Sales Tax as prescribed by law, and any overpayment made to the Contractor.

Add the following to the list of definitions in Subsection 101.02 on pages 3 through 13.

Performance Bond - The approved form of security, executed by the Contractor and issued by the Contractor's Surety(ies), guaranteeing satisfactory completion of the contract and all supplemental agreements pertaining thereto.

Payment Bond - The approved form of security, executed by the Contractor and issued by the Contractor's Surety(ies), guaranteeing the payment of all legal debts pertaining to the construction of the project including, but not limited to, the labor and materials of subcontractors and suppliers to the prime contractor.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-102-8

DATE: 10/25/2012

SUBJECT: Bidding Requirements and Conditions

Delete Subsection 907-102.06 on page 1, and substitute the following.

907-102.06--Preparation of Proposal. Delete the first, fifth, sixth, and seventh paragraphs of Subsection 102.06 on pages 17 & 18, and substitute the following.

The bidder's complete original proposal shall be submitted upon the forms (Certification of Performance, Certification Regarding Non-Collusion, etc.) furnished by the Department and shall include Expedite Bid printed bid sheets along with the bid data on the MDOT-supplied USB Flash Drive. Expedite Bid System (EBS) files shall be downloaded from the Department's website www.goMDOT.com. In case of discrepancy between a unit price and the extension, the unit price will govern and the extension along with the total amount of the proposal will be corrected.

Bid sheets generated by the Department's Electronic Bid System (Trns•port Expedite Bid) along with a completed proposal package (with all forms completed and signed) will constitute the official bid and shall be signed on the last sheet of the Expedite Bid generated bid sheets and delivered to the Department in accordance with the provisions of Subsection 102.09. Bids submitted using any other form, format or means will result in an irregular bid. The bidder's bid data shall be saved on the MDOT-supplied USB Flash Drive and submitted with the bid. Failure to return the USB Flash Drive with bid data will result in an irregular bid.

Bidders are cautioned that using other versions of the Expedite Bid may result in improperly printed bid sheets. The correct version of Expedite Bid can be obtained at no cost from the MDOT Contract Administration Division or at the MDOT website, www.gomdot.com. The current version of Expedite Bid is also included on the MDOT-supplied USB Flash Drive.

The Expedite Bid generated bid sheets should be stapled together in order beginning with page 1, signed and included in the bid proposal package in the sealed envelope. Only the Expedite Bid generated sheets will be recognized as the official bid. The MDOT-provided USB Flash Drive containing the information printed on the Expedite Bid generated bid sheets should be placed in the padded envelope included with the bid proposal package and enclosed in the sealed envelope. Bid sheets printed from Expedite Bid should be a representation of the data returned on the flash drive. To have a true representation of the bid sheets, the Bidder must copy the EBS and EBS amendment files used to prepare the bid sheets to the flash drive. Otherwise, the unit prices bid will not be recorded to the flash drive. Bidders are cautioned that failure to follow proper flash drive handling procedures could result in the Department being unable to process the flash drive. Any modification or manipulation of the data contained on the flash drive, other than entering unit bid prices and completing all required Expedite Bid sections, will not be allowed and will cause the Contractor's bid to be considered irregular.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-102-8 **CODE: (IS)**

DATE: 01/20/2011

SUBJECT: Bidding Requirements and Conditions

907-102.06--Preparation of Proposal. Delete the fifth, sixth, and seventh paragraphs of Subsection 102.06 on page 18 and substitute the following:

Bid sheets generated by the Department's Electronic Bid System (Trns•port Expedite Bid) along with a completed proposal package will constitute the official bid and shall be signed on the last sheet of the Expedite Bid generated bid sheets and delivered to the Department in accordance with the provisions of Subsection 102.09.

Bidders are cautioned that using other versions of the Expedite Bid may result in improperly printed bid sheets. The correct version of Expedite Bid can be obtained at no cost from the MDOT Contract Administration Division or at the MDOT website, www.gomdot.com.

If bidders submit Expedite Bid generated bid sheets, then the bid sheets included in the proposal should not be completed. The Expedite Bid generated bid sheets should be stapled together, signed and included in the bid proposal package in the sealed envelope. If both the forms in the proposal and the Expedite Bid generated bid sheets are completed and submitted, only the Expedite Bid generated sheets will be recognized and used for the official bid. The USB Flash Drive containing the information printed on the Expedite Bid generated bid sheets should be placed in the padded envelope included with the bid proposal package and enclosed in the sealed envelope. Bid sheets printed from Expedite Bid should be a representation of the data returned on the flash drive. To have a true representation of the bid sheets, the Bidder must copy the EBS and EBS amendment files used to prepare the bid sheets to the flash drive. Otherwise, the unit prices bid will not be recorded to the flash drive. Bidders are cautioned that failure to follow proper flash drive handling procedures could result in the Department being unable to process the flash drive. Any modification or manipulation of the data contained on the flash drive, other than entering unit bid prices and completing all required Expedite Bid sections, will not be allowed and will cause the Contractor's bid to be considered irregular.

907-102.08--Proposal Guaranty. Delete the first and second paragraphs in Subsection 102.08 on page 20 and substitute the following:

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 907-103.05.1, 907-103.05.2, and as required by law.

If a bid bond is offered as guaranty, the bond must be on a form approved by the Executive Director, 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 907-103.05.2 as applicable.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-103-8 **CODE: (SP)**

DATE: 12/15/2009

SUBJECT: Award and Execution of Contract

Section 103, Award and Execution of Contract, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-103.04--Return of Proposal Guaranty. Delete the second paragraph of Subsection 103.04 on page 23 and substitute the following:

Certified checks or cashier's checks submitted as proposal guaranties, except those of the two lowest bidders, will be returned within 10 days of contract award. The retained proposal guaranty of the unsuccessful of the two lowest bidders will be returned within ten days following the execution of a contract with the successful low bidder. The retained proposal guaranty of the successful bidder will be returned after satisfactory performance and payment bonds have been furnished and the contract has been executed.

In the event all bids are rejected by the Commission, certified checks or cashier's checks submitted as proposal guaranty by all bidders will be returned within 10 days of rejection.

Delete Subsection 103.05 on page 23 and substitute the following:

907-103.05--Contract Bonds.

907-103.05.1--Requirement of Contract Bonds. Prior to the execution of the contract, the successful bidder shall execute and deliver to the Executive Director a performance and payment bond(s), in a sum equal to the full amount of the contract as a guaranty for complete and full performance of the contract and the protection of the claimants and the Department for materials and equipment and full payment of wages in accordance with Section 65-1-85 Miss. Code Ann. (1972 as amended). In the event of award of a joint bid, each individual, partnership, firm or corporation shall assume jointly the full obligations under the contract and the contract bond(s).

907-103.05.2--Form of Bonds. The form of bond(s) shall be that provided by or acceptable to the Department. These bonds shall be executed by a Mississippi agent or qualified nonresident agent and shall be accompanied by a certification as to authorization of the attorney-in-fact to commit the Surety company. A power of attorney exhibiting the Surety's original seal supporting the Mississippi agent or the qualified nonresident agent's signature shall be furnished with each bond. The Surety company shall be currently authorized and licensed in good standing to conduct business in the State of Mississippi with a minimum rating by A.M. Best of (A-) in the latest printing "Best's Key Rating Guide" to write individual bonds up to ten percent of the policy holders' surplus or listed on the current list of “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as

published by the United States Department of the Treasury, Financial Management Service, Circular 570 (latest revision as published and supplemented on the Financial Management Service Web site and in the Federal Register) within the underwriting limits listed for that Surety. All required signatures on the bond(s) and certifications shall be original signatures, in ink, and not mechanical reproductions or facsimiles. The Mississippi agent or qualified nonresident agent shall be in good standing and currently licensed by the Insurance Commissioner of the State of Mississippi to represent the Surety company(ies) executing the bonds.

Surety bonds shall continue to be acceptable to the Commission throughout the life of the Contract and shall not be canceled by the Surety without the consent of the Department. In the event the Surety fails or becomes financially insolvent, the Contractor shall file a new Bond in the amount designated by the Executive Director within thirty (30) days of such failure, insolvency, or bankruptcy. Subsequent to award of Contract, the Commission or the Department may require additional security for any supplemental agreements executed under the contract or replacement security in the event of the surety(ies) loss of the ratings required above. Suits concerning bonds shall be filed in the State of Mississippi and adjudicated under its laws without reference to conflict of laws principles.

907-103.08--Failure to Execute Contract.. In the first sentence of Subsection 103.08 on page 24, change "bond" to "performance and payment bonds".

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-104-4 **CODE: (SP)**

DATE: 03/01/2011

SUBJECT: Disposal of Materials

Section 104, Scope of Work, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-104.05--Removal and Disposal of All Materials From the Project. Delete the second sentence of the first full paragraph of Subsection 104.05 on page 30 and substitute the following:

The Contractor shall also furnish the Engineer a certified letter stating that the area of disposal is not in a wetland or in Waters of the U.S.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-105-6

DATE: 12/12/2011

SUBJECT: Control of Work

After Subsection 907-105.05 on page 1, add the following.

907-105.14--Maintenance During Construction. Before the first sentence Subsection 105.14 on page 39, add the following:

The Contractor will be responsible for the maintenance of existing roadways within the limits of this project starting on the date of the Notice To Proceed / Beginning of Contract Time. Anytime work is performed in a travel lane, the Contractor shall install portable lane closure signs meeting the requirement of the MDOT Standard Drawing or MUTCD.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-105-6 **CODE: (IS)**

DATE: **01/20/2011**

SUBJECT: **Control of Work**

Section 105, Control of Work, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is modified as follows:

907-105.05--Cooperation by Contractor. In the third sentence of the second paragraph of Subsection 105.05 on page 35, change "Notice to Proceed" to "Notice of Award".

Delete the fourth paragraph of Subsection 105.05 on page 35, and substitute the following.

On projects that include erosion control pay items, the Contractor shall also designate a responsible person whose primary duty shall be to monitor and maintain the effectiveness of the erosion control plan, including NPDES permit requirements. This responsible person must be a Certified Erosion Control Person certified by an organization approved by the Department. Prior to or at the pre-construction conference, the Contractor shall designate in writing the Certified Erosion Control Person to the Project Engineer. The designated Certified Erosion Control Person shall be assigned to only one (1) project. When special conditions exist, such as two (2) adjoining projects or two (2) projects in close proximity, the Contractor may request in writing that the State Construction Engineer approve the use of one (1) Certified Erosion Control Person for both projects. The Contractor may request in writing that the Engineer authorize a substitute Certified Erosion Control Person to act in the absence of the Certified Erosion Control Person. The substitute Certified Erosion Control Person must also be certified by an organization approved by the Department. A copy of the Certified Erosion Control Person's certification must be included in the Contractor's Protection Plan as outlined in Subsection 907-107.22.1. This in no way modifies the requirements regarding the assignment and availability of the superintendent.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-107-9

DATE: 08/23/2011

SUBJECT: Legal Relations and Responsibility to Public

907-107.14.2.2--Railroad Protective. Delete the first sentence of subparagraph (b) of Subsection 907-107.14.2.2 on page 3 and substitute the following.

(b) **Contractor's Liability - Railroad**, including subcontractors, XCU and railroad contractual with limits of $1,000,000 each occurrence; $2,000,000 aggregate.

After Subsection 907-107.17 on page 4, add the following:

907-107.18--Contractor's Responsibility for Utility Property and Services. After the first sentence of Subsection 107.18 on page 63, add the following:

Prior to any excavation on the project, the Contractor shall contact MS 811 and advise them to mark all known utilities in the area of the excavation.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-107-9 **CODE: (IS)**

DATE: 01/20/2011

SUBJECT: **Legal Relations and Responsibility to Public**

Section 107, Legal Relations and Responsibility to Public, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-107.02--Permits, Licenses and Taxes. Delete in toto Subsection 107.02 on page 49 and substitute the following:

The Contractor or any Subcontractor shall have the duty to determine any and all permits and licenses required and to procure all permits and licenses, pay all charges, fees and taxes and issue all notices necessary and incidental to the due and lawful prosecution of the work. At any time during the life of this contract, the Department may audit the Contractor's or Subcontractor's compliance with the requirements of this section.

The Contractor or any Subcontractor is advised that the "Mississippi Special Fuel Tax Law", Section 27-55-501, et seq. and the Mississippi Use Tax Law, Section 27-67-1, et seq., and their requirements and penalties, apply to any contract or subcontract for construction, reconstruction, maintenance or repairs, for contracts or subcontracts entered into with the State of Mississippi, any political subdivision of the State of Mississippi, or any Department, Agency, Institute of the State of Mississippi or any political subdivision thereof.

The Contractor or any Subcontractor will be subject to one or more audits by the Department during the life of this contract to make certain that all applicable fuel taxes, as outlined in Section 27-55-501, et seq., and any sales and/or use taxes, as outlined in Section 27-67-1, et seq. are being paid in compliance with the law. The Department will notify the Mississippi State Tax Commission of the names and addresses of any Contractors or Subcontractors.

907-107.14--Damage Claims and Insurance.

907-107.14.2--Liability Insurance. Delete Subsection 107.14.2 beginning on page 60 and substitute:

907-107.14.2.1--General. The Contractor shall carry Contractor's liability, including subcontractors and contractual, with limits not less than: $500,000 each occurrence; $1,000,000 aggregate; automobile liability - $500,000 combined single limit - each accident; Workers' Compensation and Employers' Liability - Statutory & $100,000 each accident; $100,000 each employee; $500,000 policy limit. Each policy shall be signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent of the Insurance Company.

The Contractor shall have certificates furnished to the Department from the insurance companies providing the required coverage. The certificates shall be on the form furnished by the Department and will show the types and limits of coverage.

907-107.14.2.2--Railroad Protective. The following provisions are applicable to all work performed under a contract on, over or under the rights-of-way of each railroad shown on the plans.

The Contractor shall assume all liability for any and all damages to work, employees, servants, equipment and materials caused by railroad traffic.

Prior to starting any work on railroad property, the Contractor shall furnish satisfactory evidence to the Department that insurance of the forms and amounts set out herein in paragraphs (a) and (b) has been obtained. Also, the Contractor shall furnish similar evidence to the Railroad Company that insurance has been obtained in accordance with the Standard Provisions for General Liability Policies and the Railroad Protective Liability Form as published in the Code of Federal Regulations, 23 CFR 646, Subpart A. Evidence to the Railroad Company shall be in the form of a Certificate of Insurance for coverages required in paragraph (b), and the original policy of the Railroad Protective Liability Insurance for coverage required in paragraph (a).

All insurance herein specified shall be carried until the contract is satisfactorily complete as evidenced by a release of maintenance from the Department.

The Railroad Company shall be given at least 30 days notice prior to cancellation of the Railroad Protective Liability Insurance policy.

For work within the limits set out in Subsection 107.18 and this subsection, the Contractor shall provide insurance for bodily injury liability, property damage liability and physical damage to property with coverages and limits no less than shown in paragraphs (a) and (b). Bodily injury shall mean bodily injury, sickness, or disease, including death at anytime resulting therefrom. Property damage shall mean damages because of physical injury to or destruction of property, including loss of use of any property due to such injury or destruction. Physical damage shall mean direct and accidental loss of or damage to rolling stock and their contents, mechanical construction equipment or motive power equipment.

(a) **Railroad Protective Liability Insurance** shall be purchased on behalf of the Railroad Company with limits of $2,000,000 each occurrence; $6,000,000 aggregate applying separately to each annual period for lines without passenger trains. If the line carries passenger train(s), railroad protective liability insurance shall be purchased on behalf of the Railroad Company with limits of $5,000,000 each occurrence; $10,000,000 aggregate applying separately to each annual period.

Coverage shall be limited to damage suffered by the railroad on account of occurrences arising out of the work of the Contractor on or about the railroad right-of-way, independent of the railroad's general supervision or control, except as noted in paragraph 4 below.

Coverage shall include:

(1) death of or bodily injury to passengers of the railroad and employees of the railroad not covered by State workmen's compensation laws,

(2) personal property owned by or in the care, custody or control of the railroads,

(3) the Contractor, or any of the Contractor's agents or employees who suffer bodily injury or death as a result of acts of the railroad or its agents, regardless of the negligence of the railroads, and

(4) negligence of only the following classes of railroad employees:

(i) any supervisory employee of the railroad at the job site

(ii) any employee of the railroad while operating, attached to, or engaged on, work trains or other railroad equipment at the job site which are assigned exclusively to the Contractor, or

(iii) any employee of the railroad not within (i) or (ii) above who is specifically loaned or assigned to the work of the Contractor for prevention of accidents or protection or property, the cost of whose services is borne specifically by the Contractor or Governmental authority.

(b) **Regular Contractor's Liability**, including subcontractors, XCU and railroad contractual with limits of $1,000,000 each occurrence; $2,000,000 aggregate. **Automobile** with limits of $1,000,000 combined single limit any one accident; **Workers' Compensation and Employer's Liability** - statutory and $100,000 each accident; $100,000 each employee; $500,000 policy limit. **Excess/Umbrella Liability** $5,000,000 each occurrence; $5,000,000 aggregate. All coverage to be issued in the name of the Contractor shall be so written as to furnish protection to the Contractor respecting the Contractor's operations in performing work covered by the contract. Coverage shall include protection from damages arising out of bodily injury or death and damage or destruction of property which may be suffered by persons other than the Contractor's own employees.

In addition, the Contractor shall provide for and on behalf of each subcontractor by means of a separate and individual liability and property damage policy to cover like liability imposed upon the subcontractor as a result of the subcontractor's operations in the same amounts as contained above; or, in the alternative each subcontractor shall provide same.

907-107.15--Third Party Beneficiary Clause. In the first sentence of the first paragraph of Subsection 107.15 on page 61, change "create the public" to "create in the public".

907-107.17--Contractor's Responsibility for Work. Delete the fifth sentence of the fifth paragraph of Subsection 107.17 on page 63 and substitute the following:

The eligible permanent items shall be limited to traffic signal systems, changeable message signs, roadway signs and sign supports, lighting items, guard rail items, delineators, impact attenuators, median barriers, bridge railing or pavement markings. The eligible temporary items shall be limited to changeable message signs, guard rail items, or median barriers.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-107-10

DATE: 11/13/2012

SUBJECT: Contractor's Erosion Control Plan

Delete the first paragraph of Subsection 907-107.22.1 on page 1, and substitute the following.

If an early Notice to Proceed is desired, the Contractor's Erosion Control Plan should be submitted to the Engineer as soon as possible after award since an approved erosion control plan is required for an early Notice to Proceed. Otherwise, at the preconstruction conference or prior to starting any work on the project, the Contractor shall submit to the Project Engineer for concurrence a comprehensive erosion and siltation control plan. The plan shall utilize temporary measures and permanent erosion control features to provide acceptable controls during all stages of construction.

Delete the first sentence of the second paragraph of Subsection 907-107.22.1 on page 1, and substitute the following.

Approximately 60 calendar days, the time between the Notice of Award and Notice to Proceed/Beginning of Contract Time in the proposal, has been allowed for the submittal and concurrence of the Contractor's erosion control plan, MDOT's review of the plan, and any revisions that may be necessary.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-107-10 **CODE: (SP)**

DATE: 03/14/2011

SUBJECT: Contractor's Erosion Control Plan

Section 107, Legal Relations and Responsibility to Public, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete in toto Subsection 107.22.1 on pages 65 and 66, and substitute the following:

907-107.22.1--Contractor's Erosion Control Plan. At the preconstruction conference or prior to starting any work on the project, the Contractor shall submit to the Project Engineer for concurrence a comprehensive erosion and siltation control plan utilizing temporary measures and permanent erosion control features to provide acceptable controls during all stages of construction.

The contract time for this project has allowed 60 calendar days for the submittal and concurrence of the Contractor's erosion control plan, MDOT's review of the plan, and any revisions that may be necessary. The original contract time shall not be adjusted unless delays are caused solely by the Department for the submission, review, and concurrence of the Contractor's erosion control plan.

As a minimum, the plan shall include the following:

1. Erosion Control Plan (ECP) sheets or the plan profile sheets, 11" x 17" or larger, of all areas within the rights-of-way from the Beginning of the Project (BOP) to the End of the Project (EOP) showing the location of all temporary erosion control devices. Erosion control devices should be identified by exact type, temporary or permanent, configuration, and placement of each item to prevent erosion and siltation. A narrative of the Contractor's temporary erosion control plan shall be submitted in a format similar to the form attached to this special provision, but must include the heading and sub-heading information. As a minimum, the narrative shall include the following:
   - A detailed description, including locations (station numbers) of the Contractor's proposed sequence of operations including, but not limited to, clearing and grubbing, excavation, drainage, and structures.
   - A detailed description, including locations, and best management practices (BMP) that will be used to prevent siltation and erosion from occurring during the Contractor's proposed sequence of operations.
2. A copy of the certification for the Contractor's Certified Erosion Control Person whose primary duty shall be monitoring and maintaining the effectiveness of the erosion control plan, BMPs, and compliance with the NPDES permit requirements.
3. A plan for the disposal of waste materials on the project right-of-way which shall include but not be limited to the following:

- containment and disposal of materials resulting from the cleaning (washing out) of concrete trucks that are delivering concrete to the project site.
- containment and disposal of fuel / petroleum materials at staging areas on the project.

The erosion and siltation control plan shall be maintained on the project site at all times, updated as work progresses to show changes due to revisions in the sequences of construction operations, replacement of inadequate BMPs, and the maintenance of BMPs. Work shall not be started until an erosion control plan has been concurred with by the MDOT. 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.

907-107.22.2--Clearing and Grubbing, Haul Roads, Waste Areas, Plant Sites or Other Areas Occupied by the Contractor. Delete the fourth paragraph of Subsection 107.22.2 on page 66 and substitute the following:

Unless otherwise determined by the Engineer from a study of overall job conditions, the exposed surface area of erodible material at any one time for each of the separate operations of this subsection shall not exceed 19 acres without prior approval by the Engineer.

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

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, temporary or permanent vegetation will be placed within 7 calendar days.**

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.

HOUSEKEEPING PRACTICES: Structural BPM's 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.

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 BMP's 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 behind BMP's when it becomes about 1/3 to 1/2 height of BMP.

_____ _____
Prime Contractor's Signature Date

_____ _____
Printed Name Title

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-108-24

DATE: 11/13/2012

SUBJECT: Prosecution and Progress

Before the first sentence of the second paragraph after the Table of Anticipated Productive Days in Subsection 907-108.06.2.2 on page 3, add the following.

Available productive days will start being assessed at the original Notice to Proceed/Beginning of Contract Time date shown in the contract documents, regardless of whether or not the Contractor has been issued an early Notice to Proceed.

Before Subsection 907-108.10 on page 5, add the following.

907-108.07--Failure to Complete the Work on Time. Delete the Schedule of Deductions table in Subsection 108.07 on page 85, and substitute the following.

Schedule of Deductions for Each Day of Overrun in Contract Time

Original Contract Amount		Daily Charge
From More Than	To and Including	Per Calendar Day
$ 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

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-108-24 **CODE: (SP)**

DATE: 03/15/2011

SUBJECT: Prosecution and Progress

Section 108, Prosecution and Progress, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-108.01--Subletting of Contract.

907-108.01.1--General. At the end of the last paragraph of Subsection 108.01.1 on page 73, add the following:

The Engineer will have the authority to suspend the work wholly or in part and to withhold payments because of the Contractor's failure to make prompt payment within 15 calendar days as required above, or failure to submit the required OCR-484 Form, Certification of Payments to Subcontractors, which is also designed to comply with prompt payment requirements.

907-108.02--Notice To Proceed. Delete the second paragraph of Subsection 108.02 on page 75 and substitute the following:

The anticipated date of the Notice to Proceed (NTP) / Beginning of Contract Time (BCT) will be specified in the proposal.

Delete the fourth paragraph of Subsection 108.02 on page 75 and substitute the following:

Upon written request from the Contractor and if circumstances permit, the Notice to Proceed may be issued at an earlier date subject to the conditions stated therein. The Contractor shall not be entitled to any monetary damages or extension of contract time for any delay claim or claim of inefficiency occurring between the early issuance Notice To Proceed date and the Notice to Proceed date stated in the contract.

907-108.03--Prosecution and Progress. Delete Subsection 108.03.1 on pages 75 & 76, and substitute the following:

907-108.03.1--Progress Schedule. Prior to or at the Pre-Construction Conference, the Contractor shall furnish a progress schedule and be prepared to discuss both its proposed methodologies for fulfilling the scheduling requirements and its sequence of operations. The Engineer will review the schedule and approve the schedule as it relates to compliance with the specifications and logic. The progress schedule must be approved by the Engineer prior to commencing work. The schedule shall be a bar-chart type schedule submitted on 11”x17” paper meeting the below minimum requirements. These activities shall be significantly detailed enough to communicate the Contractor's understanding of the construction sequencing and phasing of the project.

When preparing the progress schedule, the Contractor shall include the following:

- Show a time scale to graphically show the completion of the work within contract time.
- Define and relate activities to the contract pay items.
- Show all activities in the order the work is to be performed including submittals, submittal reviews, fabrication and delivery.
- Show all activities that are controlling factors in the completion of the work.
- Show the time needed to perform each activity and its relationship in time to other activities.

Should the schedule not include the above requirements or becomes unrealistic during construction, the Contractor should immediately submit a revised, more realistic schedule for approval.

907-108.03.2--Preconstruction Conference. Delete the first paragraph of Subsection 108.03.2 on page 76 and substitute the following:

Prior to commencement of the work, a preconstruction conference shall be held for the purpose of discussing with the Contractor essential matters pertaining to the prosecution and satisfactory completion of the work. The Contractor will be responsible for scheduling the preconstruction conference. The Contractor will advise the Project Engineer in writing 14 days prior to the requested date that a conference is requested. When the contract requires the Contractor to have a certified erosion control person, the Contractor's certified erosion control person shall be at the preconstruction conference. The Department will arrange for utility representatives and other affected parties to be present.

Delete the third paragraph of Subsection 108.03.2 on page 76.

907-108.06--Determination and Extension of Contract Time. Delete Subsections 108.06.1 and 108.06.2 on pages 79 thru 85 and substitute the following:

907-108.06.1--Blank.

907-108.06.2--Based on Calendar Date Completion.

907-108.06.2.1--General. Contract Time will be established on the basis of a Completion Date, as indicated in the contract. The span of time allowed for the completion of the work included in the contract will be indicated in the contract documents and will be known as "Contract Time".

The span of time allowed in the contract as awarded is based on the quantities used for comparison of bids. If satisfactory fulfillment of the contract requires performance of work in greater quantities than those set forth in the proposal, the time allowed for completion shall be increased in Calendar Days in the same ratio that the cost of such added work, exclusive of the cost of work altered by Supplemental Agreement for which a time adjustment is made for such altered work in the Supplemental Agreement, bears to the total value of the original contract unless it can be established that the extra work was of such character that it required more time

than is indicated by the money value.

The Contractor shall provide sufficient materials, equipment and labor to guarantee the completion of the work in the contract in accordance with the plans and specifications within the Contract Time.

907-108.06.2.2--Contract Time. The following TABLE OF ANTICIPATED PRODUCTIVE DAYS indicates an average/anticipated number of productive days per month.

TABLE OF ANTICIPATED PRODUCTIVE DAYS

Month	Available Productive Days
January	6
February	7
March	11
April	15
May	19
June	20
July	21
August	21
September	20
October	16
November	11
December	5
Calendar Year	172

Allocation of anticipated productive days for a fractional part of the month will be computed as a proportion of the listed anticipated productive days for the applicable month.

An available productive day will be assessed (a) any day of the week, Monday through Friday, exclusive of legal holidays recognized by the Department in Subsection 108.04.1, in which the Contractor works or could have worked for more than six (6) consecutive hours on the controlling items of work, as determined by the Engineer, or (b) any Saturday, exclusive of legal holidays recognized by the Department in Subsection 108.04.1, in which the Contractor works for more than six (6) consecutive hours on the controlling items of work, as determined by the Engineer. When the Contractor works less than four consecutive hours during the day, no time will be charged for that day. When the Contractor works more than four but less than six consecutive hours, one-half (0.5) of an available work day will be charged for that day. When he Contractor works six or more consecutive hours during the day, one (1.0) available work day will be charged for that day.

Should the weather or other conditions be such that four (4) consecutive satisfactory hours are not available prior to noon (for daytime operations) or midnight (for nighttime operations), no time will be assessed for that day regardless of the above conditions. However, if the Contractor elects to work, time will be assessed in accordance with the previous paragraph.

Weather delays will not be considered for Saturdays, Sundays or legal holidays recognized by the Department in Subsection 108.04.1.

Available productive days will be based on soil and weather conditions and other specific conditions cited in the contract. The Engineer will determine on each applicable day the extent to which work in progress could have been productive, regardless of whether the Contractor actually worked.

Each month the Engineer will complete, and furnish to the Contractor, an "Assessment Report for Available Productive Days" (CSD-765). This report shows the number of available productive days during the estimate period and the cumulative available productive days to date. The Contractor should review the Engineer's report as to the accuracy of the assessment and confer with the Resident or Project Engineer to rectify any differences. Each should make a record of the differences, if any, and conclusions reached. In the event mutual agreement cannot be reached, the Contractor will be allowed a maximum of 15 calendar days following the ending date of the monthly report in question to file a protest Notice of Claim in accordance with the provisions of Subsection 105.17. Otherwise, the Engineer's assessment shall be final unless mathematical errors of assessment are subsequently found to exist, and any claim of the Contractor as to such matter shall be waived.

At any given date, the ratio of the accumulated monetary value of that part of the work actually accomplished to the total contract bid amount adjusted to reflect approved increases or decreases shall determine the "percent complete" of the work.

The "percentage of elapsed time" shall be calculated as a direct ratio of the expired calendar days to the total calendar days between the Beginning of Contract Time and the Specified Completion Date in the contract.

When the "percent complete" lags more than 20 percent behind the "percentage of elapsed time", the Contractor shall immediately submit a written statement and revised progress schedule indicating any additional equipment, labor, materials, etc. to be assigned to the work to ensure completion within the specified contract time. When the "percent complete" lags more than 40 percent behind the "percentage of elapsed time", the contract may be terminated.

907-108.06.2.3--Extension of Time. The Contractor may, prior to the expiration of the Contract Time, make a written request to the Engineer for an extension of time with a valid justification for the request. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time.

No extension of the specified completion date will be granted except as provided herein. An extension of contract time may be granted for unusually severe weather, abnormal delays caused

solely by the State or other governmental authorities, or unforeseeable disastrous phenomena of nature of the magnitude of earthquakes, hurricanes, tornadoes, or flooded essential work areas which are deemed to unavoidably prevent prosecuting the work.

Unusually severe weather is defined as when the actual available productive days for the contract time are less than the number of available productive days shown in the Table of Anticipated Productive Days.

Any extension of contract time will be based on a calendar days basis, excluding Saturdays, Sundays or legal holidays recognized by the Department in Subsection 108.04.1. No proration of contract time will be made. Any extension of contract time will be made on or after the specified completion date. No extension of contract time will be made on a monthly basis.

Any revision of the specified completion date provided in the contract will be made automatically on the specified completion date as established in the contract, and at a later date if additional conditions so warrant.

If the completion of the project is extended into a season of the year in which completion of certain items of work would be prohibited or delayed because of seasonal or temperature limitations, the Engineer may waive the limitations provided the completion of the work will not result in a reduction in quality. When determined that the completion of the out-of-season items will cause a reduction in the quality of the work, the completion of the project will be further extended so the items may be completed under favorable weather conditions. In either case, the Engineer will notify the Contractor in writing.

Liquidated damages as set forth in Subsection 108.07 under the heading "Daily Charge Per Calendar Day" in the Table titled "Schedule of Deductions for Each Day of Overrun in Contract Time", shall be applicable to each calendar day after the specified completion date, or authorized extension thereof, and until all work under the contract is completed.

907-108.06.2.4--Cessation of Contract Time. When the Engineer by written notice schedules a final inspection, time will be suspended until the final inspection is conducted and for an additional 14 calendar days thereafter. If after the end of the 14-day suspension all necessary items of work have not been completed, time charges will resume. If the specified completion date had not been reached at the time the Contractor called for a final inspection, the calendar day difference between the specified completion date and the date the Contractor called for a final inspection will be added after the 14-day period before starting liquidation damages. If a project is on liquidated damages at the time a final inspection is scheduled, liquidated damages will be suspended until the final inspection is conducted and for seven (7) calendar days thereafter. If after the end of the 7-day suspension all necessary items of work have not been completed, liquidated damages will resume. When final inspection has been made by the Engineer as prescribed in Subsection 105.16 and all items of work have been completed, the daily time charge will cease.

907-108.10--Termination of Contractor's Responsibility. In the last sentence of Subsection 108.10 on page 88, change "bond" to "performance and payment bond(s)".

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-109-5

DATE: 05/15/2012

SUBJECT: Measurement and Payment

After the last paragraph of Subsection 907-109.01 on page 1, add the following.

After the second sentence of the fourth full paragraph of Subsection 109.01 on page 90, add the following.

Where loose vehicle measurement (LVM) is used, the capacity will be computed to the nearest one-tenth cubic yard and paid to the whole cubic yard. Measurements greater than or equal to nine-tenths of a cubic yard will be rounded to the next highest number. Measurements less than nine-tenths of a cubic yard will not be rounded to the next highest number. Example: A vehicle measurement of 9.9 cubic yards will be classified as a 10-cubic yard vehicle. A vehicle measurement of 9.8 cubic yards will be classified as a 9-cubic yard vehicle.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-109-5 **CODE: (IS)**

DATE: 1/20/2011

SUBJECT: Measurement and Payment

Section 109, Measurement and Payment, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-109.01--Measurement of Quantities. Delete the third full paragraph of Subsection 109.01 on page 90 and substitute the following.

When requested by the Contractor, material specified to be measured by the cubic yard or ton may be converted to the other measure as appropriate. Factors for this conversion will be determined by the District Materials Engineer and agreed to by the Contractor. The conversion of the materials along with the conversion factor will be incorporated into the contract by supplemental agreement. The supplemental agreement must be executed before such method of measurement is used.

907-109.04--Extra and Force Account Work. In the last sentence of subparagraph (b) in Subsection 109.04 on page 91, change "bond" to "bond(s)".

Delete the first sentence of the second paragraph of subparagraph (d) in Subsection 109.04 on page 92 and substitute the following:

In the event an agreement cannot be reached for a particular piece of equipment, the book entitled "Rental Rate Blue Book For Construction Equipment" as published by EquipmentWatch® and is current at the time the force account work is authorized will be used to determine equipment ownership and operating expense rates.

907-109.06--Partial Payment.

907-109.06.1--General. Delete the fourth and fifth sentences of the third paragraph of Subsection 109.06.1 on page 94, and substitute the following:

In the event mutual agreement cannot be reached, the Contractor will be allowed a maximum of 25 calendar days following the Contractor's receipt of the monthly estimate in question to file in writing, a protest Notice of Claim in accordance with the provisions Subsection 105.17. Otherwise, the Engineer's estimated quantities shall be considered acceptable pending any changes made during the checking of final quantities.

907-109.07--Changes in Material Costs. Delete the third full paragraph of Subsection 109.07 on page 96 and substitute the following:

A link to the established base prices for bituminous products and fuels will be included in the contract documents under a Notice to Bidders entitled "Petroleum Products Base Prices."

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-237-4 **CODE: (SP)**

DATE: 03/13/2012

SUBJECT: Wattles

Section 907-237, Wattles, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-237 - WATTLES

907-237.01--Description. This work consists of furnishing, constructing and maintaining wattles for the retention of soil around inlets, swale areas, small ditches, sediment basins and other areas as necessary. Also, the work includes removing and disposing of the wattles and silt accumulations.

Measurement and payment for wattles will be made only when a pay item is included in the bid schedule of the proposal. The quantity is estimated for bidding purposes only and will be dependent upon actual conditions which occur during construction of the project.

907-237.02--Materials. Wattles used around inlets shall have a diameter of twelve inches (12") and a length adequate to meet field conditions. Wattles used at other locations shall have a diameter of twenty inches (20") and a length adequate to meet field conditions. The minimum diameter for the above wattle sizes shall be one inch (1") less than the specified diameter.

The stakes used in securing the wattles in place shall be placed approximately three feet (3') apart throughout the length of the wattle. Stakes shall be wooden and of adequate size to stabilize the wattles to the satisfaction of the Engineer.

In addition to the requirements of this specifications, wattles shall be listed on the Department's "Approved Sources of Materials".

907-237.03--Construction Requirements.

907-237.03.1--General. The wattles shall be constructed at the locations and according to the requirements shown on the erosion control plan.

907-237.03.2--Maintenance and Removal. The Contractor shall maintain the wattles and remove and dispose of silt accumulations.

When the wattles are no longer needed, they shall be removed and the Contractor shall dispose of silt accumulations and treat the disturbed areas in accordance with the contract requirements.

907-237.04--Method of Measurement. Wattles of the size specified will be measured per linear foot.

907-237.05--Basis of Payment. Wattles, measured as prescribed above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for installation, maintaining and removal of the wattles, the removal and disposal of silt accumulations and any required restoration of the disturbed areas.

Payment will be made under:

907-237-A: Wattles, Size - per linear foot

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-242-26 **CODE: (SP)**

DATE: 11/14/2012

SUBJECT: Gulf Coast Regional Office / First Responders' Building

PROJECT: BWO-6208-24(001) / 502085301 & 302 – Harrison County

Section 907-242, Gulf Coast Regional Office / First Responders' Building, is hereby added to and made part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-242--GULF COAST REGIONAL OFFICE / FIRST RESPONDERS' BUILDING

The following specifications are to be used ONLY for the construction of the Gulf Coast Regional Office / First Responders' Building. The Mississippi Standard Specifications for Road and Bridge Construction shall be used for all other items of work.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

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PROJECT: **GULF COAST REGIONAL OFFICE / FIRST RESPONDERS' BUILDING AT LYMAN, HARRISON COUNTY, MISSISSIPPI**

PROJECT NUMBER: **BWO-6208-24(001) 502085**

DATE: **10-29-12**

DESCRIPTION A: This Work shall consist of all construction work necessary in constructing the (Base Bid – State Funds) Gulf Coast Regional Office / First Responders' Building at Lyman, Harrison County, Mississippi, in accordance with these Specifications and conforming with the Drawings.

DESCRIPTION B: This Work shall consist of all construction work necessary in constructing the (Alternate Bid – FEMA Funds) Gulf Coast Regional Office / First Responders' Building at Lyman, Harrison County, Mississippi, in accordance with these Specifications and conforming with the Drawings.

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

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

END OF SECTION

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C20	13	SITE PLAN -ALTERNATE
C30	14	GRADING & DRAINAGE PLAN - ALTERNATE
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END OF SECTION

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 QUESTIONS

A. Questions should be directed to MDOT through Question and Answer link on Letting page at goMDOT.com. Click Call Number of Project selected on left side. This page should also be used if a Bidder finds Discrepancies in or omissions from the Drawings or Project Manual or be in doubt as to their meaning. The Contract Administration Engineer will send written instruction(s) or interpretation(s) to all known holders of the Documents. MDOT will not be responsible for any oral instruction or interpretation.

1.02 BIDDER'S QUALIFICATIONS

A. Certificate of Responsibility: The Mississippi State Board of Contractors is responsible for Issuing Certificates of Responsibility to Contractors. To be awarded a Contract for public work, Sections 31-3-15 and 31-3-21 of the Mississippi Code 1972, Annotated requires a Contractor to have a current Certificate of Responsibility at bid time and during the entire length of the job. The Certificate of Responsibility number issued becomes a significant item in all public bidding.

B. Bid Under $50,000: If a Bidder submits a bid not exceeding $50,000, no Certificate of Responsibility number is required; however, a notation stating the bid does not exceed $50,000 must appear on the face of the envelope, or a Certificate of Responsibility number.

C. Bid Equal to or Over $50,000: Each Bidder submitting a bid equal to or over $50,000 must show its Certificate of Responsibility number on the bid and on the face of the envelope containing the bid.

D. As a condition for awarding of a bid, the total amount of which is equal to or over $50,000 and financed 100% with State funds, the bidder must have a current Certificate of Responsibility to do Building Construction issued by the Mississippi State Board of Public Contractors or a similar certificate issued by another state recognizing such certificate issued by the State of Mississippi.

E. Joint Venture Bid: When multiple Contractors submit a joint venture bid in excess of $50,000, a joint venture Certificate of Responsibility number must be shown on the bid and on the face of the envelope containing the bid. If the Multiple-Contractor joint venture has no joint venture Certificate of Responsibility number, each of the Contractors participating in the bid must indicate their individual Certificate of Responsibility numbers on the bid and on the face of the envelope.

1.03 NON-RESIDENT BIDDER

A. When a non-resident Bidder (a Contractor whose principal place of Business is outside the State of Mississippi) submits a bid for a MDOT project, one of the following is required and shall be submitted with the Proposal Form:

B. Copy of Law: If the non-resident Bidder's state has a resident Bidder preference law, a copy of that law shall be submitted with the Proposal Form.

C. Statement: If the state has no such law then a statement indicating the State of (Name of State) has no resident Contractor preference law shall be submitted with the Proposal Form.

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 SITE

A. All Bidders, including the general Contractor and Subcontractors shall visit the building site, compare the Drawings and Project Manual with any work in place and informed of all conditions. Mandatory attendance of the Pre-Bid Meeting is required to submit a Bid for this Project, refer to Section 00 25 13 “Pre-Bid Meeting. Failure to visit the site on this day will in no way relieve the successful Bidder from furnishing any materials or performing any work required to complete Work in accordance with Drawings and Project Manual (Proposal) without additional cost to the Owner.

1.06 LAWS AND REGULATIONS

A. The Bidder’s attention is directed to the fact that all applicable Mississippi state laws, rules and regulations of all authorities having jurisdiction over construction of the Project apply to the Contract.

1.07 OBLIGATION OF BIDDER

A. At the bid opening, each Bidder will be presumed to have inspected the site, read and become thoroughly familiar with the Drawings and the Project Manual (Proposal) including all addenda.

1.08 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.

1.09 METHOD OF BIDDING

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

1.10 PROPOSAL FORMS

A. The Bidder shall make all proposals on forms provided and shall fill all applicable blank spaces without interlineation or alteration and must not contain recapitulation of the work to be done. No oral or telegraphic proposals will be considered.

1.11 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 Form.

1.12 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 62 15 entitled *Product Options and Substitution Procedures* which covers procedures after the award of Contract.

1.13 ADDENDA

A. Any 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.

1.14 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 the same as the name appearing in the current Mississippi State Board of Contractors Roster.

C. Legal Address: The address appearing on the Proposal Form should be the same address appearing in the current Mississippi State Board of Contractors Roster.

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.

1.15 BID SECURITY

A. The Bid Security shall be in the form of a Bid Bond, or a Certified Check:

1. Bid Bond: The Bidder may submit a Bid Bond made out to the STATE OF MISSISSIPPI by a Surety licensed in Mississippi in the amount of five percent (5%) of the base bid. The Bidder, the Surety and a Mississippi Agent or Qualified Non-Resident Agent, with Power of Attorney attached, shall duly execute the Bid Bond. The Project number shall be identified on the Bid Bond. (No standard form is required for the Bid Bond.)
2. Certified Check: The Bidder may submit a certified check made out to the STATE OF MISSISSIPPI in the amount of five percent (5%) of the base bid. The Project number shall be identified on the Certified check. All checks received from Bidders will be returned upon request, unless a Bidder is one (1) of the three (3) apparent low Bidders. The three (3) apparent low Bidder's checks will be held for forty-five (45) days, unless a Contract is awarded and executed in less time.

1.16 POWER OF ATTORNEY

A. Each bid security must be accompanied by an appropriate Power of attorney.

1.17 SUBMITTAL

A. This Proposal, which includes the Bid Forms and Specifications, must have all applicable parts completely filled out and delivered in its entirety to the address indicated on the Advertisement for Bids prior to the time and date stated.

B. DO NOT remove any part of the Contract Documents (Exception – An addendum requires substitution of second sheet of Section 905 (*Proposal Forms*).

C. Failure to complete all of the applicable requirements may be cause for the Proposal to be considered irregular.

D. A STRIPPED PROPOSAL THAT IS NOT RE-ASSEMBLED IN ITS CORRECT ORDER IS CONSIDERED AS AN IRREGULAR BID AND WILL BE REJECTED.

E. The Proposal shall be submitted and sealed in the opaque envelope provided and mailed or hand-delivered.

1. If the Bid is mailed, the bid envelope shall be placed inside a second envelope to prevent inadvertent premature opening of the Proposal. The second mailing envelope shall have the notations “SEALED BID ENCLOSED” on the face thereof.

1.18 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.

1.19 WITHDRAWAL OF BID

A. Any bid may be withdrawn prior to the scheduled time for opening of bids.

1.20 OPENING OF BIDS

A. Bids will be publicly opened shortly after the time stated in the advertisement for Bids. Bidder representatives are invited; however, attendance is not mandatory.

1.21 IRREGULARITIES

A. The omission of any information requested on the Proposal Form may be considered as an informality, or irregularity, by the awarding public body when in their opinion the omitted information does not alter the amounts contained in the submitted bid proposal, or place other Bidders at a disadvantage.

1.22 PROTEST

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

1.23 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.

1.24 AWARD OF CONTRACT

A. The Owner reserves the right to reject any or all bids. A Contract will be awarded on the basis of the low base bid, or low base bid and alternate selected by the Owner determined to be in the best interest of the Mississippi Transportation Commission and which produces a total within available funds.

1.25 FAILURE TO ENTER INTO A CONTRACT

A. The Bidder shall forfeit the Bid Security to the Owner as liquidated damages for failure, or refusal, to execute and deliver the Contract, Bond and Certificate of Insurance within the required ten (10) days after notice of the acceptance of the bid.

1.26 SECURITY FOR FAITHFUL PERFORMANCE

A. Simultaneously, with delivery of the executed Contract, the Contractor shall furnish a Surety Bond, or Bonds, as security for faithful performance, the payment of all persons performing labor on the project and furnishing materials in connection with this Contract. The Surety on such Bond or Bonds shall be a duly authorized surety company satisfactory to the Owner and meeting all of the following requirements:

1. Licensed at the time of award by the State of Mississippi's Commissioner of Insurance for the purpose of providing surety.
2. Listed at the time of award in the Department of the Treasury's Federal Register as a company holding certificates of authority as acceptable sureties on Federal Bonds, commonly referred to as the Treasury List.
3. All Bonds shall be executed on the form provided in the Project Manual under Section 00 61 00 entitled *Bond Forms.*
4. A Mississippi Agent or Qualified Non-Resident Agent with Power of Attorney attached or on file with the Contract Administration Engineer, shall countersign all Bonds with the name and address typed, or lettered legibly.
5. All Bonds must be accompanied by an appropriate Power of Attorney.

1.27 BIDDER'S CHECKLIST

A. PROPOSAL FORM

1. Base Bid
   ( ) Write in the amount of the base bid in numbers.

2. Alternates
   ( ) Write in each alternates amount in words and 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 as it appears in the current Mississippi State Board of Contractors Roster.
   ( ) Legal address of the business listed above.
   ( ) 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 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

1.28 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	Emma Taylor – Contract Administration	(601) 359-7744
2.	Additional Prints	Clint Wells – MDOT Plans Print Shop	(601) 359-7460
3.	Bid Forms	B.B. House – Contract Admin. Engineer	(601) 359-7730

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

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 00 22 13 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 WORK IN PROXIMITY OF HIGH VOLTAGE POWER LINES

A. Bidders are hereby advised of Section 45-15-1, et seq., Mississippi Code of 1972, regarding the performance of work in the proximity of high voltage overhead power lines. It is the Contractor's responsibility to comply with those statutory requirements.

1.02 AGENCY, COMMISSION AND OFFICER NAME CHANGES

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

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

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

1.03 PLANT PEST QUARANTINES INFORMATION

A. AT the request of the U. S. Department of Agriculture, Plant Pest Control Information Concerning Domestic Quarantines is cited as follows:

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

<u>IMPORTED FIRE AN QUARANTINES</u>

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

1. Soil, separately or with other things, except soil samples shipped to approved laboratories*. Potting soil is exempt, if commercially prepared, packaged and shipped in original containers.
2. Plants with roots with soil attached, except houseplants maintained indoors and not for sale.
3. Grass sod.

4. Baled hay and straw that have been stored in contact with the soil.
5. Used soil-moving equipment.

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

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

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

1.04 PROMPT PAYMENT

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

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

1.05 ALTERATIONS IN BIDDING PROCESS

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

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

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

1.06 CONTRACT TIME

A. It is anticipated that the Recommendation to Award will be issued contingent on approval from FEMA. Contractor shall be required to submit a complete Schedule of Values showing Base and Alternate and a Construction Schedule for the Alternate by January 28, 2013, for FEMA review and approval. Allow 1 month for this process. Then the date for Notice to Proceed and Beginning of Contract Time, contingent on approval of submitted items, shall be issued April 15, 2013.

B. The calendar date for completion of this Contract shall be November 20, 2014 which date or extended date as provided in Article 8 – TIME shall be the end of contract time.

C. A Schedule of Values as described in Section 01 29 73 – Schedule of Values of these Specifications shall be required on or before the Monday after Bids have been received. They shall be sent to MEMA / FEMA for review and approval. Written approval shall be made prior to issuing Notice to Proceed.

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

1. Contractor Note: As first item of work the contractor shall schedule and attend MDOT's Erosion Control training session(s) and become certified to prepare Contractor's Erosion Control Plan (if not already certified).
2. Site work shall not proceed until Contractor's Erosion Control Plan has been approved by MDOT.
3. Contractor should allow approximately 60 days in his construction schedule for the completion of this process.

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. Specialty Items:
   a. Termite Treatment
   b. Masonry Items
   c. Metal Roofing Items
   d. Windstorm Resistant Aluminum Storefront and Glazing Items
   e. Plumbing Items
   f. Heating, Ventilating and Air Conditioning Items
   g. Electrical Items
   h. Communication Items
   i. Electronic Safety and Security Items
   k. Water Well Items

These items are not to be confused with Division 10 – Specialties of the Specifications.

END OF SECTION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

PRE-BID MEETING
SECTION 00 25 13

PROJECT: **Gulf Coast Regional Office / First Responders' Building at Lyman, Harrison County, Mississippi**

PROJECT NUMBER: **BWO-6208-24(001) 502085**

PART 1 GENERAL

1.01 DESCRIPTION

A. Bidders are hereby advised that this Project provides for a Pre-Bid Meeting.

B. This Meeting will be held in the Conference Room at the MDOT Project Office Building located on Highway 49N at Lyman, Mississippi, in Harrison County, telephone (228) 832-0277, at 10:30 A.M. on Tuesday, January 8, 2013. It is **MANDATORY** for prospective bidders to attend to discuss requirements of the Drawings and Specifications for this Project, to request clarifications or additional information to the Documents, and to visit the Project site.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 00 31 32 GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Geotechnical Investigation, MDOT Gulf Coast Headquarters Building, Lyman, Mississippi prepared by Burns Cooley Dennis, Inc. on June 2, 2010, is hereby made a part of the information made available to Bidders. For brevity, 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.

Part 2 - PRODUCTS (Not Used)

Part 3 - EXECUTION (Not Used)

END OF SECTION

BURNS COOLEY DENNIS, INC.

GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

Corporate Office
551 Sunnybrook Road
Ridgeland, MS 39157
Phone: (601) 856-9911
Fax: (601) 856-9774

Mailing Address
Post Office Box 12828
Jackson, MS 39236

www.bcdgeo.com

Materials Laboratory
278 Commerce Park Drive
Ridgeland, MS 39157
Phone: (601) 856-2332
Fax: (601) 856-3552

June 2, 2010

Pamela D. Leonard, AIA
Canizaro Cawthon Davis
129 South President Street
Jackson, Mississippi 39201-3605

Report No. 100181

Geotechnical Investigation
MDOT Gulf Coast Headquarters Building
Lyman, Mississippi

Dear Ms. Leonard:

Submitted here is the report of our geotechnical investigation for the above-captioned project. This investigation was authorized by your e-mail dated April 12, 2010, after our revised cost proposal dated March 17, 2010, was approved by MDOT. The investigation was generally performed in accordance with our letter Proposal No. 09001P-113 dated December 10, 2009.

We appreciate the opportunity to be of service. If you should have any questions concerning this report, please do not hesitate to call us.

Very truly yours,

BURNS COOLEY DENNIS, INC.

Marcos Rodrigues, E.I.

W. David Dennis, Jr., P.E.

MR/WDD/khb
Copies Submitted: (3)

TABLE OF CONTENTS

1.0 INTRODUCTION

Plans are being made for construction of a new Gulf Coast headquarters building within the Mississippi Department of Transportation (MDOT) complex located west of Highway 49 in Lyman, Mississippi. The proposed building will be a lightly loaded, single-story structure with an approximate footprint area of 10,000 sq ft. For a lightly loaded structure, we expect that column loads will be less than 150 kips and wall loads will not exceed 7 kips per ft. An existing building to be demolished currently occupies a portion of the proposed new building footprint area.

The specific purposes of this investigation were:

1) to make exploratory soil borings within the area planned for construction of the new building;

2) to verify field classifications and to evaluate pertinent physical properties of the soils encountered in the borings by visual examination of the soil samples and routine laboratory tests performed on selected samples; and

3) after analysis of the soil boring and laboratory test data, to provide recommendations for site preparation, earthwork construction, and foundation design and construction.

2.0 FIELD INVESTIGATION

2.1 General

Subsurface soil conditions within the area planned for construction of the new building were explored by means of six borings. The approximate locations of the borings are shown on Figure 1 of this report. The borings were located in the field by means of visual sighting and taped measurements from existing site features using distances scaled from the site plan furnished to Burns Cooley Dennis, Inc.

All soils were classified in general accordance with the Unified Soil Classification System. A synopsis of the Unified Soil Classification System is presented on Figure 2 along with symbols and terminology typically utilized on graphical soil boring logs. Logs of the soil borings are presented on Figures 3 through 8. The graphical logs illustrate the types of soil and stratification encountered with depth below the existing surface at the individual boring locations.

2.2 Drilling Methods and Groundwater Observations

The borings were made with a buggy-mounted rotary drill rig. The borings were made to exploration depths of 15 ft and 25 ft. Borings 1, 2 and 5 were advanced full depth by dry augering. Borings 3, 4 and 6 were initially advanced by dry augering to depths of 10 ft and 11 ft and then were further advanced to completion using rotary wash drilling procedures. Observations were made continuously during auger drilling to detect free water entering the open boreholes. Notes pertaining to groundwater observations are included at the bottom right corner of the graphic boring logs.

2.3 Sampling Methods

Relatively undisturbed samples of fine-grained soils encountered in Borings 1, 3, 4, 5 and 6 were obtained in the borings by pushing a 3-in. OD Shelby tube sampler approximately 2 ft into the soil. The Shelby tube samples were obtained within the depth intervals illustrated as shaded portions of the "Samples" column of the graphic logs for Borings 1, 3, 4, 5 and 6. Disturbed samples of fine and coarse-grained soils were obtained at approximate 3-ft to 5-ft intervals of depth by driving a standard 2-in. OD split-spoon sampler 18 in. into the soil with a 140-lb hammer falling freely a distance of 30 in. The depths at which the split-spoon samples were taken are illustrated as crossed rectangular symbols under the "Samples" column of the graphic boring logs. Standard penetration test (SPT) blow counts resulting from split-spoon sampling are recorded under the "Blows Per Ft" column of the graphic logs. Disturbed auger cutting samples were obtained in the borings just below the surface. The depths at which the auger cutting samples were taken are illustrated as small I-shaped symbols under the "Samples" column of the graphic boring logs.

2.4 Field Classification, Sample Preservation and Borehole Abandonment

All soils encountered during drilling were examined and classified in the field by a geotechnical engineering technician. Each undisturbed Shelby tube sample was extruded from the sampling tube in the field. An approximate 6-in. long portion of each Shelby tube sample was sealed with melted paraffin in a cylindrical cardboard container to prevent moisture loss and structural disturbance. An additional portion of each Shelby tube sample, representative portions of the split-spoon samples and the auger cutting samples were sealed in jars to provide material

for visual examination and testing in the laboratory. The boreholes were plugged with soil cuttings after completion of drilling and sampling.

3.0 LABORATORY INVESTIGATION

3.1 General

All of the soil samples were examined in the laboratory and tests were performed on selected samples to verify field classifications and to assist in evaluating the strengths and volume change properties of the soils encountered. The types of laboratory tests performed are described in the following paragraphs.

3.2 Strength Tests

The undrained shear strength characteristics of the fine-grained soils encountered in the borings were investigated by means of six unconfined compression tests performed on the undisturbed Shelby tube samples taken in Borings 1, 3, 4, 5 and 6. The results of the unconfined compression tests in terms of cohesion are plotted as small open circles in the data section of the graphic logs for Borings 1, 3, 4, 5 and 6. The water content and dry density were also determined for each unconfined compression test specimen. The water contents are plotted as small shaded circles in the data section of the graphic logs. The dry densities are tabulated to the nearest lb per cu ft under the "Dry Density" column of the logs for Borings 1, 3, 4, 5 and 6.

3.3 Classification Tests

The classifications and volume change properties of the fine-grained soils encountered in the borings were investigated by means of seven sets of Atterberg liquid and plastic limit tests performed on selected representative samples. The results of the liquid and plastic limit tests are plotted as small crosses interconnected by dashed lines in the data section of the graphic boring logs. In accordance with the Unified Soil Classification System, fine-grained soils are classified as either clays or silts of low or high plasticity based on the results of Atterberg limit tests. The numerical difference between the liquid limit and plastic limit is defined as the plasticity index (PI). The magnitudes of the liquid limit and plasticity index and the proximity of the natural water content to the plastic limit are indicators of the potential for a fine-grained soil to shrink or

swell upon changes in moisture content or to consolidate under loading. The proximity of the natural water content to the plastic limit is also an indicator of soil strength.

The classifications of sandy soils were investigated by means of seven minus No. 200 sieve tests performed on selected samples. The percentages of fines resulting from the minus No. 200 sieve tests are tabulated at the appropriate depths under the "% Passing No. 200 Sieve" column of the graphic boring logs.

3.4 Water Content Tests

Water content tests were performed on 20 samples to corroborate field classification and to extend the usefulness of the strength, plasticity and field SPT blow count data. The results of the water content tests are plotted as small shaded circles in the data section of the graphic boring logs. The water content data have been interconnected on the logs to show a continuous water content profile versus depth.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General

Subsurface soils encountered within the 25-ft maximum exploration depth of the borings made for this investigation generally consist of silty sand (SM) fill materials underlain by natural soils including sandy clays (CL), silts (ML), sandy silts (ML) and sands (SM, SP-SM and SP). A general description of the stratification revealed by the borings and a discussion of the physical properties of the soil types encountered are provided in the following paragraphs. The graphical logs presented on Figures 3 through 8 should be referred to for specific soil conditions encountered at the boring locations.

4.2 Soil Stratification

The ground surface at the boring locations was found to be directly underlain by silty sand (SM) fill materials. The silty sand (SM) fill materials were encountered to depths ranging from about 1 ft to 1.5 ft below the surface. The silty sand (SM) fill materials are classified as medium dense and are considered to have moderate strength and low-moderate compressibility. The silty sand (SM) fill materials have no potential for shrinking and swelling.

The silty sand (SM) fill materials at the locations of Borings 1 and 6 were found to be underlain by apparent natural sandy clays (CL). The natural sandy clays (CL) were encountered within the approximate depth interval of 1 ft to 8 ft at Borings 1 and 6. Sandy clays (CL) were also encountered within the approximate depth interval of 4 ft to 8 ft at Borings 3, 4 and 5. For the most part, the sandy clays (CL) are classified as stiff and very stiff with respect to consistency; however, the sandy clays (CL) at Boring 1 within the approximate depth interval of 1 ft to 4 ft are classified as medium stiff. The medium stiff sandy clays (CL) are considered to have low to moderate strength and moderate to high compressibility. The stiff and very stiff sandy clays (CL) are considered to have moderate to high strength and low to moderate compressibility. Six unconfined compression tests performed on undisturbed Shelby tube samples of the sandy clays (CL) yielded cohesions ranging from 0.99 to 2.64 kips per sq ft. Atterberg limit tests performed on six samples of the sandy clays (CL) yielded liquid limits ranging from 24 to 44, plastic limits that vary between 15 and 18, and plasticity indices that range from 9 to 28. The sandy clays (CL) are considered to have low shrink/swell potential.

The silty sand (SM) fill materials at the locations of Borings 3 and 4 were found to be underlain by apparent natural sandy silts (ML). The sandy silts (ML) were encountered within the approximate depth interval of 1 ft to 4 ft at Borings 3 and 4. Sandy silts (ML) were also encountered within the approximate depth interval of 4.5 ft to 8 ft at Boring 2. At Boring 4, the sandy silts (ML) are classified as medium dense and are considered to have moderate to high strength and low-moderate to low compressibility. The sandy silts (ML) are classified as very loose and loose at Borings 2 and 3. The very loose and loose sandy silts (ML) are considered to have low strength and moderate to high compressibility. The sandy silts (ML) have no potential for shrinking and swelling.

The silty sand (SM) fill materials at the locations of Borings 2 and 5 were found to be underlain by apparent natural silty sands (SM). The natural silty sands (SM) were encountered within the approximate depth intervals of 1 ft to 4.5 ft at Boring 2 and 1.5 ft to 4 ft at Boring 5. Silty sands (SM), slightly silty sands (SP-SM) and sands (SP) were also encountered from a depth of about 8 ft to the respective completion depths of Borings 1 through 6. The sands (SM, SP-SM and SP) are classified as medium dense, dense and very dense and are considered to have moderate to high strength and low-moderate to low compressibility. The sands (SM, SP-SM and SP) have no potential for shrinking and swelling.

4.3 General Groundwater Conditions

Free water was not encountered during auger drilling within the 15-ft exploration depth of Borings 1, 2 and 5. Free water was encountered during auger drilling for Borings 3, 4 and 6 at approximate depths of 10 ft, 11 ft and 10 ft, respectively. The water level in the open boreholes for Borings 3, 4 and 6 was measured at an approximate depth of 8 ft after an observation period of about 15 minutes. In our opinion, groundwater conditions at the site will primarily be influenced by rainfall, surface drainage, and by the rise and fall of water levels in any nearby ditches, creeks, ponds or other bodies of water. Groundwater conditions at the site can also be influenced by man-made environmental changes. Surficial soils can become saturated and weak to relatively shallow depths during periods of prolonged and heavy rainfall.

5.0 DISCUSSION

5.1 General Soil Conditions

Subsurface soils encountered within the 25-ft maximum exploration depth of the borings made for this investigation generally consist of silty sand (SM) fill materials underlain by natural soils including sandy clays (CL), sandy silts (ML), silts (ML) and sands (SM, SP-SM and SP). With the exception of medium stiff sandy clays (CL) at Boring 1 and loose and very loose sandy silts (ML) at Borings 2 and 3, the soils encountered in the borings are generally considered to have moderate to high strength and low to moderate compressibility. The medium stiff sandy clays (CL) at Boring 1 and the loose and very loose sandy silts (ML) at Borings 2 and 3 are generally considered to have low to moderate strength and moderate to high compressibility. The medium stiff sandy clays (CL) and the loose and very loose sandy silts (ML) would provide a low bearing capacity for a shallow foundation and would consolidate excessively under fill and structural loadings. The sand (SM, SP-SM and SP) fill and natural soils and the sandy silts (ML) have no potential for shrinking and swelling. The sandy clays (CL) are considered to have low shrink/swell potential.

5.2 Geotechnical-Related Design Considerations

A foundation should be utilized for the new building that that will accommodate the anticipated structural loadings and also minimize future differential vertical movements resulting from settlement due to consolidation of subsurface soils under fill and structural loadings. For

the soil conditions revealed by the borings, it is our opinion that a shallow foundation could be utilized for support of the building, provided column loads are less than 150 kips and wall loads do not exceed 7 kips per ft, and existing on-site weak soils are excavated and replaced with compacted select fill materials. We recommend that the building be supported by either a stiffened slab-on-grade foundation or a spread footing foundation. Details of our recommendations for site preparation, earthwork construction, and foundation design and construction are included in the following subsections of this report.

6.0 RECOMMENDATIONS

6.1 Site Preparation and Earthwork Construction

6.1.1 Site Preparation. As an initial step of site preparation within the construction area for the building, all existing structures, pavement, underground piping or other subsurface obstructions which may interfere with earthwork and foundation construction should be removed. Stripping should be performed to a sufficient depth within the construction area to remove organic-laden and high moisture content surficial soils, debris, brush and roots. Excavation should then be conducted to remove weak soils. As stated previously in the report, weak sandy clays (CL) with a consistency of medium stiff were encountered within the approximate depth interval of 1 ft to 4 ft at the location of Boring 1, and very loose and loose sandy silts (ML) were encountered within the approximate depth intervals of 4.5 ft to 8 ft at Boring 2 and 1 ft to 4 ft at Boring 3. The actual vertical and lateral extent of excavation required to remove weak soils must be determined in the field during earthwork construction. Excavation of weak soils should extend laterally not less than 6 ft beyond the building perimeter.

After stripping and excavation of weak soils, the soils exposed should be scarified to a minimum depth of 6 in. and compacted to not less than **95** percent of standard Proctor maximum dry density (ASTM D 698) with stability present. Alternatively, the exposed soils could be proofrolled with loaded dump trucks to demonstrate stability. Stability is defined as the absence of significant pumping or rutting during compaction or proofrolling. If stability is not evident in some areas, either additional excavation, drying by processing, treatment of the in situ soils with admixtures, or a combination of these approaches, might be required to achieve stable conditions.

On-site sandy clays (CL) and sandy silts (ML) are susceptible to pumping when wet. The construction techniques, types of equipment utilized and site drainage provided during construction will have an effect on the performance of near-surface soils. The routing of heavy, rubber-tired equipment should be controlled to minimize, as much as possible, traffic in the construction areas. All traffic should be discouraged during periods of inclement weather. It should be noted that soils which initially demonstrate adequate stability can become unstable if they are disturbed by construction traffic. If pumping is initiated in sandy clays (CL) and sandy silts (ML), as a construction expedient the pumping can be counteracted by treating these materials with hydrated lime. It is estimated that about 4 to 6 percent hydrated lime by dry weight of soil could be required.

6.1.2 Fill Placement and Compaction. We recommend that backfilling and filling follow immediately after stripping and excavation to remove weak soils. Fill materials should consist of select nonorganic and debris-free silty clays (CL) or sandy clays (CL) having a plasticity index (PI) within the range of 10 to 24 and a liquid limit less than 45, or clayey sands (SC) or slightly clayey silty sands (SM) with a PI in the range of 3 to 15 and a liquid limit less than 35. Excavated on-site soils that do not meet the recommendations for select fill could be placed outside the building area or they should be disposed off-site. Nonplastic sands (SP or SP-SM) with a fines content less than 12 percent may also be used as fill material, provided there is an awareness of potential problems that may occur and what precautions should be taken. Nonplastic sands will not compact well and will rut easily beneath construction equipment. Utility trench and foundation excavations made in nonplastic sands will slough. The contractor should be made aware of these issues. Nonplastic sands will also be susceptible to erosion and surface protection will need to be provided. The best method for protecting the surface is plating the sands with about 12 in. to 18 in. of sandy clays (CL) or clayey sands (SC). This plating material will also be necessary to facilitate growth of grass.

The fill soils should be compacted from lifts not exceeding 9 in. in loose thickness to not less than **98** percent of standard Proctor maximum dry density (ASTM D 698) at moisture contents within 3 percentage points of the optimum water content. Where hand-held compactors are used, the loose lift thickness should be limited to a maximum of 5 in. Stability must be evident during compaction of each lift before any subsequent lifts of fill material are added.

Finished site grades should be sloped to promote quick runoff of storm water and provide positive drainage away from the building on all sides.

Laboratory classification tests, including Atterberg limit determinations and grain-size analyses, should be performed on the fill soils initially and routinely during earthwork operations to check for compliance with the recommendations provided herein. Field moisture/density tests should be performed frequently in the scarified and compacted on-site soils and in each compacted lift of fill material to assist in evaluating whether the recommended moisture contents and dry densities are being achieved. As a guide for building earthwork construction, we suggest a minimum of one test per lift for each 2,500 sq ft of surface area or portion thereof.

6.2 Foundation Design Recommendations

6.2.1 Stiffened Slab-on-Grade Foundation. The proposed building could be supported by a foundation system consisting of a slab-on-grade stiffened with perimeter grade beams, or turned-down edges, and interior grade or tie beams. Grade beams should be utilized to support all exterior and interior load bearing and partition walls, or otherwise they should be spaced in a grid pattern that will result in a relatively strong and stiff slab. Any columns should be supported by widened portions of the grade beams. We recommend that grade beams or turned-down edges around the perimeter of the building be brought to bear at a depth not less than 2 ft below lowest adjacent finished outside grades. Interior tie or grade beams should be brought to bear at a depth not less than 1.5 ft below the bottom of the floor slab. We recommend that grade beams be proportioned for critical combinations of dead, live and wind loads utilizing a net allowable soil bearing pressure of 1,500 lbs per sq ft. A net allowable soil bearing pressure of 2,000 lbs per sq ft should be utilized to dimension widened portions of grade beams used to support column loads. We recommend a minimum base width of 12 in. for the grade beams. The grade beams should be reinforced for both positive and negative bending. The floor slab should be reinforced for anticipated loading conditions and deflections and to minimize slab cracking. We recommend that the slab be reinforced with a grid of relatively closely spaced reinforcing bars (i.e., No. 3 or No. 4 bars) in lieu of welded wire fabric.

6.2.2 Spread Footing Foundation. The proposed building could alternatively be supported by a spread footing foundation. For this type of foundation, strip footings should be utilized to support all exterior and interior load bearing and partition walls, and columns should

be supported by square footings. The footings should be founded directly upon strong natural soils or compacted select fill materials. We recommend that footings around the perimeter of the building be brought to bear at a depth not less than 2 ft below lowest adjacent finished outside grades. Interior footings should be brought to bear at a depth not less than 1.5 ft below the bottom of the floor slab. Strip footings should be proportioned for critical combinations of dead, live and wind loads utilizing a net allowable soil bearing pressure of 1,500 lbs per sq ft. We recommend a minimum width of 18 in. for strip footings. A net allowable soil bearing pressure of 2,000 lbs per sq ft should be used to dimension square footings. We recommend a minimum width of 24 in. for square footings.

The floor slab of the building can bear directly upon strong natural soils or compacted select fill materials. The slab should be adequately reinforced for anticipated loading conditions and deflections and to minimize slab cracking. Stiffening ribs, or grade beams, cast monolithically with the slab could be utilized to provide rigidity, if considered to be necessary.

6.2.3 Settlement. For the shallow foundation system, on-site soils and earthwork performed as recommended, total settlement should be less than 1 in. and future differential vertical movements should be less than 1/2 in. over a horizontal distance of 25 ft to 30 ft, provided that proper drainage is maintained and any leaks that develop in pipes are promptly repaired. It should be noted that differential movements of the magnitude stated in the preceding sentence could result in minor cracking of the foundation, walls and floor slab. The actual magnitude of the differential movements can be influenced by any number of events or circumstances that occur during the life of the building. For example, surface drainage conditions, broken water pipes, trees and shrubs, etc., can influence the actual movements which develop.

6.2.4 Other Foundation Considerations. If flower and shrub beds including sprinkler systems are placed adjacent to the building, the beds should be prepared such that they do not trap water, and sprinklers should be operated only enough to satisfy the water demands of the plants and shrubs. Excessive watering and ponding adjacent to the building could result in downward percolation of water into the subsurface soils causing them to lose strength. Rainwater falling on the roof of the building should be collected and prevented from reaching the ground immediately adjacent to the building. Trees remove water from the ground by transpiration

causing vertical and horizontal shrinkage of fine-grained soils. To minimize these effects, any trees planted for landscaping purposes should be located at least one-half their anticipated mature height away from the building. If the risk of more movement is acceptable, a less strict building-to-tree spacing of about 25 ft for hardwoods and 15 ft for pines could be utilized.

Final grades around the building should provide rapid and effective drainage of rainwater, downspout water and air-condition condensate away from the building, with no areas allowed for water to pond. Underground sources of water such as leaking water lines, sewer lines, etc., should be prevented as much as possible in the initial construction, and any leaks that develop should be promptly repaired.

We recommend that foundation excavations be left open for the shortest possible duration to minimize exposure of the bearing soils to rainfall. Drainage should be maintained away from the foundation excavations during construction. Soils exposed in the bottom of the excavations should be observed prior to concrete placement. If these materials are found to be weak or loose, overexcavation and backfilling will be required to provide strong soils immediately beneath foundation elements.

6.3 Other Design and Construction Considerations

The site of the proposed new building in Lyman, Mississippi, lies within a relatively low seismic activity region according to the seismic zone mapping referenced in the 2003 International Building Code. Given the site soil profile as revealed by the borings and anticipated for the area based on our experience, a site class D could be used in a seismic load evaluation.

7.0 REPORT LIMITATIONS

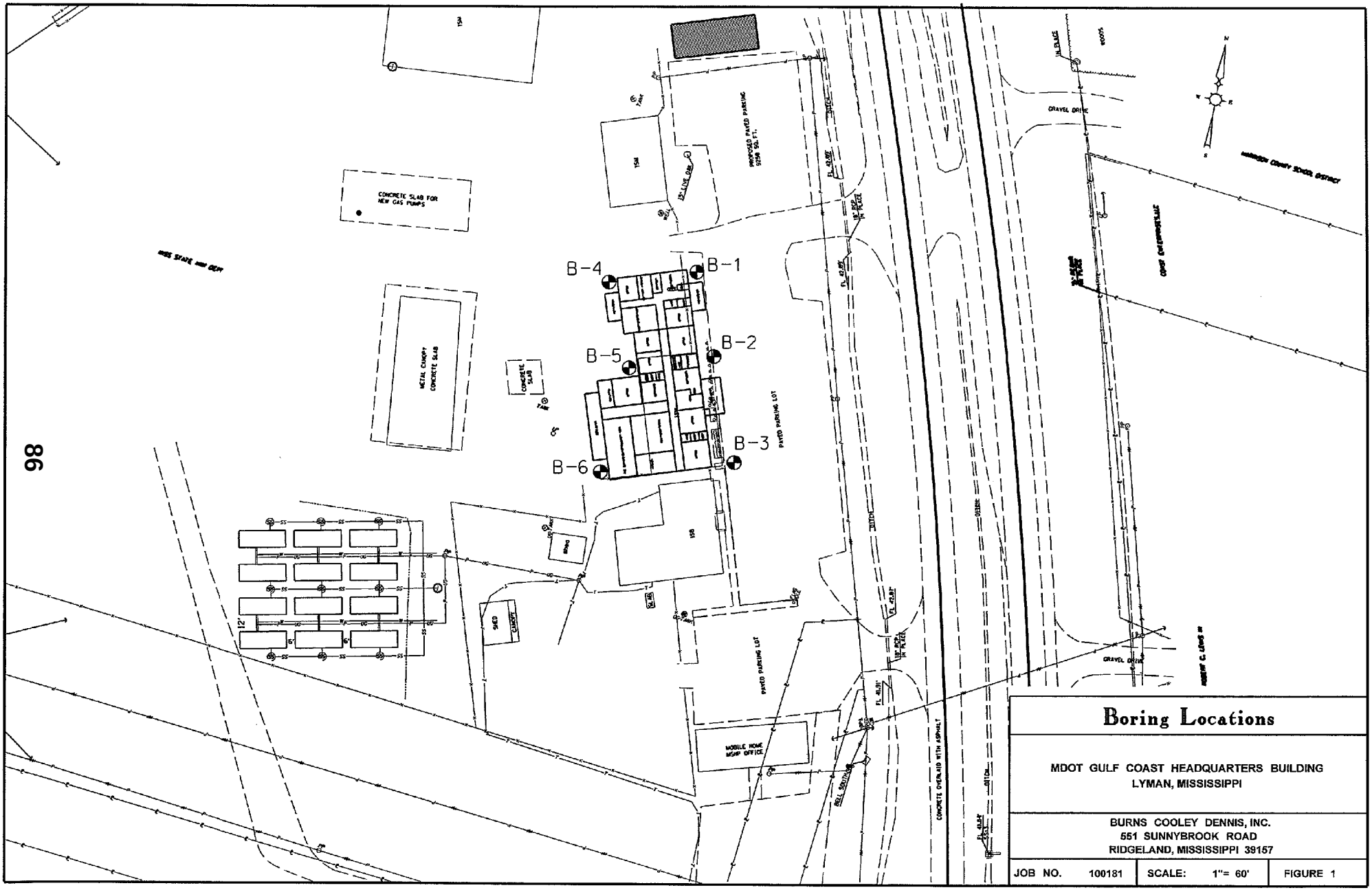
The analyses, conclusions, and recommendations discussed in this report are based on conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of subsurface conditions throughout the area investigated. It should be noted that actual subsurface conditions between and beyond the borings might differ from those encountered at the boring locations. If subsurface conditions are encountered during construction that vary from those discussed in this report, Burns Cooley

Dennis, Inc., should be notified immediately in order that we may evaluate the effects, if any, on earthwork and foundation design and construction.

Burns Cooley Dennis, Inc., should be retained for a general review of final design drawings and specifications. It is advised that we be retained to observe earthwork and foundation construction for the project in order to help confirm that our recommendations are valid or to modify them accordingly. Burns Cooley Dennis, Inc., cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report has been prepared for the exclusive use of Canizaro Cawthon Davis for specific application to the geotechnical-related aspects of design and construction for the new MDOT Gulf Coast headquarters building within the existing MDOT complex located west of Highway 49 in Lyman, Mississippi. The only warranty made by us in connection with the services provided is we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, express or implied, is made or intended.

FIGURES



Boring Locations

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

BURNS COOLEY DENNIS, INC.
551 SUNNYBROOK ROAD
RIDGELAND, MISSISSIPPI 39157

JOB NO. 100181	SCALE: 1"= 60'	FIGURE 1

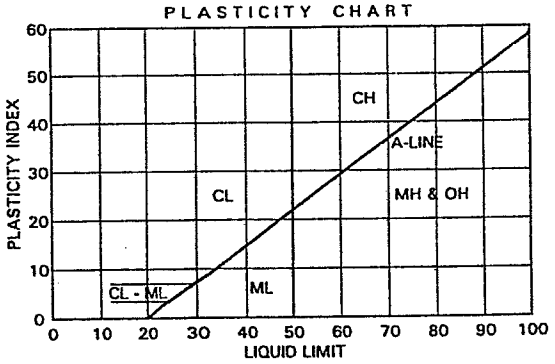
UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL & LETTER	DESCRIPTION
COARSE-GRAINED SOILS More than half of material larger than No. 200 sieve size	GRAVELS More than half of coarse fraction larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURE
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE
		Gravels with fines (Appreciable amount of fines)	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURE
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURE
	SANDS More than half of coarse fraction smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	WELL GRADED SAND, GRAVELLY SAND
			SP	POORLY GRADED SAND, GRAVELLY SAND
		Sands with fines (Appreciable amount of fines)	SM	SILTY SAND, SAND-SILT MIXTURE
			SC	CLAYEY SAND, SAND-CLAY MIXTURE
FINE-GRAINED SOILS More than half of material smaller than No. 200 sieve	SILTS AND CLAYS	Liquid limit less than 50	ML	SILT WITH LITTLE OR NO PLASTICITY
			ML	CLAYEY SILT, SILT WITH SLIGHT TO MEDIUM PLASTICITY
			CL	SILTY CLAY, LOW TO MEDIUM PLASTICITY
			CL	SANDY CLAY, LOW TO MEDIUM PLASTICITY (30% TO 50% SAND)
	SILTS AND CLAYS	Liquid limit greater than 50	MH	SILT, FINE SANDY OR SILTY SOIL WITH HIGH PLASTICITY
			CH	CLAY, HIGH PLASTICITY
			OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOIL

TERMS CHARACTERIZING SOIL STRUCTURE

- **Slickensided** - Clays with polished and striated planes created as a result of volume changes related to shrinking, swelling and/or changes in overburden pressure.
- **Fissured** - Clays with a blocky or jointed structure generally created by seasonal shrinking and swelling.
- **Laminated** - Composed of thin alternating layers of varying color and texture.
- **Calcareous** - Containing appreciable quantities of calcium carbonate.
- **Parting** - Paper thin (less than 1/8 inch).
- **Seam** - 1/8 inch to 3 inch thickness.
- **Layer** - Greater than 3 inches in thickness.

PLASTICITY CHART



FOR CLASSIFICATION OF FINE GRAINED SOILS

DENSITY AND CONSISTENCY

COARSE-GRAINED SOILS		FINE-GRAINED SOILS		
DENSITY	PENETRATION RESISTANCE, N Blows per Foot	CONSISTENCY	COHESION Kips/Sq.Ft	PENETRATION RESISTANCE, N Blows per Foot
Very loose	0 - 4	Very Soft	<0.25	0 - 1
Loose	5 - 10	Soft	0.25 - 0.50	2 - 4
Medium Dense	11 - 30	Medium Stiff	0.50 - 1.00	5 - 8
Dense	31 - 50	Stiff	1.00 - 2.00	9 - 15
Very Dense	>50	Very Stiff	2.00 - 4.00	16 - 30
		Hard	>4.00	>30

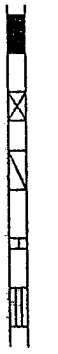
PARTICLE SIZE IDENTIFICATION

- **Cobbles** - Greater than 3 inches
- **Gravel** - Coarse - 3/4 inch to 3 inches; Fine - 4.76 mm to 3/4 inch
- **Sand** - Coarse - 2 mm to 4.76mm; Medium - 0.42 mm to 2 mm; Fine - 0.074 mm to 0.42 mm
- **Silt & Clay** - Less than 0.074 mm

RELATIVE COMPOSITION

Slightly With	5 - 15%
	16 - 29%
Sandy	30 - 50%
(or gravelly)	

SAMPLE TYPES
(Shown in Sample Column)



- Shelby Tube
- Split Spoon
- No Recovery
- Auger
- Dennison Barrell

CLASSIFICATION, SYMBOLS AND TERMS USED ON GRAPHICAL BORING LOGS

BURNS COOLEY DENNIS, INC.

FIGURE 2

LOG OF BORING NO. 1

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger LOCATION: See Figure 1

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	DRY DENSITY LBS/CU FT	Cohesion, kips/sq ft (○- UC, △- UU) 1 2 3 4 / PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT 20 40 60 80	% PASSING NO. 200 SIEVE
			SURFACE EL: ±ft				
1			Medium dense tan and light gray silty fine sand (SM), slightly clayey (FILL)				
2			Medium stiff tan and light gray sandy clay (CL)				
3					115		
4			- very stiff below 4'				
5							
6					112		
7							
8							
9			Medium dense light gray and tan silty fine sand (SM)				
10				25			
11							
12							
13			- very dense below 13'				
14							
15				50/5"			
16							
17							
18							
19							
20							

BORING DEPTH: 15 ft

DATE: 04/26/10

COMMENTS:

GROUNDWATER DATA: No free water encountered during auger drilling.

100181 6/2/2010 8:33:26 AM

BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

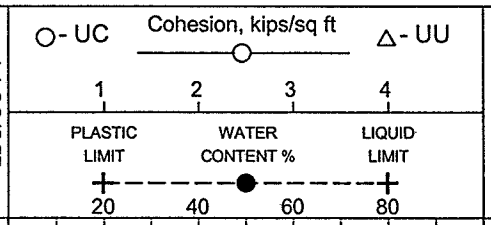
FIGURE 3

LOG OF BORING NO. 2

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger LOCATION: See Figure 1

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	DRY DENSITY LBS/CU FT	% PASSING NO. 200 SIEVE
			SURFACE EL: ±ft			
1			Medium dense tan and light gray silty fine sand (SM), slightly clayey, with trace of gravel (FILL)			
2			Medium dense gray and light gray silty fine sand (SM), slightly clayey	12		47.2
5			Very loose light gray sandy silt (ML)	3		56.2
8			Medium dense light gray silty fine sand (SM)	15		
13			Dense light gray fine sand (SP-SM), slightly silty	33		
15						
20						



BORING DEPTH: 15 ft

DATE: 04/26/10

COMMENTS:

GROUNDWATER DATA: No free water encountered during auger drilling.

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BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

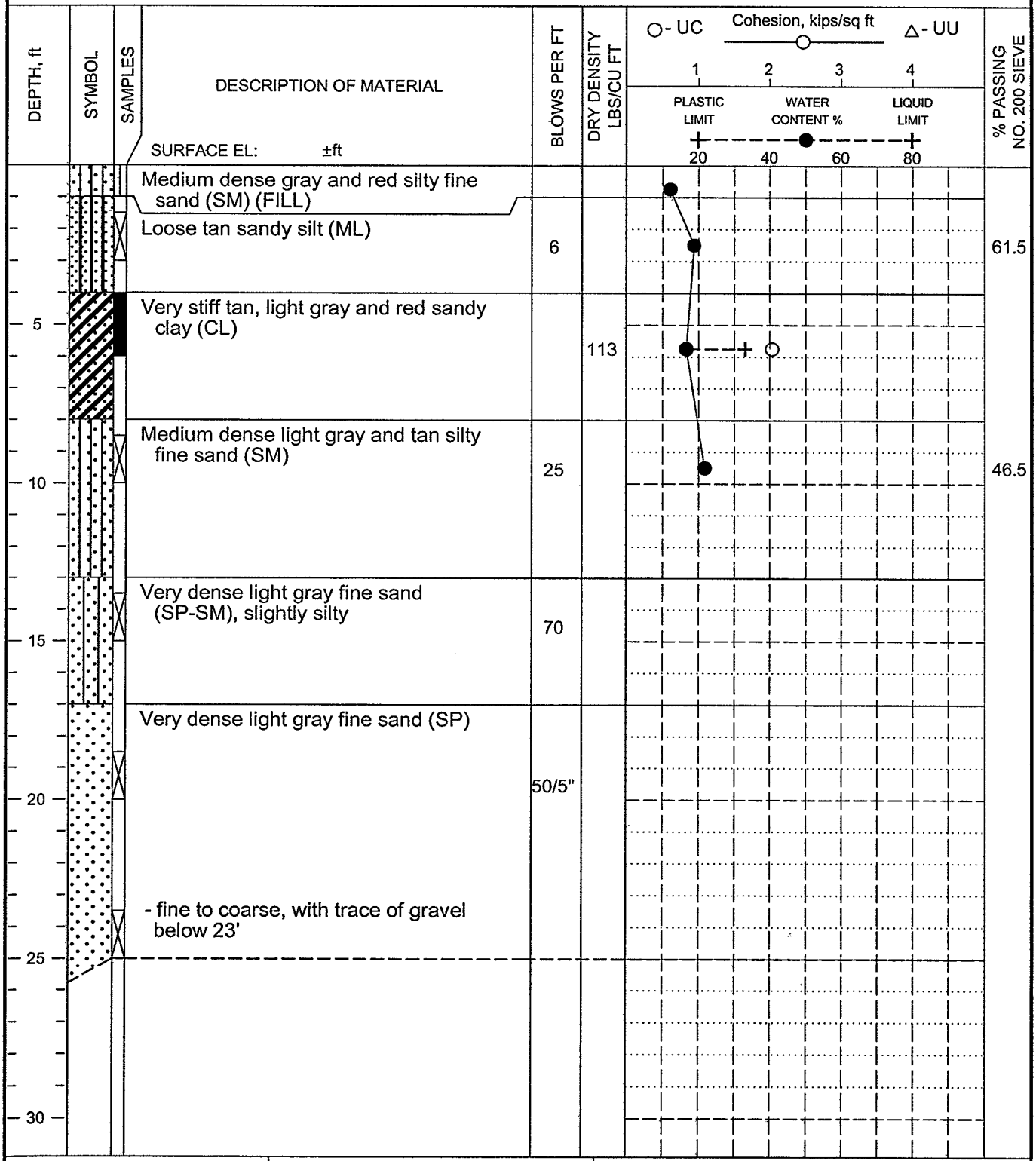
FIGURE 4

LOG OF BORING NO. 3

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 10', then rotary wash to completion.

LOCATION: See Figure 1



BORING DEPTH: 25 ft

DATE: 04/26/10

COMMENTS:

GROUNDWATER DATA: Free water encountered at an approximate depth of 10' during auger drilling. Water level at 8' after about 15 minutes.

100181 6/2/2010 8:33:27 AM

BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

FIGURE 5

LOG OF BORING NO. 4

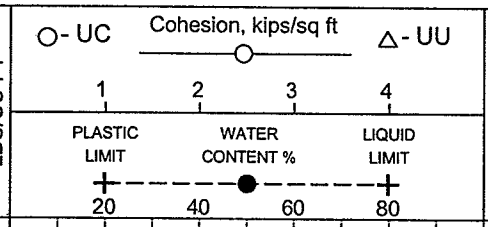
MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 11', then rotary wash to completion.

LOCATION: See Figure 1

SURFACE EL: ±ft

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	DRY DENSITY LBS/CU FT	% PASSING NO. 200 SIEVE
			Medium dense tan and red silty fine sand (SM) with trace of gravel (FILL)			
			Medium dense tan and light gray sandy silt (ML)	12		
5			Stiff tan, light gray and red sandy clay (CL)		112	
			Dense light gray and tan silty fine sand (SM)	40		23.2
10						
15			Very dense light gray fine sand (SP-SM), slightly silty	76		
			- dense below 18'	33		
20						
25						
30						



BORING DEPTH: 25 ft

DATE: 04/27/10

COMMENTS:

GROUNDWATER DATA: Free water encountered at an approximate depth of 11' during auger drilling. Water level at 8' after about 15 minutes.

6/2/2010 8:33:28 AM

100181

BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

FIGURE 6

LOG OF BORING NO. 5

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger

LOCATION: See Figure 1

DEPTH, ft	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	DRY DENSITY LBS/CU FT	% PASSING NO. 200 SIEVE
			SURFACE EL: ±ft			
1			Medium dense red and tan silty fine sand (SM) (FILL)			
2			Medium dense light gray and gray silty fine sand (SM)	20		57.2
4			Very stiff tan and light gray sandy clay (CL)		113	
8			Medium dense light gray and tan silty fine sand (SM)	27		
13			Medium dense light gray fine sand (SP-SM), slightly silty			
15						
20						

Cohesion, kips/sq ft: ○ - UC, △ - UU; scale 1, 2, 3, 4

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT; scale 20, 40, 60, 80

BORING DEPTH: 15 ft

DATE: 04/27/10

COMMENTS:

GROUNDWATER DATA: No free water encountered during auger drilling.

100181 6/2/2010 8:33:29 AM

BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

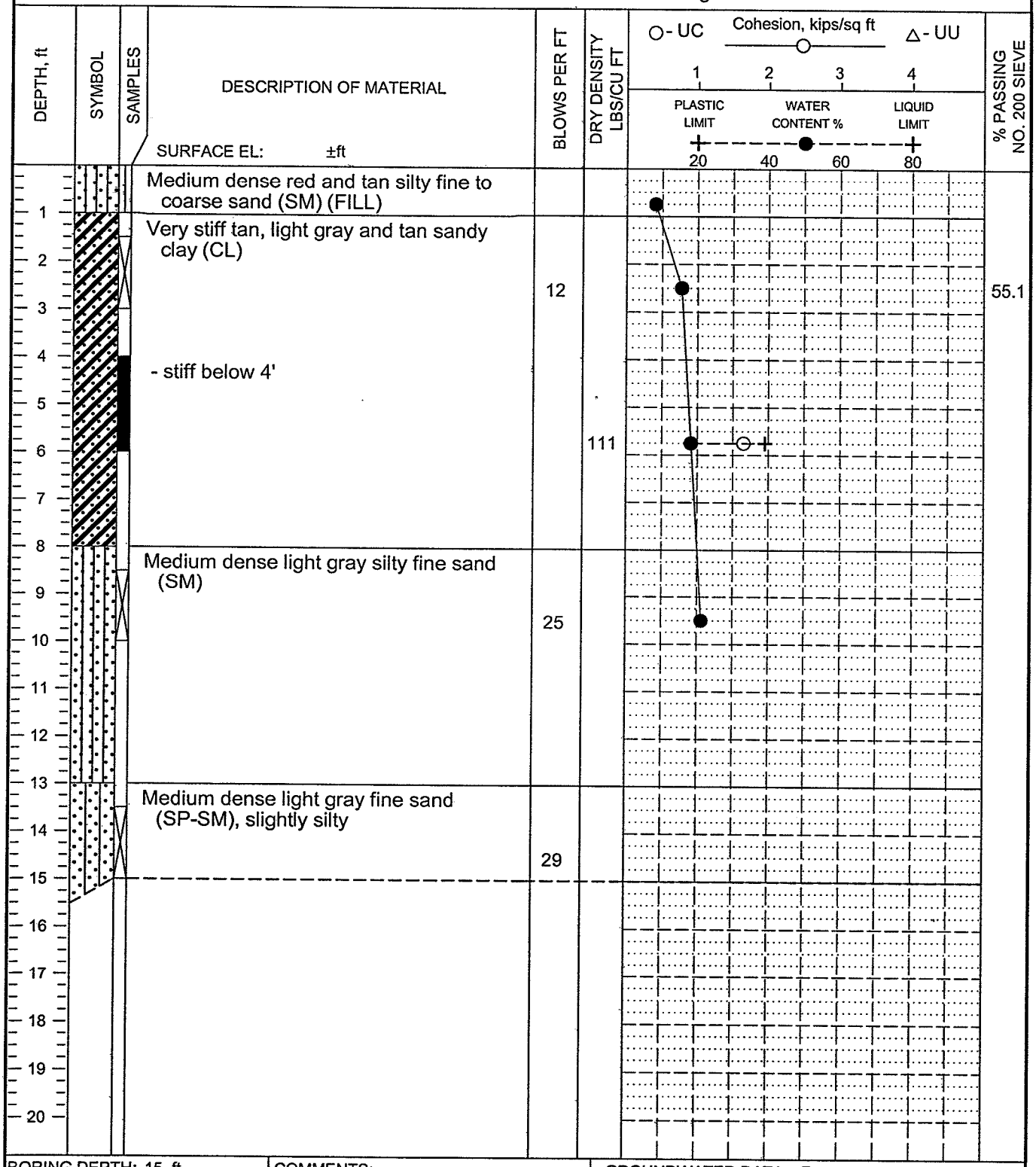
FIGURE 7

LOG OF BORING NO. 6

MDOT GULF COAST HEADQUARTERS BUILDING
LYMAN, MISSISSIPPI

TYPE: 6" Short-flight auger to 10', then rotary wash to completion.

LOCATION: See Figure 1



BORING DEPTH: 15 ft

DATE: 04/27/10

COMMENTS:

GROUNDWATER DATA: Free water encountered at an approximate depth of 10' during auger drilling. Water level at 8' after about 15 minutes.

100181 6/2/2010 8:33:30 AM

BURNS COOLEY DENNIS, INC.
GEOTECHNICAL AND MATERIALS ENGINEERING CONSULTANTS

FIGURE 8

SECTION 00 72 00 GENERAL CONDITIONS

PART 1- GENERAL

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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
GULF COAST REGIONAL OFFICE / FIRST RESPONDER'S BUILDING
AT LYMAN, HARRISON COUNTY, MISSISSIPPI

BWO-6208-24(001) 502085

THE OWNER:
(Name, legal status and address)
MISSISSIPPI TRANSPORTATION COMMISSION
P O BOX 1850
JACKSON, MISSISSIPPI 392150-1850

THE ARCHITECT:
(Name, legal status and address)
CANIZARO CAUTHON DAVIS
129 SOUTH PRESIDENT STREET
JACKSON, MISSISSIPPI 39201-3605

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.

§ 6.1.2 The Contractor, including his subcontractors, shall keep informed of the progress and the detailed work of the Owner or other Contractors and shall immediately notify the Project Engineer and Architect of lack of progress or

delays by other Contractors which are affecting Contractor's Work. Failure of Contractor to keep informed of the progress of the work of the Owner or other Contractors and / or failure of Contractor to give notice of lack of progress or delays by the Owner or other Contractors shall be deemed to be acceptance by Contractor of the status of progress by other Contractors for the proper coordination and completion of Contractor's Work. If, through acts or neglect on the part of the Contractor, the Owner or any other Contractor or subcontractor shall suffer loss or damage or assert any claims of whatever nature against the Owner, the Contractor shall defend, indemnify and hold harmless the Owner from any such claims or alleged damages, and the Contractor shall resolve such alleged damages or claims directly with the other Contractors or subcontractors.

§ 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.

(Paragraph deleted)

§ 8.3.4 This provision specifies the procedure for the determination of time extensions for unusually severe weather. In order for the Owner and Architect to award a time extension under this clause, the following conditions must be satisfied:

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

(Paragraph deleted)

§ 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 and occupied. This date shall be the Date of Completion. All Warranties and Extended Warranties shall use this date as the starting date of Warranty Period.

§ 9.8.2 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 Day
$ 0	$ 100,000	$ 140
100,000	500,000	200
500,000	1,000,000	300
1,000,000	2,000,000	400
2,000,000	5,000,000	650
5,000,000	10,000,000	750
10,000,000	--------	1,400

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 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……	$ 500,000.00	Per Occurrence
Fire Damage Liability……	$ 50,000.00	Per Fire
Medical Expense……	$ 5,000.00	Per Person

.2 OWNERS & CONTRACTORS PROTECTIVE LIABILITY:

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

.3 AUTOMOBILE LIABILITY:

(Owned, Non-owned & Hired Vehicle
Contractor Insurance Option Number 1:
Bodily Injury & Property Damage……$ 500,000.00 Per Occurrence
(Combined Single Limit)
Contractor Insurance Option Number 2:
Bodily Injury…….$ 250,000.00 Per Person
Bodily Injury…….$ 500,000.00 Per Accident
Property Damage……...$ 100,000.00 Per Occurrence

.4 EXCESS LIABILITY:

(Umbrella on projects over $500,000)
Bodily Injury & Property Damage ……$ 1,000,000.00 Aggregate
(Combined Single Limit)

.5 WORKERS' COMPENSATION:

(As required by Statute)

EMPLOYERS' LIABILITY:

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

.6 PROPERTY INSURANCE:

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

§ 11.1.6 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 11.1.4.

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

§ 13.2 SUCCESSORS AND ASSIGNS

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

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

§ 13.3 WRITTEN NOTICE

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

§ 13.4 RIGHTS AND REMEDIES

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

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

§ 13.5 TESTS AND INSPECTIONS

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

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or

approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

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

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

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

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

§ 13.6 INTEREST

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

§ 13.7 TIME LIMITS ON CLAIMS

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

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

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

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

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

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with

the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

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

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

§ 14.3.2 The Contract 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.

§ 15.1.5.2 ADVERSE WEATHER DELAYS

.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.

§ 15.1.5.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 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.

(Paragraphs deleted)

§ 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.

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

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

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

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

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

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

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

(Paragraph deleted)

SECTION 00 91 13 ADDENDA

PART 1 - GENERAL

1.01 DESCRIPTION

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered by the Contract Documents shall be provided by one (1) General Contractor as one (1) Contract to improve the Mississippi Department of Transportation site to construct the Gulf Coast Regional Office / First Responders' Building at Lyman, Harrison County, Mississippi. Some Construction Documents are intended to show requirements for a building to be constructed following codes for coastal counties in Mississippi in the Base Bid. Other Construction Documents are intended to upgrade these requirements for a building to be constructed following FEMA 631 Guidelines for construction to withstand storm events. Separate Bids shall be required for these two amounts as described below:

1. Description A: Base Bid (State Funds)
2. Description B: Alternate Bid (FEMA Funds)

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

C. Contractor's Duties:

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

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

1.02 CONTRACTOR'S USE OF PREMISES

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

1. Law
2. Ordinances
3. Permits
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 any stored products which interfere with operations of MDOT or other Contractors.

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

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

1.03 SPECIFICATION FORMATS AND CONVENTIONS

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

1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in Divisions 02 through 49 in the Specifications.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 21 00 ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order (Supplemental Agreements).

B. Types of allowances include the following:

1. Lump-sum allowances.

1.02 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Project Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Project Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Project Engineer from the designated supplier.

1.03 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Order (Supplemental Agreement).

1.04 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.06 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials selected by Project Engineer under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Project Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Project Engineer, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.07 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order (Supplemental Agreement) proposal based on the difference between purchase amount and the allowance.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order (Supplemental Agreement) cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $165,000 for the video wall system for the Traffic Management Center as specified in Section 27 41 14 "Video Wall Control System."

END OF SECTION

SECTION 01 23 00 ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the Alternate Bid.

1.02 DEFINITIONS

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

1. Alternate described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost for alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.03 PROCEDURES

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Add cost to upgrade Project to conform to FEMA 631 Guidelines for construction to withstand storm events as indicated on Drawings and in Specifications.

END OF SECTION

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SCOPE

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

1.02 CHANGE ORDER PROCEDURES

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

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

C. Contractor's Documentation:

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

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

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

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

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

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

F. Types of Change Orders (Supplemental Agreements):

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 METHOD OF MEASUREMENT

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

1.02 APPLICATION FOR PAYMENT

A. Format:

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

B. Preparation of Application:

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

C. Submittal Procedures:

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

D. Substantiating Data:

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

1.03 STATEMENTS AND PAYROLLS

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

B. The payroll records shall contain the name, 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.

1.04 BASIS OF PAYMENT

A. This Work will be paid for by Contract Sum for the construction in District Six. The Work includes Gulf Coast Regional Office / First Responders’ Building at Lyman, Harrison 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. Pay Item 907-242-006A (Base Bid – State Funds):
MDOT Project No. BWO-6208-24(001) 502085
Gulf Coast Regional Office / First Responders' Building
at Lyman, Harrison County lump sum

OR

2. Pay Item 907-242-006B (Alternate Bid – FEMA Funds):
MDOT Project No. BWO-6208-24(001) 502085
Gulf Coast Regional Office / First Responders' Building
at Lyman, Harrison County lump sum

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 73 SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Submit eight (8) copies plus electronic .pdf of the Schedule of Values to the MDOT Architect, with a copy of the Transmittal Letter to the Project Engineer, by January 28, 2013. This will be submitted for MEMA review with one month to be allowed for this processing and approval. Notice to Award by Commission will be based on FEMA recommendations. Upon Project Engineer's request, support the values given with data substantiating their correctness. Payment for materials stored on site will be limited to those listed in Schedule of Unit Material Values (refer to Article 9 of the General Conditions for requirements). Use Schedule of Values only as basis for contractor's Application for Payment.

B. The eight (8) copies 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, with the following electronic pdf and / or hard copies forwarded to MEMA, Project Engineer, Architect, Civil, Structural, Mechanical, Electrical, and Commissioning Consultants, and one sent to Contract Administration for use in reviewing requests for Permission to Sub-Contract (CAD-720 Form), one sent to the Project Engineer, and two returned to the Contractor. If any extra copies are needed for the Contractor, adjust number submitted.

C. Form of Submittal: Submit typewritten Schedule of Values on AIA Document G703-1992, using Table of Contents of this Specification as basis for format for listing costs of Work for Sections under Divisions 02 - 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. For each line item, which has installed value of more than $20,000, break down costs to list major products for operations under each item; rounding figures to nearest dollar. Make sum of total costs of all items listed in schedule equal to total Contract Sum.
4. Group line items to show subtotal of Description A and then Description B with the same amounts indicated on the Bid Forms and a total equal to the Contract amount indicated on the Bid Form.

E. Preparing Schedule of Unit Material Values:

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

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

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

END OF SECTION

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

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

1.02 DEFINITIONS

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

1.03 SUBMITTALS

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

1.04 DUTIES OF PROJECT COORDINATOR (SUPERINTENDENT)

A. General:

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

B. Interpretations of Contract Documents

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

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

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

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

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

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

1.05 COORDINATION AND PROJECT CONDITIONS

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

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

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

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

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

1.06 SUBCONTRACTOR'S DUTIES

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

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

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

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

1.07 REQUESTS FOR INTERPRETATION (RFIs)

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

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

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

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

C. Hard-Copy RFIs: CSI Form 13.2A

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

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

1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 days of receipt of the RFI response.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 19 PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

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

1.02 MEETINGS

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

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

1.03 SCHEDULING AND ADMINISTRATION

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

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

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

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

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

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

1.04 PRE-CONSTRUCTION MEETING

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

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

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

D. Minimum Agenda:

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

1.05 PROGRESS MEETINGS

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

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

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

D. Minimum Agenda:

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

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

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: Provide projected Construction Schedule of entire Work for Alternate Bid by January 28, 2013. When approved by MEMA, revise monthly to show progress through the pay period. The following is a minimum requirement and other type schedules are acceptable with Owner's approval.

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

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

C. Content of Schedules:

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

D. Updating:

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

E. Submittals:

1. Submit initial schedules to the Project Engineer / MDOT Architect by January 28, 2013.
2. Submit to the Project Engineer / MDOT Architect, periodically updated schedules accurately depicting progress to first day of each month.
3. Submit 2 copies, one to be retained by the Project Engineer and the other forwarded to the MDOT Architect.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

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

B. Shop Drawings: Original (LEGIBLE) drawings (NO FAXED COPIES) prepared by Contractor, subcontractor, supplier or distributor which illustrates actual portions of the Work; showing fabrication, layout, setting or erection details. REPRODUCTIONS of the Contract Drawings WILL NOT be acceptable. Minimum requirements for shop drawings shall include the following:

1. Prepared by a qualified detailer.
2. IDENTIFY DETAILS BY REFERENCE TO SHEET AND DETAIL NUMBERS SHOWN ON CONTRACT DRAWINGS.
3. Minimum sheet size: 8-1/2 inches by 11 inches.
4. Maximum sheet size: 24 inches by 36 inches.
5. Shop drawings shall be stamped and signed by the Contractor certifying accuracy, completeness and COMPLIANCE with Contract requirements PRIOR TO SUBMITTING to the MDOT Architectural Services Unit.

C. Product Data: Minimum information (NO FAXED COPIES) submitted shall include the following:

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

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

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

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

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

F. Contractor Responsibilities:

1. Review shop drawings, product data, and samples prior to submission.
2. Verify field measurements, construction criteria, catalog numbers and other data.
3. Coordinate each submittal with requirements of Work and Contract Documents.
4. Contractor's responsibility for errors and omissions in submittals is not relieved by MDOT Architect's / Consultant's review of submittals.
5. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by review of submittals unless written acceptance of specific deviations is given.
6. Notify the Project Engineer in writing at the time of submission, of deviations in submittals from requirements of Contract Documents.
7. Do not order materials or begin Work requiring submittals until the return of submittals bearing MDOT Architect / Consultant's stamp and initials indicating review.
8. After MDOT Architect / Consultant's review, distribute copies.

G. Submission Requirements:

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

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

H. Resubmission Requirements:

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

I. Distribution of Submittals after Review:

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

J. MDOT Architect / Consultants' Duties:

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

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

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

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

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

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

END OF SECTION

SECTION 01 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 in the following list.

AABC Associated Air Balance Council

AAMA American Architectural Manufacturers Association

AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute (Formerly: ACI International)
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The)
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	APA - The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)
ARI	American Refrigeration Institute (See AHRI)
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers)

ASSE	American Society of Safety Engineers (The)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
ATIS	Alliance for Telecommunications Industry Solutions
AWEA	American Wind Energy Association
AWI	Architectural Woodwork Institute
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association)
BISSC	Baking Industry Sanitation Standards Committee
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)
BWF	Badminton World Federation (Formerly: International Badminton Federation)
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CFSEI	Cold-Formed Steel Engineers Institute
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute

CPA	Composite Panel Association
CRI	Carpet and Rug Institute (The)
CRRC	Cool Roof Rating Council
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
CWC	Composite Wood Council (See CPA)
DASMA	Door and Access Systems Manufacturers Association
DHI	Door and Hardware Institute
ECA	Electronic Components Association
ECAMA	Electronic Components Assemblies & Materials Association (See ECA)
EIA	Electronic Industries Alliance (See TIA)
EIMA	EIFS Industry Members Association
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ESTA	Entertainment Services and Technology Association (See PLASA)
EVO	Efficiency Valuation Organization
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council U.S.
GA	Gypsum Association

GANA	Glass Association of North America
GS	Green Seal
HI	Hydraulic Institute
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)
HMMA	Hollow Metal Manufacturers Association (See NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAPSC	International Association of Professional Security Consultants
IAS	International Approval Services (See CSA)
ICBO	International Conference of Building Officials (See ICC)
ICC	International Code Council
ICEA	Insulated Cable Engineers Association, Inc.
ICPA	International Cast Polymer Alliance
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America)
IESNA	Illuminating Engineering Society of North America (See IES)
IEST	Institute of Environmental Sciences and Technology
IGMA	Insulating Glass Manufacturers Alliance
IGSHPA	International Ground Source Heat Pump Association
ILI	Indiana Limestone Institute of America, Inc.
Intertek	Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA)
ISA	International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society)
ISAS	Instrumentation, Systems, and Automation Society (The) (See ISA)
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association)

ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association (See ISFA)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (See CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MCA	Metal Construction Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association)
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations

NFPA	NFPA (National Fire Protection Association)
NFPA	NFPA International (See NFPA)
NFRC	National Fenestration Rating Council
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association (See NWFA)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSPE	National Society of Professional Engineers
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWFA	National Wood Flooring Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing & Drainage Institute
PLASA	PLASA (Formerly: ESTA - Entertainment Services and Technology Association)
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International (Society of Automotive Engineers)
SBCCI	Southern Building Code Congress International, Inc. (See ICC)
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SIA	Security Industry Association

SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance
SPIB	Southern Pine Inspection Bureau
SPRI	Single Ply Roofing Industry
SRCC	Solar Rating and Certification Corporation
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWPA	Submersible Wastewater Pump Association
TCA	Tilt-Up Concrete Association
TCNA	Tile Council of North America, Inc.
TEMA	Tubular Exchanger Manufacturers Association, Inc.
TIA	Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance)
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance (See TIA)
TMS	The Masonry Society
TPI	Truss Plate Institute
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UBC	Uniform Building Code (See ICC)
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council

USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WDMA	Window & Door Manufacturers Association
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WMMPA	Wood Moulding & Millwork Producers Association (See MMPA)
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DIN	Deutsches Institut fur Normung e.V.
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
ICC-ES	ICC Evaluation Service, LLC

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

COE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce National Institute of Standards and Technology
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FG	Federal Government Publications
GSA	General Services Administration
HUD	Department of Housing and Urban Development

LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division
OSHA	Occupational Safety & Health Administration
SD	Department of State
TRB	Transportation Research Board National Cooperative Highway Research Program
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory
USDA	Department of Agriculture Rural Utilities Service
USDJ	Department of Justice Office of Justice Programs National Institute of Justice
USP	U.S. Pharmacopeia
USPS	United States Postal Service

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

CFR	Code of Federal Regulations Available from Government Printing Office
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point
DSCC	Defense Supply Center Columbus (See FS)
FED-STD	Federal Standard (See FS)
FS	Federal Specification Available from Department of Defense Single Stock Point Available from Defense Standardization Program Available from General Services Administration Available from National Institute of Building Sciences/Whole Building Design Guide
MILSPEC	Military Specification and Standards (See DOD)
USAB	United States Access Board
USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

E. State 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.

CBHF	State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation
CCR	California Code of Regulations Office of Administrative Law California Title 24 Energy Code
CDHS	California Department of Health Care Services (Formerly: California Department of Health Services) (See CCR)
CDPH	California Department of Public Health Indoor Air Quality Program
CPUC	California Public Utilities Commission
SCAQMD	South Coast Air Quality Management District
TFS	Texas Forest Service Forest Resource Development and Sustainable Forestry

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 43 00 QUALITY ASSURANCE

PART 1 - GENERAL

1.01 WORK QUALITY

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

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

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

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

1.02 MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS

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

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

1.03 SPECIALIST APPLICATOR/INSTALLER

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

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

1.04 MANUFACTURER'S FIELD SERVICES

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

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

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

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

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

1.05 TOLERANCES

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

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

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

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

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

1.06 PROTECTION OF WOOD

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

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

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

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

1.07 GROUT FILL

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 45 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 Sections:

1. Individual specifications sections contain specific tests and inspections to be performed.
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 [C1077] [D3666] [D3740] [E329] and [E543].
2. Authorized to operate in State in which project is located.

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 any 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 LABORATORY 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 03 20 00, Concrete Reinforcing.
2. Section 03 30 00, Cast-In-Place Concrete.
3. Section 31 20 00, Earth Moving (for excavation, fill and grading).

1.02 LABORATORY'S DUTIES

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

B. Prepare reports of inspections and tests including:

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

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

1.03 CONTRACTOR'S RESPONSIBILITIES

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

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

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

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

1.04 MATERIAL CERTIFICATIONS AND CERTIFIED TEST REPORTS

A. All certifications shall meet the following requirements:

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 GENERAL

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

1.02 FIELD OFFICE AND STORAGE FACILITIES

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

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

1.03 FURNISHING AND MAINTENANCE OF EQUIPMENT

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

1.04 ELECTRIC LIGHTS AND POWER

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

1.05 WATER

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

1.06 ROADS AND ACCESS

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

1.07 TOILETS FOR WORKMEN

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

1.08 SECURITY / PROTECTION PROVISIONS

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

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

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

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

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

1.09 BURNING OF TRASH

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

1.10 POWDER ACTUATED TOOLS

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

1.11 FIRE HAZARDS

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

1.12 CONDUCT OF WORKERS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 61 15 BASIC PRODUCT REQUIREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

1.03 QUALITY ASSURANCE – GENERAL

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

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

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

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

1.04 QUALITY ASSURANCE – PRODUCTS

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

B. Matching / Mating of Products:

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

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

1.05 QUALITY ASSURANCE – WORKMANSHIP

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

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

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

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

D. Provide finishes to match approved samples.

E. Adjusting of Operating Products: As follows:

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

1.06 TRANSPORTATION AND HANDLING

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

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

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

1.07 STORAGE AND PROTECTION

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 62 14 PRODUCT OPTIONS AND SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

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

1.02 CONTRACTOR'S OPTIONS

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

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

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

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

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

1.03 PRODUCT SUBSTITUTION LIST

A. The MDOT Architect WILL NOT consider requests for substitutions during bidding.

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

C. Tabulate list by each Specification Section.

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

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

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

1.04 SUBSTITUTIONS

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

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

B. In making request for substitution, Contractor represents:

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

C. Substitutions WILL NOT be considered if:

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRODUCT SUBSTITUTION REQUEST FORM (AS FOLLOWS)

SUBSTITUTION REQUEST FORM

PROJECT:_____ PROJECT NO._____

OWNER:_____

CONTRACTOR:_____

ARCHITECT:_____

_____

_____

CONTRACTOR'S REQUEST, WITH SUPPORTING DATA

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

   _____

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

   [ ] Sample is attached

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: _____

Other Contracts, if any:_____

CONTRACTORS STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENTS

I / We have investigated the proposed substitution. I / We

1. Believe that it is equal or superior in all respects to originally specified product, except as stated in 2. above;
2. Will provide same warranty as required in Contract Documents;
3. Have included all cost data and cost implications of proposed substitution; including, if required, costs to other contractors, and redesign and special inspection costs caused by use of proposed substitution;
4. Will coordinate incorporation of proposed substitution in the Work;
5. Will modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning;
6. Have verified that use of this substitution conforms to all applicable codes.
7. Waive future claims for added cost to Owner caused by proposed substitution.

CONTRACTOR_____ DATE:_____
Signature

ARCHITECT'S REVIEW AND ACTION

___ Accepted

___ Not Accepted

___ Provide more information in the following categories and resubmit _____

___ Sign Contractor's Statement of Conformance and resubmit

___ Proposed substitution is accepted, with the following conditions:

_____

_____

Change Order will make the following changes:

(Add to) (Deduct from) Contract Sum: $_____

(Add to) (Deduct from) Contract Time: _____days

ARCHITECT:_____ DATE_____

OWNER: _____ DATE_____

_____Accepted _____Not accepted

END OF SECTION

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope: To set forth broad general conditions covering cutting and patching that applies to everyone and everything on the job.

B. Execute cutting including excavating, fitting or patching or work required to:

1. Make several parts fit properly.

2. Uncover work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to Contract requirements.

C. In addition to Contract requirements, upon MDOT Architect's written instructions:

1. Uncover work for observation of covered work.

2. Remove samples of installed materials for testing.

D. Do not cut or modify work of another Contractor without his consent.

E. Payment for Costs: Costs caused by ill-timed, defective or work not conforming to the Contract will be borne by party responsible for ill-timed, defective or non-conforming work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials for replacement of work removed shall comply with individual Specifications Sections for type of work to be done.

PART 3 - EXECUTION

3.01 GENERAL

A. Inspection: Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching.

B. Preparation prior to cutting: Provide shoring, bracing and supports required to maintain structural integrity. Provide protection for other portions of project and protection from the elements.

C. Performance:

1. Execute cutting and demolition of methods that prevent damage to other work and will provide surfaces to receive installation of repairs and new work.

2. Execute excavating and backfilling by methods that prevent damage to other work and prevent settlement

3. Restore work that has been cut or removed install new products to provide completed work in accordance with requirements of the Contract Documents.

4. Refinish entire surfaces as necessary to provide an even finish. Refinish continuous surfaces to the nearest intersection and assemblies.

END OF SECTION

SECTION 01 74 00 CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Maintain premises and public properties from accumulations of waste, debris, and rubbish, caused by operations. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

B. Dispose of all waste, debris and rubbish in accordance with the 0wner's requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by the manufacturer of surface to be cleaned, but cross reference cleaning materials used on surfaces to insure they are recommended by the cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to insure that structure, grounds, and surrounding properties are maintained free from accumulations of waste materials and rubbish. Wet down dry materials and rubbish to lay dust and prevent blowing dust. Clean site and surrounding properties at reasonable intervals during progress of Work, and remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off MDOT owned property. Handle materials in a controlled manner with as few handling as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust or other contaminants resulting from cleaning process will not fall on wet or newly painted surfaces.

B. No materials may be disposed of by dumping them in the sanitary or storm sewer systems without specific approval by the Project Engineer.

C. Washdown of cement trucks will be done at locations determined by the Project Engineer.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning. In preparation for Inspection of structure, conduct final inspection of sight-exposed surfaces and concealed spaces. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed finished surfaces. Repair, patch and touch up marred surfaces to specified finish to match adjacent surfaces.

B. Remove temporary fencing and leave in same condition as surrounding landscaped areas.

C. Broom clean paved surfaces; rake clean other surfaces of grounds. Keep Project clean until occupied by Owner.

END OF SECTION

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Scope of Work required under this Section consists of the Final Inspections, submitting of all closeout Documents and related items to complete the Work indicated on the Drawings and described in the Project Manual.

1.02 FINAL INSPECTIONS

A. Engineer and Architect's Inspection: The Contractor shall make written request for a Final Inspection to the Project Engineer and MDOT Architect. Notice is to be given 10 calendar days prior to this inspection. At the day of inspection, the Contractor shall have in hand 6 copies of the HVAC Test and Balance Report, Reference Specification Sections in Division 23 and 6 copies of a list prepared by the Contractor of deficiencies, which will be edited by the Project Engineer, MDOT Architect and Consultants. A copy of these composite lists will be given to the Contractor for correcting the Work. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed. If, in the Project Engineer and MDOT Architect's judgment, the Project is not ready for an Inspection, the Project Engineer may schedule another inspection.

B. Owner's Inspection: After the Project Engineer and MDOT Architect have determined the Project to be Complete and all punch list items have been corrected, an Owner's Inspection will be scheduled. The Contractor shall submit a letter that states all items have been corrected and submit required closeout Documents. The Owners may add to the punch list items; if it is determined that corrective work still needs to be done. Within 15 calendar days after this revised list is received, the Contractor shall make all corrections of the items listed.

C. Correction of Work before Final Payment: Contractor shall promptly remove from the Owner's premises, all materials condemned for failure to conform to the Contract, whether incorporated in Work or not, and Contractor shall, at his own expense, replace such condemned materials with those conforming to the requirements of the Contract. Failure to remedy such defects after 10 days written notice will allow the Owner to make good such defects and such costs shall be deducted from the balance due the Contractor or charged to the Contractor in the event no payment is due.

D. Should additional inspections by the MDOT Architect's Consultants of the Work be required due to failure of the Contractor to remedy defects listed, the Project Engineer may deduct the expense of additional Consultants inspections from the Contract Sum in the Owner / Contractor Agreement. The additional expense will be based on the rate shown for services in the Consultants' Architect or Engineering Services Contract.

1.03 FINAL ACCEPTANCE

A. The Mississippi Department of Transportation does not recognize the term "Substantial Completion". The Project Engineer shall determine when the building is complete to the point it can be used for its intended purpose and occupied. This date shall be the Date of Completion.

B. All Warranties and Extended Warranties shall use this Date of Completion as the starting date of Warranty Period.

C. Final Payment shall not be made until items covered in Closeout Procedures are satisfied. This date shall be the Date of Final Acceptance.

1.04 CLOSEOUT DOCUMENTS

A. Unless otherwise notified, the Contractor shall submit to the Owner through the Project Engineer to the MDOT Architect 2 copies the following before final payment is made:

1. Request for Final Payment: AIA Document G702, current edition, completed in full or a computer generated form having similar data.

2. Contractor's Affidavit of Payment of Debts and Claims: AIA Document G706, current edition, completed in full.

3. Release of Liens and Certification that all Bills Have Been Paid: AIA Document G706A, current edition, completed in full or a sworn statement and affidavit from the Contractor to the Owner stating that all bills for this project have been paid and that the Owner is released from any and all claims and / or damages.

4. Consent of Surety Company to Final Payment: AIA Document G707, current edition, completed in full by the Bonding Company.

5. Power of Attorney: Closeout Documents should be accompanied by an appropriate Power of Attorney.

6. Guarantee of Work: Sworn statement that all Work is asbestos free and guaranteed against defects in materials and workmanship for one year from Date of Completion, except where specified for longer periods.
   a. Word the guaranty as follows: "We hereby guarantee all Work performed by us on the above captioned Project to be free from asbestos and defective materials. We also guarantee workmanship for a period of one (1) year or such longer period of time as may be called for in the Contract Documents for such portions of the Work".
   b. All guarantees and warranties shall be obtained in the Owner's name.
   c. Within the guaranty period, if repairs or changes are requested in connection with guaranteed Work which, in the opinion of the Owner, is rendered necessary as a result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular, all such guaranteed Work, correct all defects wherein and make good all damages to the building, site, equipment or contents thereof which, in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract; and make good any Work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guaranty.
   d. If, after notice, the Contractor fails to proceed promptly to comply with the terms of the guaranty, the Owner may have the defects corrected and the Contractor and his sureties shall be liable for all expense incurred.
   e. All special guaranties applicable to definite parts of the Work stipulated in the Project Manual or other papers forming part of the Contract shall be subject to the terms of this paragraph during the first year of the life of such special guaranty.

7. Project Record Documents: Furnish all other record documents as set forth in Section 01 78 39 - Project Record Documents.
   a. Provide all certificates, warranties, guarantees, bonds, or documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements

8. Additional Documents Specified Within the Project Manual:
   a. General: Provide all Operational and Maintenance documents as called for in the individual Sections of the Project Manual. The Contractor is responsible for examining the Project Manual for these requirements.
   b. Maintenance Stock: Deliver to Owner all required additional maintenance materials as required in the various Sections of the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 23 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

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

1. Emergency manuals.
2. Operation manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, a finishes systems and equipment.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.02 DEFINITIONS

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

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

1.03 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual with request for Final Inspection. Include a complete operation and maintenance directory. MDOT Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 2 copies of each manual in final form at least 5 days before Owner’s Final Inspection. MDOT Architect will return one copy with comments (if required) within 15 days after Owner’s Final Inspection.

1. Correct or modify each manual to comply with MDOT Architect's comments. Submit 2 copies of each corrected manual within 15 days of receipt of MDOT Architect's comments.

1.04 COORDINATION

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

PART 2 - PRODUCTS

2.01 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

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

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 inches by11 inches paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2 inches by11 inches white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.02 EMERGENCY MANUALS

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

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

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

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

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

D. Emergency Procedures: Include the following, as applicable

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.03 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.

8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

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

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.04 PRODUCT MAINTENANCE MANUAL

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

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

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

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

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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

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

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

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

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available from manufacturers / suppliers.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

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

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

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

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

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

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work.

1. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
2. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: To set forth the minimum procedure and requirements for keeping the Project Record Documents. One of these Documents is to be kept on site throughout the Project.

1.02 MAINTENANCE OF DOCUMENTS

A. Maintain two (2) copies of all: Half-size Contract Drawings, Project Manual (Proposal), Addenda, Change Orders, Warranties, Certificates, Guarantees, Bonds, reviewed Shop Drawings, reviewed submittals (materials, fixtures, appliances, etc.), hardware schedules, field and laboratory test records, equipment brochures, spare parts lists, maintenance and operation manuals and other modifications to the Contract.

B. Store Record Documents apart from Documents used for construction.

C. Maintain Record Documents in clean, dry, and legible condition. Do not use Record Documents for construction purposes.

D. Make Record Documents available at all times for inspection by the Project Engineer, MDOT Architect and Owner.

1.03 RECORDING

A. General: Mark all modifications in red pencils. Keep Record Documents current. Review log at Progress Meetings. Do not permanently conceal any Work until required information has been accurately recorded.

B. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground and overhead utilities with their connections referenced to permanent surface improvements.
2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
3. Field changes that involve dimension and detail.
4. Changes made by Supplemental Agreement (Change Order) or Field Order.

C. Project Manual (Proposal) and Addenda: Legibly mark up each Section to record manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

D. Shop Drawings: Maintain as Record Documents; legibly mark Drawings to record changes made after review.

1.04 SUBMITTALS

A. Furnish two (2) copies of all Record Documents.

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

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

D. Sufficient information, such as as-built control drawings for air handling system and variable drive controls, shall be furnished to allow qualified personnel to service equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 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) ----------> _____ ☐

<u>Video-taping.</u> __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 13 COMMISSIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. General provisions and mechanical and electrical systems are specified in Divisions 04, 07, 08, 22, 23, and 26, and section 28 31 11 Fire Alarm. Other divisions may be required to participate in the commissioning process.

B. These Divisions cover the commissioning of mechanical, electrical, building envelope, plumbing, 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. Review the contractor submitted project schedule, and within 60 days from contractor's initial start of work and pre-construction meeting, schedule, plan, and conduct a commissioning scoping meeting to review the commissioning process, the draft commissioning plan, and commissioning schedule with the commissioning team. The appropriate date of the scoping meeting shall be at the commissioning agent's discretion. 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 3.02.A.

1. Mechanical Equipment and/or Systems:
    a. Air handling units
    b. Split system condensing units
    c. Computer room air conditioning units
    d. Fans
    e. Variable speed drives
    f. Building pressurization

g. CV/VAV air terminal units with electric reheat
h. Electric unit heaters
i. Building automation systems.
j. Domestic water heating system

2. Electrical Equipment and/or Systems:
   a. Electrical distribution system
   b. Electrical switchboard
   c. Electrical switchgear
   d. Emergency and standby power systems
   e. Electrical lighting and day-lighting controls

3. Specialty Equipment and/or Systems
   a. Fire and smoke alarm system including fireman's control panel

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 SECTION INCLUDES

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

1.02 RELATED ITEMS SPECIFIED ELSEWHERE

A. Section 03 20 00 – Concrete Reinforcing.

B. Section 03 30 00 – Cast-in-Place Concrete.

1.03 PROJECT CONDITIONS

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

PART 2-PRODUCTS

2.01 MATERIALS

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

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

C. Form Oil: Approved non-staining type, Nox-Crete Products Group Nox-Crete Form Coating EB, SEI Form Release Gcc-100, Dayton Superior Bio-Release EF, or equal. Oil must not affect bonding of finishes on exposed concrete.

PART 3-EXECUTION

3.01 FORM CONSTRUCTION

A. Forms shall be properly aligned, adequately braced and mortar tight to produce concrete shapes required by Drawings. Align forms so that the actual surface does not vary from true surface more than l/8 inch. The surface shall be clean, undamaged, and free of offsets and irregularities at joints. Adequately brace and frame to retain true shapes under vibration and placing strains without leaks, bowing, or deflection.

B. Studs, girts, and walls shall not be less than 2 by 4's, S4S, construction of standard grade Douglas fir, or equal, selected for straightness. All walls shall consist of at least two 2 by 4's. Studs shall not be spaced more than l6 inches, girts not more than 24 inches and ties not more than 27 inches, on center.

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

D. Meet recommendations of "Recommended Practice for Concrete Form work" ACI 347 unless specified herein otherwise.

3.02 INSERTS AND FASTENING DEVICES FOR OTHER WORK

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

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

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

D. Do not put aluminum conduits in concrete.

3.03 FORM REMOVAL

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

B. Floor slab wood forms may be removed l0 days after pour, providing compressive strength has reached a minimum of 2500 psi based on job cast cylinders.

3.04 EARTH FORMS

A. Earth forms are permitted for spread footings, interior grade beams and the interior face of perimeter grade beams. THE EXTERIOR FACE OF PERIMETER GRADE BEAMS SHALL BE FORMED.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

PART 1-GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED ITEMS SPECIFIED ELSEWHERE

A. Section 03 10 00 – Concrete Forming and Accessories.

B. Section 03 30 00 – Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Submit reinforcing steel shop drawings and materials list prior to placement for MDOT Architect's approval. Shop drawings shall include complete DIMENSIONED placing plans including control joint locations, order lists, bend diagrams, and DETAILS SHOWING DIMENSIONS WITH CLEARANCES. Submittals not including this requirement will be considered as an incomplete submittal and will be returned to Contractor for re-submittal.

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

1.04 QUALITY ASSURANCE

A. Reinforcing bars shall conform to ASTM A 615 "Deformed Billet-Steel Bars for Concrete".

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

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

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

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

F. Structural Special Inspection and Testing: Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following inspections and tests:

1. Inspection of reinforcing steel for size, spacing, location and support.
2. Inspection of proper reinforcing steel concrete coverage.
3. Submit certified copies of mill test report of reinforcement materials analysis.
4. Welders' Certificates: If approved by the Engineer of Record, submit Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

1.06 PROJECT CONDITIONS

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

PART 2-PRODUCTS

2.01 STEEL BAR REINFORCEMENT

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

2.02 WELDED STEEL WIRE FABRIC

A. Shall conform to ASTM A 185, new, free from rust and other coatings that will prevent bond.

2.03 ACCESSORIES

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

PART 3-EXECUTION

3.01 INSTALLATION

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

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

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

1.	Footings (bottom and sides)	3 inches clear
2.	Slabs	1-1/2 inches clear top and 3/4 inch clear bottom
3.	Beams	1-1/2 inch clear to stirrups
4.	Walls	2-1/2 inches clear
5.	Columns	2 inches clear to verticals

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

G. Lap all bars 24 bar diameters at corners, splices and intersections.

H. INTERRUPT REINFORCING steel at control joints in floor slabs.

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

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1-GENERAL

1.01 SECTION INCLUDES

A. All cast-in-place concrete and other related items necessary to complete Project indicated by Contract Documents unless specifically excluded.

1.02 RELATED SECTIONS

A. Section 01 45 29 – Testing Laboratory Services

B. Section 03 10 00 – Concrete Forming and Accessories.

C. Section 03 20 00 – Concrete Reinforcing.

D. Section 07 26 00 – Vapor Retarders.

E. Section 09 90 00 – Painting and Coating.

1.03 SUBMITTALS

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

1.04 TESTING LABORATORY SERVICES

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

1.05 QUALITY ASSURANCE

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

B. Concrete mix design proportioning shall be by a certified MDOT Class III technician and submitted to the Project Engineer prior to placing concrete. Mix proportions shall meet the requirements of the 804.02.10 Section of the MDOT's Standard Specifications, 2004 Edition, except concrete requiring a trowel finish shall not be air entrained. Concrete shall be sampled according to ASTM C 172 and compression test cylinders made and cured according to ASTM C 31. Control of mixes is to be maintained at the Ready-Mix Plant and on the job site. Adjustments of the mix proportions shall meet the requirements of Section 804.02.10.4 of MDOT's Standard Specifications, 2004 Edition.

C. The Owner will provide testing as specified in Section 01 45 29 – Testing Laboratory Services. Cylinders, 3 specimens from each sample, are to be cast on the job in accordance with ASTM C 31. Specimens will be tested in accordance with ASTM C 39. One cylinder from each location will be tested at 7 days for information and the other two at 28 days for acceptance. Owner is to make at lease one strength (average of two cylinders) for each class of concrete placed on any one day and an additional one strength test for each 100 cubic yards, or fractions thereof, of concrete placed in any one day. Copies of all test reports shall be furnished to the ready mixed concrete producer and as directed by the Project Engineer.

D. Structural Special Inspection and Testing: Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections. Tests shall be performed in accordance with ACI 301.

1. Verify correct design mix is provided.
2. Perform a slump test as deemed necessary for each load of concrete. Record if water or admixtures are added to the concrete at the jobsite. Perform additional slump tests after job site adjustments.
3. Mold four specifications per set for compressive testing; one set for each 100 or less cubic yards of each class concrete placed per day. Test one at 7 days, 2 at 28 days, and hold one as a spare to be broken as directed by the Architect/Engineer if compressive strengths do not appear adequate.
4. For each set of molded specimens record the following:
   a) Slump
   b) Temperature, ambient and concrete
   c) Air content
   d) Location of placement
   e) Verification of correct design mix
5. Inspection of concrete placement for proper application techniques.
6. Inspection for maintenance of specified curing temperature and techniques.

1.06 COORDINATION

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

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

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

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

PART 2-PRODUCTS

2.01 CONCRETE

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

B. All concrete shall have 3,000-psi minimum compressive strengths at 28 days for footings and 4,000-psi minimum compressive strength at 28 days for all other concrete, unless noted otherwise.

C. Maximum slump for normal weight concrete shall be 4 inches. Sump may be increased to 6 inches with an approved mid-range water reducer and up to 8 inches with an approved high-range water reducer.

D. Water/Cement ratio shall be .5 or below for all concrete.

2.02 CONCRETE MATERIALS

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

B. Water: From an approved source.

C. Structural Concrete Aggregate: Nominal maximum aggregate size 67 shall be used and shall meet the requirements of MDOT Standard Specifications, 2004 Edition.

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

E. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

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 Sonneborn, Safe-Cure, manufactured by Dayton Superior Corp. or approved equal. Compound shall not interfere with bonding or floor finish.

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

E. Sealant for Pavements, Sidewalks, Curb and Gutter: Silicone joint sealant Dow Corning 888 or approved equal.

2.04 CONCRETE MIXES

A. The ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C 94 Alternate No. 2. Uniformly and accurately control proportions of material weight.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1 or Method 2. Submit proposed mix design to Architect/Project Engineer in accordance with ACI 301.

C. Provide concrete to the following criteria:

1. Compressive strength: As noted on drawings or other specification sections.
2. Slump: 3 to 5 inches.
3. Water/Cement Ratio shall be .5 or below for all concrete.

D. Use accelerating admixtures in cold weather only when approved by Architect/Project Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Do not use calcium chloride.

F. Use set retarding admixtures during hot weather only when approved by Architect/Project Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

H. Failure of concrete to meet the specified requirements may result in rejection with subsequent removal and replacement or re-testing (including coring, load test, etc.) at the supplier's expense. Concrete exhibiting adverse reaction as a result of the presence of deleterious substances shall be removed and replaced or repaired in a manner completely satisfactory to the Project Engineer. All cost of such corrective action, including all necessary testing, shall be borne by the concrete producer.

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

PART 3-EXECUTION

3.01 PLACING CONCRETE

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

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

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

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

E. Notify Architect/Project Engineer minimum 24 hours prior to commencement of operations.

F. Ensure reinforcement, inserts, embedded parts, formed expansion and construction joints are not disturbed during concrete placement.

G. Install joint devices in accordance with manufacturer's instructions.

3.02 CONSTRUCTION JOINTS

A. Locate construction joints in floor slabs and floor beams in the middle third of the span. Locate construction joints for grade beams at one third of the span beyond the spread footing support. Provide shear keys per plans and 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.

B. Place concrete continuously between predetermined expansion, control, and construction joints.

C. Do not interrupt successive placement; do not permit cold joints to occur.

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 to maintain concrete minimal moisture loss at relatively constant temperature necessary for hydration of cement and hardening of concrete.

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.

B. Slab on grade floor surface shall be the following flatness and levelness: F_F 25/F_L 18 minimum overall and F_F 18/F_L 13 minimum local.

C. 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.

D. 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.

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

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

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

END OF SECTION

SECTION 03 30 10 CRYSTALLINE CONCRETE WATERPROOFING ADMIXTURE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section covers the requirements for waterproofing of concrete structures to include all tilt up panels and roof topping slab included in the Alternate.

1.02 RELATED SECTIONS

A. Section 03 30 00 Cast-In-Place Concrete

1.03 SUBMITTALS

A. Submit as part of concrete mix design under the Alternate. Submit product data, test data showing compliance with performance criteria, and manufacturer's instructions for inclusion in the concrete preparation.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. Army Corp of Engineers (CRD)

C. American Concrete Institute Reference 308

1.05 STORAGE, DELIVERY AND HANDLING

A. Store manufacture's sealed and labeled material containers in dry, protected environments off the ground.

PART 2 – PRODUCTS

2.01 PRODUCT DESCRIPTION

A. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.

B. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.

C. The concrete crystalline waterproofing admixture shall be specifically formulated as a concrete admixture.

D. Shall comply with all performance criteria.

2.02 PERFORMANCE CRITERIA

A. U.S. Army Corp of Engineers CRD C48-73 “Permeability of Concrete” Requirement: Treated and untreated samples shall be subjected to a pressure of 150 psi (350 feet head pressure) in accordance with COE CRD-C 48. Untreated samples showed water leakage after 24 hours while treated samples shall show no measureable leakage and water penetration of no more than 1.5 mm after 120 hours. In all cases treated and untreated samples shall have the same mix design.

B. U.S. Army Corp of Engineers CRD C48-73 “Permeability of Concrete” Requirement: Treated and untreated samples (minimum of 5) shall be subjected to a gradual increase in pressure up to 96 psi (224 feet head pressure) to 10 days in accordance with COE CRD-C 48. All untreated samples showed water leakage after 5 days and increased through the test, while treated samples shall show no water leakage at any time during the test. In all cases treated and untreated samples shall have the same mix design.

C. DIN 1048 “Water Impermeability of Concrete” Requirement: Treated and untreated samples that are 120 mm thick shall be subjected to hydrostatic pressure for 28 days. Water shall totally permeate the control samples, but no water shall permeate the treated samples. In all cases treated and untreated samples shall have the same mix design.

D. NSF 61 “Standard Water System Component Health Effects” Requirement: Certified for use in potable water in accordance with ANSI/NSF Std. 61.

E. ASTM C 39 “Compressive Strength of Cylindrical Concrete Specimens” Requirement: After 28 days, a minimum of 10% increase in compressive strength over control specimens. In all cases treated and untreated samples shall have the same mix design.

F. Crack Bridging Capability: Requirement: Minimum of 0.4mm. Crystalline manufacturer shall provide test report verifying ability to seal cracks.

2.03 MIXES

A. The dosage rate for crystalline concrete waterproofing admixture is 15 lbs per yard of concrete, minimum.

PART 3 – EXECUTION

3.01 MATERIALS PREPARATION

A. Concrete crystalline waterproofing admixture must be added to the concrete at the time of batching.

B. Follow manufacturer’s standard mixing instructions. Add the admix powder first to the rock and sand, blend thoroughly for 2-3 minutes before adding cement and water.

C. Blend total concrete mix using normal practices to ensure formation of homogeneous mixture.

D. For ready-mix batch plants, follow manufacturer's instructions for adding and blending the admixture properly.

3.02 APPLICATION

A. Materials shall be installed in accordance with manufacturer's written instructions.

B. Placement of concrete shall be per 03 30 00 Cast-In-Place Concrete.

C. Retardation of set may occur when using concrete crystalline waterproofing admixture. The amount of retardation will depend upon the concrete mix design and dosage rate of the admix. Consult with the manufacturer regarding proper dosage rate.

D. Concrete that contains concrete crystalline waterproofing admixture must be cured as per "Standard for Curing Concrete" (ACI 308).

END OF SECTION

SECTION 03 41 10 STRUCTURAL PRECAST CONCRETE

PART 1-GENERAL

1.01 SECTION INCLUDES

A. This specification includes plant precast and/or prestressed structural concrete members and accessories.

1.02 RELATED SECTIONS

A. Section 03 20 00 – Concrete Reinforcing.

B. Section 03 30 00 – Cast-in-Place Concrete.

C. Section 01 45 29 – Testing Laboratory Services

1.03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

E.. PCI MNL-120 - Design Handbook - Precast and Prestressed Concrete.

F. PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.

G. PCI MNL-126 - Manual for the Design of the Hollow-Core Slabs.

1.04 SUBMITTALS

A. Size components to withstand design loads as shown on the Drawings.

B. Maximum Allowable Deflection: 1/240 span.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate layout, unit locations, fabrication details, reinforcement, connection details, embedded items, support items, dimensions, openings, lifting devices on installation drawings, and relationship to adjacent materials, and sealed by a Professional Structural Engineer.

C. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.

D. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.

E. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with the requirements of PCI MNL-116, PCI MNL-123, PCI MNL-120, PCI MNL-126.

1.07 QUALIFICATIONS

A. Fabricator: Company specializing in manufacturing the work of this section with minimum five years successful experience.

B. Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Protect members to prevent staining, chipping, or spalling of concrete.

D. Mark each member with date of production and final position in structure.

PART 2-PRODUCTS

2.01 PRECAST PRESTRESSED UNITS

A. Furnish precast prestressed units in accordance with Prestressed Concrete Institute AManual for Quality Control for Plants and Production of Precast Prestressed Concrete Products@.

B. Design units according to ACI 318 for load and span conditions indicated.

2.02 MANUFACTURING TOLERANCES

A. Provide units with tolerances within the limits recommended by the Prestressed Concrete institute AManual for Quality Control for Plant and Production of Precast Prestressed Concrete Products@, PCI MNL-116.

2.03 ACCESSORIES

A. Provide all clips, hangers, and other accessories required for installation of precast units and for support of subsequent construction or finishes.

2.04 DESIGN MODIFICATIONS

A. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work, and only as acceptable to the MDOT Architect/Structural Engineer. Maintain the general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown. Provide complete design calculations and drawings prepared by a registered engineer.

PART 3-EXECUTION

3.01 PREPARATION

A. Installer must examine all parts of the supporting structure and the conditions under which the precast concrete work is to be erected. 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.

B. Verify dimensions of supporting structures at the project site and adjust final shop drawings to reflect actual field dimensions.

3.02 INSTALLATION

A. Install precast concrete framing structural members plumb, level, and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.

B. Install flexible bearing pads where indicated as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

C. Do not install precast units until concrete has attained its design ultimate compressive strength.

D. Grout open spaces at connections and joints, after precast concrete units have been placed and permanently connected.

END OF SECTION

SECTION 04 20 00 UNIT MASONRY

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Brick veneer masonry work as shown on the Drawings and schedules.

1.02 RELATED SECTIONS

B. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit product data, specifications and other data for each type of masonry unit and accessory required, including certification that each type complies with the specified requirement. Include instructions for handling, storage, installation, cleaning and protection of each. Indicate by transmittal that the Installer has received a copy of each instruction.

1.04 QUALITY ASSURANCE

A. Fire-rated Masonry: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (4 hour, 3 hour, and similar designations), comply with the requirements for materials and installation established by the American Insurance Association and other governing authorities for the construction shown.

B. Job Mock-up: Prior to installation of masonry work, erect sample wall panel mock-up materials, bond and joint tooling shown or specified for final Work. Provide special features as directed for caulking and contiguous work. Build mock-up at the site, where directed, of full thickness and approximately 4 feet by 3 feet unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed Work. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until Work is completed. Provide mock-up panel for each type of exposed unit masonry work.

1.05 PROJECT CONDITIONS

A. Protect partially completed masonry against weather, when Work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane. Extend membrane a minimum of 2 inches down both sides of walls and anchor securely in place.

B. Protect masonry against freezing when the temperature of the surrounding air is 40 degrees F. and falling. Heat materials and provide temporary protection of completed portions of masonry work. Comply with the requirements of the governing code and with the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes on Brick and Tile Construction by the Brick Institute of America (BIA).

PART 2-PRODUCTS

2.01 ACCEPTABLE BRICK MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable subject to compliance with specifications:

1. Acme Brick Company, Jackson, Mississippi
2. Boral Brick, Hattiesburg, Mississippi
3. Columbus Brick, Columbus, Mississippi
4. Old South Brick & Supply Company, Jackson, Mississippi

B. Substitutions shall fully comply with specified requirements and Section 01630-Product Options and Substitution Procedures.

2.02 MASONRY UNITS

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

2.02 BRICK, GENERAL

A. Unless otherwise shown or specified, provide standard size brick (8 inches long by 2-l/4 inches high by 3-3/4 inches wide) for exposed vertical brickwork. At Contractor's option, provide solid or cored brick for vertical brickwork. Do not use cored brick with net cross-sectional area less than 75 percent of gross area in the same plane or with core holes closer than 3/4 inch from any edge. Provide solid units where indicated and where the cores in cored bricks are exposed to view.

B. Face Brick: Brick exposed to view, ASTM C 2l6, Grade SW for exterior exposures.

C. Building (Common) Brick: Brick not exposed to view, ASTM C 62, Grade SW for exterior exposures and Grade MW for interior masonry which will be concealed by other work. Select from manufacturer's standard colors and textures.

2.04 CONCRETE MASONRY VENEER: (Synthetic Limestone)

A. Provide high density pre-finished concrete masonry units complying with ASTM C-90, Type I moisture controlled units. Acceptable Products: Subject to compliance with requirements, provide Continental Cast Stone, www.continentalcaststone.com, or equal.

1. Compressive strength as tested in accordance with ASTM C-1364.
2. Density: as tested in accordance with ASTM C-1364.
3. Absorption: Cold Water as tested in accordance with ASTM C-1364.
4. Freeze Thaw Durability: less than one percent average as tested in accordance with ASTM C-1262.

C. Tolerances: Overall dimensions for width, height, and length shall differ by not more than plus or minus 1/8 inch from the specified dimensions. The provisions of the ASTM C-90 Paragraph 8 apply with regards to imperfections.

D. Color and Texture: Color and texture shall be as indicated in Section 09050 – Color Design. Permissible variation in color: Total Color Difference shall comply with ASTM C 1364, 6 units; Hue Difference shall comply with ASTM C 1364, 2 units. Surface texture shall comply with ASTM C 1364.

E. Sizes: Provide sizes as indicated on the Drawings. Provide custom shapes as indicated or required. Quirk miter all outside corners.

F. Anchorage: Horizontal joint reinforcement and general detailing shall be as per NCMA TEK Note 36A. Control joint placement shall be as per NCMA Note 10-2A.

G. Cleaner: Use only manufacturer's approved cleaner for intended use for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces.

2.05 MORTAR MATERIALS

A. Mortar mixes shall comply with the requirements of ASTM C 270 Standard Specification for Mortar for Unit Masonry. Type S mortar shall be used for exterior Work. Type N mortar shall be used for interior Work. Mortar color for face brick shall be as selected by the MDOT Architect from manufacturer's standard colors. Mortar color for building (common) brick shall use either natural color or white standard mortar color. Mortar color for the concrete masonry veneer shall match the blocks exactly.

B. Portland Cement: ASTM C 150 Type I, except Type III may be used for cold weather protection.

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

D. Sand: ASTM C 144, except for joints less than 1/4 inches, use aggregate graded with 70 to 100 percent passing the No. 16 sieve.

2.06 MASONRY ACCESSORIES

A. Provide adjustable wire ties conforming to ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement. The wire shall be a minimum of W1.7, 9 gage. Plate portions of adjustable ties shall be a minimum of 14 gage in thickness. Plate portion shall conform to ASTM A 366 Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality. All tie components shall be hot-dip galvanized after fabrication and shall conform to ASTM A 153 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Class B-2.

B. Anchoring Devices for Masonry: Provide straps, bars, bolts and rods fabricated from not less than l6 gage sheet metal or 3/8 inch diameter rod stock, unless otherwise indicated.

C. Concrete Inserts for Masonry:

1. Furnish dovetail shots with filler strips, where masonry abuts concrete. Fabricate from 24 gage galvanized steel unless otherwise indicated.
2. For installation of concrete inserts, see concrete sections of these Specifications. Advise concrete installer of specific requirements regarding his placement of inserts, which are to be used, by the masonry installer for anchoring of masonry Work.

D. Flashing for Brick Veneer Walls: Provide concealed flashing, shown to be built into masonry, as specified in Section 07650 - Flexible Flashing, unless otherwise indicated.

2.07 MASONRY MAT AND WEEP VENTS

A. Manufacturer and Type: Products equal to CavClear Masonry Mat and CavClear Weep Vents as manufactured by Archovations, Inc., PO Box 241, Hudson, WI 54016. Telephone (888) 436-2620.

1. Description: Airspace maintenance and drainage system for masonry cavities to prevent mortar from making contact with the backup to ensure water management. The system shall be fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100 percent recycled polymer with PVC binder. Weep Vents shall have “M” notched bottom. Color to be selected by the Project Architect from full range of standard colors
2. Mat Size: 1-1/4 inch thick by 16 inches high by 8 feet long.
3. Weep Vent Size: 1/2 inch thick by 2-1/2 inches high by 3-1/2 inches wide.

B. Equivalent products by the following manufacturers are acceptable:

1. Advanced Building Products, Inc., P.O. Box 98, Springvale, ME 04083. Tel: (800) 252-2306.
2. Colbond Geosynthetics, P.O. Box 1057, Sand Hill Road, Enka, NC 28728. Tel. (800) 664-6638.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

PART 3-EXECUTION

3.01 INSPECTION

A. Masonry installer must examine the areas and conditions under which masonry is to be installed and notify the Project Engineer and 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 masonry installer.

3.02 INSTALLATION

A. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

C. Cut brick with motor-driving saw designed to cut masonry with clean, sharp, un-chipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full units without cutting wherever possible.

D. Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per sq. inch per minute. Determine absorption by drawing a circle the size of a quarter on typical units and place 20 drops of water inside the circle. Wet brick units only if water is absorbed within 1-1/2 minutes. The units shall be wetted thoroughly 3 to 24 hours prior to their use so as to allow moisture to become distributed throughout the unit. The units shall be surface dry when laid.

E. Frozen Materials and Work: Do not use frozen materials or materials mixed or coated with ice or frost. For masonry, which is specified to be wetted, comply with the BIA recommendations. Do not use calcium chloride in mortar or grout.

F. Pattern Bond: Lay masonry work in a running bond unless indicated otherwise.

G. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and offsets. Avoid the use of less-than half-size units at corner, jambs and wherever possible at other locations unless otherwise indicated at cut brick locations behind downspouts. Lay-up walls plumb and true and with courses level, accurately spaced and coordinated with other work.

H. Stopping and Resuming Work: Rack back l/2 masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

3.03 MORTAR BEDDING AND JOINTING

A. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials, which would impair the work. Do not use mortar, which has begun to set, or if more than 2-l/2 hours has elapsed since initial mixing. Re-temper mortar during 2-l/2 hour period as required restoring workability.

B. Lay brick and other solid masonry units with completely FILLED bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. DO NOT slush head joints.

C. Joints: Maintain joints widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials. Tool exposed joints in slightly concave. Rake out mortar in preparation for application of caulking or sealant where shown.

D. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units that have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.04 EXTERIOR BRICK VENEER WALLS

A. Keep cavity clean of mortar droppings during construction. Strike joints facing cavity, flush.

B. Tie exterior wythe to back-up with adjustable ties embedded in mortar joints at proper spacing, not more than l6 inches on center vertically and 24 inches on center

horizontally. Fasten ties to wood frame with corrosion-resistant nails that penetrate the sheathing and are driven a minimum of 1-1/2 inches into the studs.

C. Place Masonry Mat continuously full height in exterior masonry cavity prior to construction of exterior wythe; follow manufacturer's installation instructions. Install horizontally between wall ties or joint reinforcement. Stagger end joints in adjacent rows. Butt adjacent pieces to moderate contact. Fit to perimeter construction and penetrations without voids. Use multiple layers at bottom of wall and above through-wall flashings when air space depth exceeds masonry mat thickness by more than 3/8 inch. Extend extra mat at least to top of base flashing.

D. Place Weep Vents in head joints at exterior wythe of cavity wall located immediately above ledges and flashing, spaced 24 inches on center, unless otherwise shown. Install with notched side down. Leave the side of the masonry units forming the vent space un-buttered and clear from mortar. Slide vent material into joint once the two masonry units forming the weep vent are in place. Install the Weep Vents as the wall is being erected so joints do not become filled with mortar or debris.

3.05 ANCHORING MASONRY WORK

A. Provide anchoring devices of the type shown and as specified. If not shown or specified, provide standard type for facing and back-up involved. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

B. Provide an open space not less than l/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections unless otherwise shown. Space anchors as shown, but not more than 24 inches on center horizontally.

3.06 CONCRETE MASONRY VENEER

A. Drench cast stone components with clear, running water immediately before installation.

B. Do not use pry bars or other equipment in a manner that could damage cast stone components.

C. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

D. Set cast stone components in a full bed of mortar.

E. Make joints 3/8 inch.

F. Leave head joints in copings and similar components open for sealant.

G. Rake mortar joints 3/8 inch for pointing.

H. Sponge face of each stone to remove excess mortar.

I. Tuck point joints to a slight concave profile.

3.07 LINTELS

A. Install loose lintels of steel and other materials where shown and as needed.

3.08 CONTROL AND EXPANSION JOINTS

A. Provide vertical expansion, control and isolation joints in masonry. Build-in related masonry accessory items as the masonry work progresses. Rake out mortar in preparation for application of caulking and sealants.

B. Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 25'-0" on center. Locate control joints at points of natural weakness in the masonry work. Coordination locations with Architect prior to installation.

3.09 FLASHING OF MASONRY WORK

A. Provide concealed flashing in masonry work as shown. Prepare masonry surfaces smooth and free from projections, which might puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 inch from face of wall, unless otherwise shown. Extend flashing beyond edge of lintels and sills at least 4 inches and turn up edge on sides to form pan to direct moisture to exterior. Provide weep holes in the head joints of the first course of masonry immediately above concealed flashing, spaced 24 inches on center, unless otherwise shown.

J. Install reglets and nailers for flashing and other related Work where shown to be built into masonry Work.

3.10 SETTING TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 5 feet, nor ¼ inch in 20 feet maximum.

B. Variation from Level: Do not exceed 1/8 in 5 feet nor ¼ inch in 20 feet maximum.

C. Variation in joint width: Do not vary joint width more than 1/8 inch or ¼ of nominal joint width, which ever is greater.

D. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/16 inch difference between planes of adjacent components or adjacent surfaces indicated to be flush with components.

3.11 REPAIR, 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. Clean exposed brick masonry surfaces as recommended by BIA Technical Notes 20 "Cleaning Clay Products Masonry" and masonry manufacturer. Clean exposed masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Protect the base of the wall from mud splashes and mortar droppings. 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.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1-GENERAL

1.01 SUMMARY

A. Section Includes:

1. Structural steel, embedded items, and miscellaneous steel.
2. Fabrication shop coat painting.
3. Steel erection.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications affecting structural steel work.
2. Section 09 90 00 – Painting and Coating: Field painting.
3. Section 01 45 29 - Testing Laboratory Services.

1.02 REFERENCES

A. ASTM International (American Society for Testing and Materials International):

1. ASTM A36 - Structural Steel.
2. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
3. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
4. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
5. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
6. ASTM A325 - High Strength Bolts for Structural Steel Joints.
7. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
8. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
9. ASTM 992 – Structural Steel, Grade 50.

B. AWS A2.0 - Standard Welding Symbols.

C. AWS D1.1 - Structural Welding Code.

D. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

E. SSPC - Steel Structures Painting Council.

1.03 SUBMITTALS

A. Shop Drawings:

1. Indicate sizes, spacing, and locations of structural members.
2. Connections.
3. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

B. Mill Test Reports: Submit indicating structural strength.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Provide ultrasonic testing reports for all complete penetration shop welds.

B. Maintain one copy of each document on site.

1.05 STRUCTURAL SPECIAL INSPECTIONS AND TESTING

A. Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections:

1. Anchor bolts
    a. Anchor bolt size, configuration, and embedment shall be verified prior to placement of concrete.
2. Inspect identification markings for compliance.
3. Review Manufacturer's Certificate of Compliance.
4. Review certified mill test reports.
5. Bolted connections
    a. Inspection and testing shall be in accordance with AISC specifications for Structural Joints using ASTM A325 or A490 Bolts.
    b. Provide periodic inspection of all bearing type bolted connections and continuous inspection of slip critical connections. Slip critical connections, if any, will be specifically noted on drawings.
6. Field welded connections
    a. Inspection shall be in accordance with AWS Structural Welding Code.
    b. Visually inspect all field welded connections. Provide continuous inspection for complete and partial penetration groove welds; multi-pass fillet welds; single-pass fillet welds greater than 5/16 inch. Provide periodic inspection for fillet welds equal to or less than 5/16 inch; and joist, floor and deck welds.
    c. Provide ultrasonic inspection of all complete penetration welds.
    d. Verify welder qualifications.
    e. Review weld filler material markings for compliance.
    f. Review Manufacturer's Certificate of Compliance.
7. Inspection of steel frame joint details for compliance with approved construction documents.
    a. Details
    b. Member location
    c. Joint details at each joint

PART 2-PRODUCTS

2.01 MATERIALS

A. Structural Steel Members:

1. W Shapes: ASTM A992 (Grade 50).
2. Angles, Channels, Plates: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Pipe: ASTM A53, Grade B.

D. Shear Stud Connectors: ASTM A108 forged steel, headed.

E. Bolts, Nuts, and Washers: ASTM A325; galvanized to ASTM A123 for galvanized members.

F. Anchor Bolts: ASTM A307.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 5000 psi at 28 days.

I. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

J. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic.

2.02 FABRICATION

A. Provide shop workmanship equal to the best modern practice conforming to listed industry standard and in accordance with the latest requirements of the American Institute of Steel Construction.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 2.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, and high strength bolted connections.

C. Galvanize to ASTM A123, structural steel members indicated on drawings. Provide minimum 1.25 oz/sq.ft.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field weld components indicated on Drawings or shop drawings.

C. All exposed welds shall be ground smooth.

D. Do not field cut or alter structural members without approval of Engineer.

E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.03 ERECTION TOLERANCES

A. All erection of steel, bracing and etc. should be as required by AISC.

END OF SECTION

SECTION 05 31 00 STEEL DECKING

PART 1-GENERAL

1.01 SUMMARY

A. Section Includes: Steel deck and accessories.

B. Related Section: Section 05 12 00 - Structural Steel Framing.

1.02 REFERENCES

A. AISI - Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM International (American Society for Testing and Materials International):

1. ASTM 36 - Structural Steel.
2. ASTM A466 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
3. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot Dip Process.
4. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.

C. AWS D1.1 - Structural Welding Code.

D. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1.03 PERFORMANCE REQUIREMENTS

A. Design metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

1.04 SUBMITTALS

A. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.

B. Product Data: Provide deck profile characteristics and dimensions, structural properties and finishes.

C. Manufacturer's Installation Instructions: Indicate specific installation sequence.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store and protect products from damage.

B. Cut plastic wrap to encourage ventilation.

C. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1.06 STRUCTURAL SPECIAL INSPECTIONS AND TESTING

A. Inspection of all welds and/or other attachment to steel members.

PART 2-PRODUCTS

2.01 MATERIALS

A. Sheet Steel: ASTM A446, Grade A Structural Quality; with G90 galvanized coating conforming to ASTM A525.

B. Bearing Plates: ASTM A36 steel.

C. Welding Materials: AWS D1.1.

D. Touch-Up Primer: Zinc chromate type.

2.02 FABRICATION

A. Metal Decking: Sheet steel, configured as follows:

Span Design:	Multiple
Minimum Metal Thickness (Excluding Finish):	as shown on drawings
Nominal Height:	as shown on drawings

B. Metal Closure Strips, Cover Plates, and Related Accessories: 20 gage galvanized sheet steel; of profile and size as required.

C. Fasteners: Galvanized hardened steel, steel-tapping.

D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

A. Erect metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

B. Bear decking on steel supports with 1-1/2 inch minimum bearing. Align and level.

C. Fasten deck to steel support members per drawings.

D. Weld in accordance with AWS D1.1.

E. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

F. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide all labor, materials and equipment necessary to complete the furnishing and installation of all cold-formed metal framing as shown, detailed and otherwise required, including cold-formed framing and exterior non-load bearing wall framing.

1.02 WORK NOT INCLUDED

A. Steel studs for interior non-structural walls are specified in Section 09 29 00.

1.03 QUALITY ASSURANCE

A. Framing system shall meet or exceed all the requirements of the International Building Code, latest edition, and shall be designed to withstand wind loading of 25 lbs. per sq. ft. inward minimum or 130 mph wind with Importance Factor of 1.15 with Exposure C, whichever is greater, and 25 lbs. per sq. ft. outward minimum. Refer to Component and Cladding Table in the Structural drawings for additional design criteria and information. Structural design of the system shall be the responsibility of the manufacturer.

1. The out-of-plane deflection for brick veneer walls shall not exceed the cold-formed framing members span length divided by 600 (L/600).

B. Installer qualifications: An experienced installer who has successfully completed cold-formed metal framing similar in material, design and extent to the indicated for this project.

C. Welding: Quality procedures and personnel according to AWS D1.1, “Structural Welding Code - Steel,” and AWS D1.3, “Structural Welding Code - Sheet Steel.”

D. AISC Specifications: Comply with AISI’s Specification for the Design of Cold-Formed Steel Structural Members” for calculating structural characteristics of cold formed metal framing. Comply with CCFSS Technical Bulletin: AISI Specification Provisions for Screw Connections.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect cold formed metal framing from corrosion, deformation or other damage during deliver, storage and handling.

B. Store cold-formed metal framing protected with a weatherproof covering and ventilate to avoid condensation.

1.05 SUBMITTALS

A. Prior to the commencement of fabrication and erection, the Contractor shall submit fabrication and erection drawings for review and approval showing all erection procedures and accessories required. Drawings shall indicate all framing conditions and connections required to fully describe the cold-formed framing system including but not limited to plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.

1. The Drawings shall show all erection procedures and accessories required and shall bear a certification stating that the system is designed to meet all governing codes and the loading requirements stated in Article 1.03 Quality Assurance. The Drawings shall be prepared and stamped by a registered professional engineer licensed in the State of Mississippi.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All stud and framing members shall be of the type and size as shown on the plans and shall be equal to products as manufactured by Dale/Incor Industries. Systems designed and manufactured by Dale/Incor Industries products establish a minimum of quality required.

1. Provide 8 inch galvanized steel studs with a 1-5/8 inch flange, max 16 inches on center, at all exterior walls, at gage required by calculations.
2. At exterior soffits, provide 3-5/8 inches minimum galvanized steel studs with a 1-5/8 inch flange, maximum 16 inches on center, at gage required by calculations.
3. Where shown on the interior at the video wall, provide 3-5/8 inches minimum galvanized steel studs with a 1-5/8 inch flange, maximum 16 inches on center, 18 gage.
4. All runner and end tracks, bridging and non-load bearing studs shall be of the type and size required and shall be manufactured by Dale/Incor Industries.
5. 11, 12, 14 and 16 gage track and bridging shall be formed from steel that corresponds to the requirements of the following Standards with a minimum yield of 33,000 psi: Painted Material - ASTM A570-75, grade C; Galvanized Material - ASTM A446-72, grade A.
6. All 16 gage steel studs and accessories shall be formed from steel that corresponds to the requirements of the following Standards with a minimum yield of 33,000 psi: Painted Material - ASTM A611-72, grade C; Galvanized Material - ASTM A446-72, grade A.
7. All studs and stud components shall be formed from steel having a G-60 galvanized coating.
8. The physical and structural properties listed by Dale/Incor Industries shall be considered the minimum permitted for all framing members.

2.02 FABRICATION

A. Dale/Incor framing components may be prefabricated into panels prior to erection. Prefabricated panels shall be square with components attached by welding to prevent racking. Handling and lifting of panels shall be done in a manner as to not cause distortion in any member.

B. All framing components shall be cut squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Members shall be held positively in place until properly fastened.

C. Axial loaded bearing studs shall be installed in a manner which will assure that stud ends are positioned against the inside track web prior to stud and track attachment.

PART 3- EXECUTION

3.01 INSPECTION

A. Examine condition of slab and other related surfaces prior to installation and do not proceed until any defects are corrected.

3.02 INSTALLATION

A. Install cold-formed framing, fasteners, trim and accessories in conformance with approved drawings and manufacturer's specifications.

B. Install all studs at 16 inches on center maximum spacing.

3.03 ERECTING FOR WINDLOAD MEMBERS

A. Tracks shall be securely anchored to the supporting structure in a manner which will transfer imposed load.

B. Studs shall be plumbed, aligned and securely attached to each side of the flange or web of the top and bottom tracks.

C. At track butt joints, abutting pieces of track shall be securely anchored to common structural element, or they shall be butt welded or spliced together.

D. Splices in wind loaded only studs shall be avoided if possible. When necessary, splice sections shall be of same or heavier size, a minimum of 18 inch long and attached in a manner to maintain original strength.

E. Jack studs shall be installed below window sills, above window and door headers and elsewhere to furnish structural support and shall be securely attached to supporting members.

F. Wall stud bridging shall be installed in accordance with the stud manufacturer recommendations.

G. Provision for structure vertical movement shall be provided where required in accordance with stud manufacturer’s recommendations.

3.04 ERECTING FOR AXIAL LOAD BEARING MEMBERS

A. Tracks shall be securely anchored to the supporting structure to properly transfer imposed loads.

B. Complete, uniform and level bearing support shall be provided for the bottom track at each bearing stud location. If not provided, install full size shims below bottom track at stud locations as needed or set bottom track in high strength grout.

C. At intersection or abutting track joints, abutting pieces of track shall be securely anchored to a common structural element, or they shall be spliced together.

D. Splices in axial loaded studs shall not be permitted.

E. Framed wall openings shall include a properly designed header and multiple (or heavier) studs at each edge of the opening, to compensate for those removed.

F. Diagonal bracing shall be installed at locations required to be "shear walls" for frame stability and to resist wind lateral loads. Bracing shall be securely anchored for uplift and horizontal shear. Additional stud(s) shall be positioned to resist the vertical component.

G. Bridging for wall framing shall be installed in accordance with the stud manufacturer recommendations.

END OF SECTION

SECTION 05 42 15 LIGHT GAUGE STEEL PRE-ENGINEERED/MANUFACTURED TRUSSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal roof trusses.

B. Anchorage, bracing, and bridging.

1.02 REFERENCES

A. ASTM:

1. ASTM A653 and A525.
2. ASTM A780-93a "Repair of Damages and Uncoated Areas of Hot-Dip Galvanized Coatings.

B. American Welding society (AWS):

1. AWS D1.1 "Structural Welding Code - Steel."
2. AWS D1.3 "Structural Welding Code - Sheet Steel."

C. Light Gauge Steel Engineers Association Field Installation Guide.

D. American Iron and Steel Institute, North American Specification for the Design of Cold-Formed Steel Structural Members, 2001 American Iron and Steel Institute Standard for Cold-formed Steel Framing-Truss Design, 2001.

1.03 PERFORMANCE REQUIREMENTS

A. AISI "Specifications": Calculate structural characteristics of cold-formed steel truss members according to AISI's "North American Specification for the Design of Cold Formed Steel Structural Members", 2001.

B. Structural Performance: Design, engineer, fabricate and erect cold-formed metal framing to withstand design loads within limits and under conditions required:

1. Design Loads:
   a) Live Load: 20 psf.
   b) Added Dead Load: Top chord: 10 psf; Bottom chord: 10 psf
   c) Wind Loads: 130 mph (ASCE-7-05) with provisions for topographic effects.
   d) Seismic Loads: Per Structural General Notes plan sheet notes and ASCE-7-05 requirements.
2. Design framing systems to withstand design loads without deflections greater than L/360.
3. Design framing systems to provide movement of framing members without damage or over stressing, sheathing failure, connection failure, undue strain of fasteners and anchors, or other detrimental effects when subject to a maximum temp. change (range) of 120 deg. F (67 deg. C).

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of cold-formed metal framing and accessory required.

B. Submit shop drawings showing member, type, location, spacing, size and gauge of members, method of attachment to supporting members and all necessary erection details. Responsibilities:

1. Truss Manufacturer to submit shop drawings showing:
   a. member, type, location spacing, size and gauge of members.
   b. location of required lateral web compression bracing.
   c. all truss to truss connection details.
   d. detailed roof truss layouts.
   e. submit structural calculations, sealed and signed by a qualified registered Professional Engineer, verifying framing assembly's ability to meet or exceed local code and design requirements.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Fabrication shall be performed by experienced cold-formed metal framing truss fabricator with not less than two years experience designing and fabricating cold-formed metal trusses equal in material, design, and extent to the systems required for this project. Primary fabrication shall be conducted in permanent facility dedicated to the manufacturing of cold-formed metal trusses. Job site fabrication is strictly prohibited.

B. Erectors Qualifications: Truss erection shall be performed by a qualified installer experienced in structural light gauge steel framing and recommended truss installation practices.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 “Structural Welding Code—Steel” and AWS D1.3 “Structural Welding Code—Sheet Steel.”

1. Qualify welding processes and welding operators in accordance with AWSI “Standard Qualification Procedure.”

1.05 DELIVERY, STORAGE AND HANDLING

A. Trusses to be delivered to job site individually labeled to match information in layout drawings. Exercise extreme care to avoid damage during unloading, storing and erection.

B. Store trusses on blocking off of ground and in an upright position when possible to avoid damage from bending and over stressing. Protect metal from corrosion, deformation, damage, and deterioration when stored on job site. Keep trusses free of dirt and other foreign matter.

1.06 PROJECT CONDITIONS

A. During construction, distributed concentrated loads applied to trusses adequately so that carrying capacity any one truss or other component is not exceeded.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials

1. Fabricate truss components of commercial quality steel, ASTM A653 galvanized finish with a minimum yield point of 45 ksi.
2. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet, ASTM A653 galvanized finish with a minimum yield of 33 ksi.

B. Metal framing components: Provide sizes, shapes and gauges indicated:

1. Design Uncoated-Steel Thickness: 20 Ga.
2. Design Uncoated-Steel Thickness: 18 Ga.
3. Design Uncoated-Steel Thickness: 16 Ga.
4. Design Uncoated-Steel Thickness: 14 Ga.
5. Design Uncoated-Steel Thickness: 12 Ga.

C. Finish: Provide components with protective zinc coating complying with ASTM A653, minimum G60 coating.

D. Fastenings:

1. Self drilling screws per manufacturers requirement, bolts, nuts and washers with corrosion-resistant plated finish. Fasteners shall be of sufficient size to ensure the strength of the connection.
2. Welding: Comply with AWS D1.1 when applicable and AWS D1.3 for welding base metals less than 1/8" thick.

2.02 FABRICATION

A. Factory fabricate cold-formed steel trusses and accessories plumb, square, true to line and with connections securely fastened.

1. Fabricate truss assemblies in jig templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by screw fastening.
   a. Locate mechanical fasteners and install according to cold-framed to cold-formed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
3. Splicing:
   a. Splicing of webs is not permitted
   b. The following procedure must be followed when splicing of chord members is necessary:
      1) Splice chord members by using a 24 inch (typ.) piece of chord material the same size and gauge of the chord material being spliced.
      2) Attach splice with a minimum of 4 screws each side of the splice. The screw count of the splice is calculated by dividing the forces in the member (see individual truss engineering drawing), by the appropriate screw shear value.
         a) 20 GA - 243 lbs/screw 18 GA - 419 lbs/screw
         b) 16 GA - 513 lbs/screw 14 GA - 519 lbs/screw

B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift trusses to prevent damage or distortion.

C. Fabricate Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to a line of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual web members no more than plus or minus 1 inch from plan location. Vertical webs located directly over bearing points shall be located plus or minus 1/8 inch (3mm) from plan location.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine structure, substrates and installation conditions. Do not proceed with truss erection until unsatisfactory conditions have been corrected. Trusses should be installed so as to allow complete and adequate contact with truss connection member at all bearing locations as indicated.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION, GENERAL

A. General:

1. Erection of trusses, including proper handling, safety precautions, temporary bracing and other safeguards or procedures are the responsibility of the Contractor and Contractor's installer. Refer to LGSEA “Field Installation Guide.”
2. Exercise care and provide erection installation bracing required to prevent toppling or dominoeing of trusses during erection.

B. Erect trusses with plan of truss webs vertical and parallel to each other accurately located at design spacing indicated.

C. Provide proper lifting equipment suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator. Exercise care to avoid damage to truss members and joints during erection and to keep horizontal bending of trusses to a minimum.

D. Provide framing anchors as indicated or accepted on the engineering design drawings or erection drawings. Anchor trusses securely at bearing points.

E. Install truss framing and accessories plumb, square, true to line, and with connections safely fastened, according to manufacturer's recommendations.

F. Provide temporary bracing and leave in place until all permanent bracing, framing, and sheathing is in place and securely fastened.

G. Erection Tolerances: Install joist and truss framing to a maximum allowable tolerance variation from plumb, level and true to line of 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

H. Do not alter, cut or remove framing members or connections of trusses.

I. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points as indicated.

3.03 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A780 and the manufacturer's instructions.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1-GENERAL

1.01 SECTION INCLUDES

A. All miscellaneous metal work. The Work includes, but is not limited to, pipe railings, safety nosings at concrete steps, steel lintels and miscellaneous framing & supports.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

B. Section 09 90 00 - Painting and Coating: Painting for all ferrous metal exposed to view.

1.03 SUBMITTALS

A. Submit shop drawings for shop fabricated items. Indicate profiles, sizes, materials connection details, attachments, reinforcing, anchorage, size and type of fasteners, and accessories. All dimensions shall be shown, including every hole location, fastening, bearing member and the like. Include erection drawings, with plans, elevations, and details.

PART 2-PRODUCTS

2.01 MATERIALS

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

B. Gray cast iron shall conform to ASTM A48-83, class 30. All castings shall be of uniform quality, free from blowholes, shrinkage defects, swells, cracks, honeycomb or other defects. Castings shall be free of fins, burrs and slag.

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

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

E. Detail metal Work for ample size, strength and stiffness and as indicated. Countersink and provide reinforcement where necessary; 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.

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

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

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

I. Shop paint and field touch up shall be ICI Devflex 4020, Rustoleum 769, Tnemec 99, Southern Coatings 476, or approved equal. Shop coat shall be compatible with finish coats specified in Section 09900 – Paints and Coatings.

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

2.02 METAL PRIMER

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

2.03 PIPE RAILINGS

A. Fabricate railings and posts from 1-1/4 inch round tube steel, ASTM A 53, Type E or S, Grade A, Schedule 40. Shop prime after fabrication. 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.

B. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railings or use welding connectors, at fabricator's option. At connections to steel supports, weld post directly to steel supports, unless otherwise indicated.

C. Anchorage: Use type of bracket with pre-drilled hole for exposed bolt anchorage. For stud partitions and framing use lag bolts set into wood backing between studs and framing members. Coordinate with stud installations for accurate location of backing members.

D. Expansion: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

2.04 SAFETY NOSINGS

A. Provide abrasive stair nosings at exterior concrete steps equal to Wooster Products Model 241BF Supergrit 4 inches wide by 6 inches less than tread width with protective tape and continuous sure-hold anchors. Color to be selected by MDOT Architect from all available colors. Install nosings before “Initial Set” of the concrete. Remove protective tape after steps are complete. Equivalent products by American Safety Tread Company .and Balco, Inc. are acceptable.

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. Provide sizes as indicated on structural drawings.

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.

PART 3-EXECUTION

3.01 INSTALLATION

A. Perform cutting, drilling and fitting required for installation; set Work accurately in location, alignment and elevation measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other Work.

B. Set loose items on cleaned bearing surfaces, using wedges or other adjustments as required. Solidly pack open spaces with bedding mortar, consisting of 2 part Portland Cement to 3 parts sand and only enough water for packing and hydration, or use commercial non-shrink grout material.

C. Touch-up shop paint after installation. After cleaning field welds, bolted connections and abraded areas, apply same type paint as used in shop. Color to be selected from standard colors available. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concealed wood grounds and blocking to frame openings, form terminations, to provide anchorage and / or support of other interior and exterior locations; plywood and rough hardware.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 06 40 00 - Architectural Woodwork.

C. Section 08 71 00 - Door Hardware.

1.03 COORDINATION

A. Fit carpentry Work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

1.04 QUALITY CONTROL

A. Factory mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks. Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the Work. Contractor shall comply with manufacturer’s required protection procedures.

1.06 PROJECT CONDITIONS

A. Installer must examine all parts of the supporting structure and the conditions under which the carpentry Work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

PART 2 - PRODUCTS

2.01 LUMBER

A. For each use, comply with the "American Softwood Lumber Standard" PS 20 by the U.S. Department of Commerce. Nominal sizes are shown or specified; provide actual sizes complying with the minimum size requirements of PS20 for the moisture content specified for each use. Provide dressed lumber, S4S, unless otherwise shown or specified. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and complying with dry size requirements of PS 20, unless otherwise specified.

2.02 FRAMING LUMBER

A. Where wood framing is shown or scheduled, provide lumber complying with grading rules which conform to the requirements of the "National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee established under PS 20.

B. For Light Framing: Standard Grade.

C. For Structural Framing: (4 inches and wider and from 2 inches to 4 inches thick), provide the following: No. 1 Grade; Douglas Fir (WCLB or WWPA), Southern Pine (SPIB). Fb (minimum extreme fiber stress in bending); 1,250 psi. E (minimum modulus of elasticity); 1,700,000 psi.

2.03 BOARDS

A. Where lumber less than 2 inches in nominal thickness and 2 inches or more in nominal width is shown or specified, provide boards complying with dry size requirements of PS 20.

B. Concealed Boards: Where boards will be concealed by other work, provide the following:

1. Moisture Content: 19 percent maximum, mark boards "S- Dry".
2. Species and Grade: Provide one of the following:
   a. Southern Pine (SPIB) No. 2 boards.
   b. WCLB (any species) No. 3 boards.

2.04 PLYWOOD

A. For each use, comply with the requirements for "Softwood Plywood/Construction and Industrial" PS 1 by the U.S. Department of Commerce.

B. Concealed Plywood: Where plywood will be concealed by other work, provide 5/8-inch minimum thickness Interior Type plywood C-D Plugged Grade, unless otherwise specified or shown on Drawings.

C. Exposed Plywood: Where plywood will be exposed to view, provide 5/8 inch minimum thickness Interior Type plywood B-C Plugged Grade, unless otherwise specified or shown on Drawings. For backing panels for electrical or telephone equipment, provide 3/4 inch thick fire-retardant treated Standard grade plywood with exterior glue. All exposed plywood shall be painted per the room finish schedule.

D. Exterior Plywood: Exterior type, medium density, C Grade for concealed faces.

1. Roof Sheathing: 1/2-inch thick

2.05 ANCHORAGE AND FASTENING MATERIALS

A. For each use, select proper type, size, material, and finish complying with the applicable Federal Specifications. Zinc electroplated steel fasteners for high humidity and treated wood locations. All nails shall be coated.

2.06 TREATED WOOD

A. Complete fabrication of treated items prior to treatment, wherever possible. If cut after treatment, coat cut surfaces with heavy brush coat of same fire-retardant chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

B. Preservative Treatment: Where lumber or plywood is indicated as "Treated", or is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Institute (AWPI). Mark each treated item to comply with the AWP Quality Mark requirements for the specified requirements.

1. Pressure-treat aboveground items with water-borne preservatives complying with AWPI P-2. After treatment, kiln-dry to maximum moisture content of 15 percent. Treat indicated items and the following:
   a. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
   b. Wood sills, sleepers, blocking, furring stripping and similar concealed members in contact with masonry or concrete.

C. Fire-Retardant Treatment: Where "PR-S" lumber or plywood is shown or scheduled, comply with the AWPI Specification C-208 for pressure impregnation with fire-retardant chemicals to achieve a flame-spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E A4, or NFPA Test 355. Where treated items are indicated to receive a transparent or paint finish, use a fire-retardant treatment that will not bleed through or adversely affect bond of finish.

1. All interior wood used for blocking or shims in walls shall be Fire-Retardant treated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing. Use materials free from warp that cannot be easily corrected by anchoring and attachment. Sort out and discard warped material and material with other defects that would impair the quality of the Work.

B. Securely attach carpentry work to substrates by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

C. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3.02 ATTACHMENT AND ANCHORAGE

A. Use common wire nails, except as otherwise shown or specified. Use finishing nails for finish Work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

B. Exposed Plywood: Panel ends and edges shall have spacing of 1/8 inch maximum, unless otherwise indicated by the panel manufacturer. Fasten 6 inches on center along supported panel edges and 10 inches on center at intermediate supports

C. Plywood Sheathing: Panel ends and edges shall have spacing of 1/8 inch, unless otherwise indicated by the panel manufacturer. Nail 6 inches on center along supported panel edges and 12 inches on center at intermediate supports with 6d common nails for panels 1/2 inch thick and 8d nails for panels 3 /4 inch thick. Provide closer spacing where required by local codes.

3.03 WOOD GROUND NAILERS, BLOCKING, AND SLEEPERS

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Set true to line and level, plumb with intersections true to required angle. Coordinate location with other Work involved. Provide all blocking as required by manufacturer's requirements of other work.

B. Attach to substrates securely with anchor bolts and other attachment devices as shown as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Building into masonry; anchor to formwork before concrete placement.

C. Provide grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inch wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.04 WOOD FURRING

A. Install plumb and level with closure strips at all edges and openings. Shim with wood as required.

D. Suspended Furring: Provide of size and spacing shown, complete including hangers and all attachment devices. Level to a tolerance of 1/8 inch in 12 feet.

3.05 WOOD FRAMING

A. Set wood framing accurately to required lines and levels. Provide framing members of sizes and on spacing shown, and frame openings as shown, or if not shown, comply with the recommendation of the "Manual for Housing Framing" of the National Forest Products Association. Cut, join, and tightly fit framing around other Work. Do not splice structural members between supports unless otherwise detailed.

B. Anchor and nail as shown, or if not shown, to comply with the "Recommended Nailing Schedule - Table 1 of the "Manual of House Framing" and other recommendations of the N.F.P.A.

END OF SECTION

SECTION 06 40 00 ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The types of architectural woodwork in this Section include, but are not necessarily limited to the following:

1. Standing and Running Trim
2. Cabinets, Counters, and Shelving
3. Solid Surface Material
4. Millwork Partitions
5. Miscellaneous work

B. The extent of each type of architectural woodwork is shown on the drawings and in 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.

1.02 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications

B. Section 06 10 00 - Rough Carpentry

C. Section 09 05 15 - Color Design

D. Section 09 29 00 - Gypsum Board

1.03 DEFINITIONS

A. Terms used in this section are in accordance with terminology of the Architectural Woodwork Institute, Architectural Woodwork Quality Standards, Seventh Edition.

1.04 SUBMITTALS

A. Submit shop drawings showing location of each item. Dimensioned plans and elevations shall be provided and drawn at a minimum scale of 1/2 inch = 1'-0". Large scale details shall be provided and drawn at a minimum scale of 3 inches = 1'-0". Shop drawings shall clearly indicate location of joints in panels, countertops, plastic laminates, brackets, hardware, metal finishes, attachment devices and other materials necessary for complete fabrication. Submit shop drawings for all work specified in this Section including but not limited to the following:

1. Lumber
2. Cabinets and Countertops
3. Millwork Partitions
4. Window stools
5. Miscellaneous work
6. Hardware and Accessory Materials

C. Submit two samples of solid surface window stools showing finish and edge conditions.

D. Submit product data of each type of hardware.

E. 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.

1.05 QUALITY ASSURANCE

A. Comply with specified provisions of the Architectural Woodwork Institute (AWI) "Quality Standards." All construction, fabrications, finishes, and materials shall meet AWI Premium Quality standards.

B. The millwork manufacturer shall:

1. Have a minimum of five (5) years 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 fabrication and finishing to meet the level of quality for the manufacture of all fabrications 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.

C. For the following types of architectural woodwork, comply with the indicated standards as applicable.

1. Lumber: AWI Section 100
2. Standing and running trim: AWI Section 300
3. Cabinets and Countertops: AWI Section 400
4. Finishing: AWI Section 1500
5. Installation of Woodwork: Section 1700

1.06 PRODUCT 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 has been completed in installation areas.

B. If woodwork must be stored in other than installation areas due to unforeseen circumstances, store only in areas meeting requirements specified for installation areas.

1.07 JOB CONDITIONS

A. The Installer shall advise the Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until the required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. The Contractor shall maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of the optimum moisture content from the date of installation through the remainder of the construction period. The fabricator of the woodwork shall determine the optimum moisture content and required temperature and humidity conditions.

1.08 COORDINATION

A. Coordinate the work of this section with the work of other sections that require penetrations, attachments, or support mechanisms for architectural woodwork.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS AND METHODS

A. Provide kiln-dried lumber and maintain optimum moisture content from 8 to 13 percent range (damp region) in solid wood (hardwood and softwood) during fabrication, installation, and finishing operations of interior work.

B. Provide plywood for concealed surfaces in accordance with AWI.

C. Wood for standing and running trim shall be subject to Architect's selection. Comply with AWI quality standards for Premium Grade for transparent finish and Custom Grade for opaque finish for selection of species, grade and cut.

E. Plastic Laminate shall comply with NEMA LD3; type, thickness, color, pattern and finish as indicated for each application. Refer to Section 09 05 15 - Color Design for selection of manufacturer, color and finish.

F. 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.

G. Comply with the details shown for profile and construction for architectural woodwork, and where not otherwise shown, comply with applicable AWI Quality Standards with alternate details at fabricator's option.

H. 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.

I. 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.

J. Woodwork in this Section shall be factory finished unless noted otherwise. Factory finishing shall meet the requirements of AWI Quality Standards Section 1500. Millwork indicated to be wood with a stain finish shall have a Premium Grade, Transparent Finish, TR-2, Catalyzed Lacquer sprayed finish, with a satin gloss. Field touch-up of factory finished woodwork shall be performed by woodwork manufacturer to match factory finishing.

2.02 CABINETS

A. Fabricate millwork in accordance with AWI Premium Standards, Section 400 Cabinets and as indicated on drawings. See Section 09 05 15-Color Design for color and finish selections.

2.03 STANDING AND RUNNING TRIM

A. Miscellaneous trims shall be fabricated to sizes indicated on drawings in longest practical lengths. Finish shall conform to adjacent wood finish.

2.04 SOLID SURFACE MATERIAL

A. Fabricate window stools, tops, and splashes as detailed on drawings of 1/2 inch solid surface polymer acrylic sheets equal to Dupont Corian. See Section 09 05 15 - Color Design for color and finish selection. Individual window stools shall be fabricated in one piece. Exposed edges shall be radiused.

2.05 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Provide cabinet hardware and accessory materials associated with architectural woodwork. Except as otherwise indicated, comply with ANSI A156.9 "American National Standard for Cabinet Hardware." Provide hanging file frames in all millwork file drawers. Unless shown or noted otherwise, cabinet hardware and accessories 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 Hafele 115.70.003 Stainless Steel Zinc handle.
3. Drawer guides: Equal to Accuride model 2132, 20 inch, side mount, 75 pound rated, black zinc plated.
4. 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.
5. Wall cabinet hangers: Equal to Kingclip as manufactured by Brooklyn Hardware, LLC.
6. Metal Identification Tag Holders: Equal to: Hafele, sheet steel, nickle plated, size 69mm x 35mm, label size 57mm x 28mm, window size 52mm x 22mm, Cat. No. 168.02.761.
7. Edge molding: T-Edge rectangular profile, flexible, semi-soft, stain resistant, UV stable, and flame retardant edge molding by Edgemold (800-334-3665).
8. Grommet: Equal to Doug Mockett, Flip Top Series - 2 inch hole plastic grommet. Provide at all workstation office area counter tops located at 4'-0" on center. Locations to be confirmed in submittal. Color to be selected from Manufacturer's full range.
9. 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.

PART 3 - EXECUTION

3.01 INSPECTION

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.

3.02 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

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.

3.03 INSTALLATION

A. All work shall be installed in strict accordance with the premium grade standards of Section 1700 - Installation of Woodwork of AWI Quality Standards.

B. 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'-0" 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.

C. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation and in accordance with AWI Premium Standards. Except where pre-finished matching fastener heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

D. Install cabinets 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.

E. Anchor countertops, workstation tops, and vanity tops securely to base units and other support systems as indicated.

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. 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 SPRAY-ON INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building insulation for interior wall for sound attenuation, as shown on the Drawings and specified herein.

1.02 SUBMITTALS

A. 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 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacture of Cellulose Spray-on Insulation with 10 years minimum experience.

B. Installer: Company specializing in Cellulose Spray-on 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.

1.04 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.

1.05 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. International Cellulose Corporation, Houston, TX Tel: (800) 444-1252.
2. ThermoCon, Inc., Monroe, LA. Tel: (800) 854-1907

C. Alternate Manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 62 14-Product Options and Substitution Procedures.

2.02 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 and shall be mold-resistant, non-toxic, non-corrosive, shall not irritate normal skin, shall not give off odor during or after installation, shall not attract vermin or insects and shall not adversely affect other building materials.

B. Thermal Performance: Cellulose insulation shall resist the flow of heat. Conductive 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 and floors.

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 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 Architect.

3.02 INSTALLATION

A. Comply with manufacturer's instructions for the particular condition of installation in each case. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

B. Extend insulation full thickness as shown over entire area to be insulated. Fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.

C. Nu-Wool WALLSEAL: Cellulose insulation shall be pneumatically sprayed with a controlled water fog for adhesion into open wall cavities after all mechanical, plumbing and 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 SECTION INCLUDES

A. Vapor retarder under concrete floor slab and covered porch slabs.

B. Concrete curing paper on top of freshly poured concrete floor slab.

C. Floor protection paper used for positive protection of finished floors.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data, installation instructions and recommendations for products specified.

1.03 WARRANTIES

A. Provide Manufacturer's standard two (2) years material warranty.

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. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

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 & B) = .01 Perms.
2. Tensile Strength: ASTM E-154, Section 9 (Method D-882) = (80lb f/in min)-MD & (78lb f/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: Unroll underslab vapor retarder over thoroughly compacted subgrade and turn down at inside perimeter of grade beams. Seal joints watertight, with a pressure sensitive tape as recommended by manufacturer, allowing a minimum overlap of 6 inches. Apply tape evenly over seams and rub out wrinkles formed during application. Seal pipes and conduits passing through the membrane with Moistop boot and tape. 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. Comply with manufacturer’s recommendations and installation procedures as outlined in ASTM E-1643.

B. Curing Paper: Unroll concrete curing paper over the entire surface once the concrete has set sufficiently hard to permit application without marring the surface. Lap joints 4 inches and seal with pressure sensitive tape. Apply tape evenly over seams and rub out wrinkles formed during application. Ensure that all tears or penetrations are repaired.

C. Floor Protection Paper: Apply floor protection paper immediately after floor covering is installed. Do not remove until final completion and acceptance by the Project Engineer. Lay paper in widest practical width with 6-inch laps to provide complete coverage of flooring. 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 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Materials and installation methods for fluid applied (fully adhered), vapor permeable air barrier membrane system located in the non-accessible part of the concrete walls included in the Alternate.
2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, masonry ties, piping and other penetrations through the wall assembly.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for embedded flashings.
2. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
3. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.02 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.03 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight.
2. It shall have an air permeability not to exceed 0.004 cfm/sq. ft. under a pressure differential of 0.3 in. water. (1.57 psf.) (equal to 0.02L/sq. m @ 75 Pa.).
3. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
4. It shall be durable or maintainable.
5. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between:
   a. Foundation and walls.
   b. Walls and windows or doors

c. Different wall systems.
d. Wall and roof.
e. Wall and roof over unconditioned space.
f. Walls, floor and roof across construction, control and expansion joints.
g. Walls, floors and roof to utility, pipe and duct penetrations.

6. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

1.04 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated

B. American Society for Testing and Materials (ASTM)

1. C920 Specifications for Elastomeric Joint Sealants
2. C1193 Guide for Use of Joint Sealants
3. D412 Standard Test Methods for Rubber Properties in Tension
4. D570 Test Method for Water Absorption of Plastics
5. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
6. D1876 Test Method for Peel Resistance of Adhesives
7. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting
8. D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
9. D4258 Practice for Surface Cleaning Concrete for Coating
10. D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
11. E96Test Methods for Water Vapor Transmission of Materials
12. E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
13. E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Source
14. E1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems
15. E2178-01 Standard Test Method for Air Permeance of Building Materials

1.05 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.

C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

D. Qualification Data: For Applicator.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.

F. Warranty: Submit a sample warranty identifying the terms and conditions stated in Article 1.09.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Preinstallation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, including masonry, sealants, windows, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, sequence of installation, and protection and repairs.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.

C. Protect fluid-applied membrane components from freezing and extreme heat.

D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.09 WARRANTY

A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in strict conformance with written manufacturer's instructions.

1. Failures include, but are not limited to, the following:
   a. Failure to maintain air permeance rating not to exceed 0.02 L/s/sq. m. when tested per ASTM E2178, within specified warranty period.

b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Me

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FLUID-APPLIED, VAPOR PERMEABLE MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Single Component Acrylic membrane.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Single Component Acrylic Membrane:
      1) Henry Company; Air-Bloc 31.
      2) Grace Construction Products; Perm-A-Barrier VP (Basis-of-Design)
2. Physical and Performance Properties:
   a. Membrane Air Permeance: Not to exceed 0.0004 cfm/sq. ft. of surface area (at specified thickness) at 1.57-lbf/sq. ft. pressure difference (0.002 L/s x sq. m of surface area at 75-Pa) when applied to CMU wall; when tested per ASTM E2178.
   b. Membrane Vapor Permeance: Not less than 11.2 perms (649.6 ng/Pa x s x sq. m); when tested per ASTM E96.
   c. UV Exposure Limit: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Liquid Membrane for Details and Terminations: Provide Bituthene Liquid Membrane as manufactured by Grace Construction Products.

C. Wall Primer (for Use with Throughwall Flashing and Tapes Applied to Substrate): Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

1. Flash Point: No flash to boiling point.
2. Solvent Type: Water.
3. VOC Content: Not to exceed 10 g/l.
4. Application Temperature: 25 degrees F and above.
5. Freezing point (as packaged): 21 degrees F.
6. Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.

D. Flexible Membrane Wall Flashing: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption: ASTM D570: max. 0.1 percent by weight

3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
4. Tear Resistance
   a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
   b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width.
6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)
7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200 percent.
9. Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.

E. Joint Reinforcing Strip: Air barrier manufacturer's approved tape.

F. Transition Tape: 0.8 mm (32 mils) of self-adhesive rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
2. Water Absorption: ASTM D570: max. 0.1% by weight
3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
4. Tear Resistance
   a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
   b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)
7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.
9. Product: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

I. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 7 Section "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

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

3.02 SURFACE PREPARATION

A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.

B. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.

C. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application

D. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

E. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.

F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 JOINT TREATMENT

A. Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.04 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Permeable Membrane Air Barrier: 90-mil wet film thickness, 45-mil dry film thickness.

D. Do not cover air barrier until it has been inspected by Project Engineer/ MDOT Architect.

E. Fill correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.05 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

B. Apply primer to substrates to receive transition tapes at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Reprime areas exposed for more than 24 hours.

C. Connect and seal exterior wall air barrier membrane continuously to exterior glazing and window systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

3.06 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 180 days.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 07 42 45 ALUMINUM COMPOSITE PANEL SYSTEM

PART 1- GENERAL

1.01 SUMMARY

A. This Section includes requirements for Aluminum Composite Panels with wet seal (caulked) reveal joints as detailed on Drawings. Provide wall panels, perimeter extrusions, extruded stiffeners, gaskets, fasteners, related flashing, clip angles, furring and framing, sealants between wall panels and other miscellaneous accessories required for a complete watertight and structurally sound, wall panel system. The extent of the panel system is shown on the Drawings

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Work of the section shall conform to all applicable codes and regulations.

B. Design Criteria:

1. Make allowances for free and noiseless vertical and horizontal thermal movement due to the contraction and expansion of component parts, for an ambient temperature range of from 20 degrees F. to plus 150 degrees F. Buckling, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement of component parts will not be permitted. Fabricator, assembly and erection procedure shall take into account the ambient temperature range at the time of the respective operation.
2. Assemblies shall be designed for flexural, shear and torsional stresses for the positive and negative wind pressures acting normal to the plane of the assemblies.
3. Seismic Forces: Seismic lateral force requirements shall comply with governing codes and regulations. The wall system shall be designed to accommodate a floor structure displacement of 0.005 per inch of floor height, to satisfy the seismic loading requirements.
4. Stresses must take into account interaction and in no case shall allowable values exceed the yield stress.
5. Flatness Criteria: Maximum 1/32 inch in 2'-0" on panel in any direction for assembled units (non-accumulative).
6. System shall not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.
7. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" by AAMA and ANSI/AAMA 302.9 requirements for aluminum windows.
8. Fabricate panel system to dimension, size, and profile indicated on the drawings based on a design temperature of 70 degrees F.
9. Fabricate panel system so that no restraints can be placed on the panel, which might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and water tight.
10. The finish side of the panel shall have a removable plastic masking applied prior to fabrication, which shall remain on the panel during fabrication, shipping, and erection to protect the surface from damage.

1.03 SUBMITTALS

A. Submit manufacturer's product data, specifications, test reports, certifications, and other pertinent data on all products including fasteners, sealants and accessories.

B. Submit two (2) samples of panel material with selected finish and color.

C. Submit installer qualifications and experience record, list of completed projects, list key personnel, photographs of existing installations, and references.

D. Submit three (3) 24 inch x 24 inch sample of panel system in specified finish complete with factory applied edge treatment, fabricated into units representative of the actual calculations. (One for on site after approval, one for the Project Engineer, and one for the Architect.)

E. Submit shop drawings indicating all components of system showing location of panels in plan and elevation, profiles of panel units, details of forming, joint supports, anchorages, trim, flashing, furring and framing, sealants, accessories, details of weatherproofing at edge terminations and openings, and structural calculations for installed metal panel system. Shop drawings shall be stamped by an engineer registered in the State of Mississippi, signifying conformance with specifications.

F. Submit SBCCI listing and test report on product submitted.

G. Submit calculations for installed metal panel system indicating conformance with specifications stamped by an engineer registered in the State of Mississippi.

1.04 QUALITY ASSURANCE

A. Fabricator/installer shall assume responsibility for all components of the aluminum composite panel system including, but not limited to attachment to sub-construction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system. Fabricator/Installer shall have a minimum of five (5) years experience in the fabrication of metal panel systems similar in size and scope to the work of this project.

B. Installer's management and key personnel shall have five (5) years experience and shall have successfully completed three (3) projects using aluminum composite panel systems of similar scope and size to the work of this project. Projects must have a record of successful in-service performance. The ability to secure qualified personnel and equipment to complete the work of this project in a professional and timely manner shall be demonstrated by documentation acceptable to the Architect.

C. Aluminum Composite Panel System: System furnished under this section shall have been tested by an independent testing laboratory. Test results shall meet or exceed the following:

1. Panels shall be designed to withstand the Design Wind Load based upon the governing code, but in no case less than 20 pounds per square foot and 30 pounds per square foot on parapet and corner panels. Wind load testing shall be conducted in accordance with ASTM E 330 to obtain the following results:
   a. Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4 inch, whichever is less.
   b. Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.

c. Maximum anchor deflection shall not exceed 1/16 inch.
d. At 1.5 times design pressure, permanent deflections of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16 inch.

2. Air/Water System Test:
a. Air Infiltration-When tested in accordance with ASTM E 283, air infiltration at 1.57 pound per square foot must not exceed 0.06 cubic feet per minute per square foot of wall area.
b. Water infiltration-Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. No water infiltration shall occur in any system under a differential static pressure of 6.24 pounds per square foot after 15 minutes of exposure in accordance with ASTM E 331.

D. Mock-up:

1. Install at project site a job mock-up using approved products and installation methods. Obtain Architect's acceptance of mock-up prior to starting work.
2. Mock-up size shall be adequate to determine characteristics of installed system and shall include horizontal and vertical joints, inside and outside corner, parapet and other shapes and profiles representative of the installed system.
3. Maintain mock-up during construction for workmanship comparison. Remove and legally dispose of mock-up when no longer required.
4. Mock-up may be incorporated into final construction upon architects approval to incorporate work.

E. Pre-installation Meeting: Conduct a pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. The Architect, General Contractor, Installer/Fabricator and key personnel evolved with the installation of the system shall be present at this meeting.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver fabricated units and component parts to site in manufacturer's unopened cartons.

B. Panels shall have strippable peel coating. Protect surfaces from damage during shipping and erection. Inspect work for damage upon delivery. No damaged panels shall be permitted on job site.

1.06 WARRANTY

A. Provide a five (5) year warranty signed by both the manufacturer and system fabricator/installer. Include coverage for water tightness, integrity of sealant, and warping and degradation of panel finish, including color fading caused by exposure to weather.

PART 2- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Panel materials shall be equal to Alucobond as manufactured by Alcan Composites USA, Inc. 208 West 5 th Street, Benton, KY 42025 (800-626-3365 270-527-4200).

B. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable:

1. Mitsubishi Chemical America, Inc., Chesapeake, VA. Tel. (800) 422-7270.
2. Reynolds Metals Company, Richmond, VA. Tel. (804) 281-3939.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 PANEL MATERIALS

A. Aluminum Composite Panels:

1. Core: Thermoplastic material that meets performance characteristics specified when fabricated into composite assembly.
2. Face Sheets: Aluminum alloy 3105 H14, 0.020 inch thick, with a fluorpolymer paint finish.
3. Thickness: 4 mm (0.157 inch).

2.03 PRODUCT PERFORMANCE

A. Fire Performance:

1. ASTM E84- Flame Spread 0, Smoke Developed 0.
2. ASTM E162 - No surface flaming.
3. No flame spread along interior face of penetration through the wall assembly.

B. Bond Integrity: When tested for bond integrity, in accordance with ASTM D 1781 (simulating resistance to panel elimination), there shall be no adhesive failure of the bond between the core and the skin or cohesive failure of the core itself below the following values:

1. Peel Strength:
   a. (22.5 in lb/in) as manufactured.
   b. (22.5 in lb/in) after 8 hours in water at 200 degrees F.
   c. (22.5 in lb/in) after 21 days soaking in water at 70 degrees Fahrenheit.

2.04 FINISH

A. Coil coated KYNAR 500 or Hylar 5000 based polyvinylidene fluoride (PVDF) resin in conformance with the following general requirements of AAMA 2605.

1. Color: Custom color as selected by Architect/Project Engineer.
2. Coating Thickness: 1.0 mil (plus or minus 0.1 mil).
3. Provide PVDF – 3 Coat Finish.

B. Hardness: ASTM D-3363; F minimum using Eagle Turquoise Pencil.

C. Impact Resistance:

1. Test Method ASTM D-2794: Gardner-SPI Modified Variable Height Impact Tester with 5/8 inch mandrel.
   a. Coating shall withstand reverse impact of 1.5 inch/pounds per mil

substrate thickness.

b. Coating shall adhere tightly to metal when subjected to number 600 Scotch Tape pick-off test. Slight minute cracking permissible. No removal of film to substrate.

D. Adhesion: Test Method ASTM D-3359; Coating shall not pick off when subjected to an 11 inch by 11 inch by 1/16 inch grid and taped with number 600 Scotch Tape.

E. Humidity Resistance: Test Method ASTM D 2247; No formation of blisters when subjected to condensing water fog at 100 percent relative humidity and 100 degree F for 4000 hours.

F. Salt Spray Resistance: Test Method ASTM B-117; expose coating system to 3000 hours, using 5 percent NAC1 solution.

1. Corrosion creepage from scribe line: 1/16 inch max (1.6 mm).
2. Minimum blister rating of 8 within the test specimen field.

G. Weather Exposure-ASTM D822:

1. Coating shall show no cracking, peeling, blistering, or loss of adhesion after 2000 hours.
2. Chalking Resistance: ASTM D 4214. No chalk greater than #8 after ten years Florida exposure at 45 degree angle facing south.
3. Color Change: ASTM D 2244. Color change shall not exceed 5 NBS units after 10 years Florida exposure at 45 degree angle facing south.
4. Abrasion Resistance: ASTM D 968. Coating shall resist 65 (plus or minus 15) liters/mil minimum falling sand.
5. After 5000 hours in an Atlas Weatherometer, coating shall show no objectionable chalking or color change.

H. Chemical Resistance:

1. ASTM D-1308 utilizing 10 percent Muriatic Acid for an exposure of 15 minutes. No loss of adhesion or gloss and no color change.
2. ASTM D-1308 utilizing 20 percent Sulfuric Acid for an exposure time of 18 hours. No loss of adhesion or gloss and no color change.

2.05 PANEL ACCESSORIES

A. Stiffeners: Extruded aluminum sections secured to edge trim and bonded to rear face of aluminum composite panel with silicone, and of sufficient size and strength to maintain flatness of the panel within the specified tolerances. Stiffeners shall have a mill finish.

B. Sealant Systems: Sealant shall be in accordance with Section 07900 - Caulking and Sealant. Sealant color shall be as selected by Architect

C. Reveals at Panel: Joints shall be 1/2 inch wide nominal.

D. Fabrication flashing from .032 minimum thickness aluminum sheet. Where exposed to view finish to match adjacent panels. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non- hardening sealant.

2.06 FABRICATION

A. Fabricate panel units to dimensions indicated on the drawings based on an assumed

design temperature of 70 degrees F. Allow for ambient temperature range of time of fabrication and erection.

B. Fabricate panels in sizes shown using composite aluminum panel material and perimeter extrusion so that the panel thickness at the joinery is 1-1/2 inch. Completed panel shall be properly fabricated and designed so that no restraints can be placed on the panel which might result in compressive skin stresses. The installation detailing shall be such that the installed panels shall remain flat due to temperature changes and at all times remain water and wind tight. Oil canning or oil pillowing of panel surface is not acceptable.

C. Where practical, shop-fabricate units ready for erection. If not shop assembled, pre-fabricate components at the shop as required for proper and expeditious field assembly.

D. Design, fabricate, assemble and erect wall panel units, to be free of water leakage.

E. Provide stiffeners secure to rear face of panels mechanically retained to edge trim members, with spacing required by specific job wind loading.

PART 3- EXECUTION

3.01 INSPECTION

A. The Aluminum Composite Panel Installer/Fabricator shall examine supporting structure and conditions under which the work is to be erected and notify the Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 INSTALLATION - ERECTION

A. Install panels plumb, level and true and anchor in place as indicated on plans and shop drawings.

B. Do not install component parts which are observed to be defective, including warped, bowed, dented, abraded and broken members.

C. Do not cut, trim, weld or braze component parts during erection, in a manner which would damage finish, decrease strength, or result in a visual imperfection or a failure in performance of wall panels. Return component parts which require alteration to shop for re-fabrication or for replacement by new parts.

D. Metal Separation: Apply a coat of bituminous paint, concealed, on one or both surfaces wherever dissimilar metals would otherwise be in contact. Use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

E. Install structural support system provided under this section. Align properly to receive wall system. Support system to be installed to the same tolerance as required of the panel system.

F. Anchor component parts of the metal wall securely in place, providing for necessary thermal structural movement.

G. No exposed fasteners except as shown on architectural drawings.

H. Penetrations required by other trades shall be performed by the Aluminum Composite System Installer/ Fabricator.

I. Remove protective film as soon as possible after surrounding material has been installed and panel joints and been caulked.

3.03 ADJUSTING

A. Repair panels with minor damage such that repairs are not discernable at a distance of 10 feet.

B. Remove and replaced damaged panels that cannot be repaired as indicated.

3.04 CLEANING AND PROTECTION

A. Protect installed products from damage during construction and institute protective measures as required to protect installed panels from damage due to work of other trades.

B. Clean panels in accordance with panel manufacturer's instructions prior to final inspection.

END OF SECTION

SECTION 07 42 65 THERMAL AND AIR BARRIER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes:

1. Requirements for a thermal and air barrier wall system for exterior cold-formed metal wall assemblies.
2. Requirements for sloped roof insulation.

B. Related Sections:

1. Section 05 40 00 Cold-Formed Metal Framing: Load-bearing, metal exterior wall framing assemblies.
2. Section 09 29 00 Gypsum Board: Interior gypsum board wall finish.

1.02 SUBMITTALS

A. Submit shop drawings for system. Include plans, elevations, and details indicating connections to adjoining work.

B. Product Data: Submit manufacturer's product data and installation instructions for each thermal wall and air barrier system component product required.

C. Submit manufacturer’s letter showing installer is a certified installer

D. Reports:

1. Submit Test Reports, summarized by Manufacturer of material(s), verifying qualities of thermal and air barrier wall system components meet or exceed specified requirements.
   a. Include results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.
   b. Include mill certificates indicating steel framing sheet complies with the specified requirements.
2. Submit Field Inspection and Test Reports in accordance with Field Quality Control requirements.

E. Samples:

1. Submit following material samples:
   a. Insulation panel, 12 inches square.
   b. Insulation fasteners/washers and joint flashing tape, one each.
   c. System: Submit a 3 foot square sample showing the entire thermal and air barrier system.

1.03 QUALITY ASSURANCE

A. Exterior Insulated Sheathing, Spray Foam Wall Insulation, and all related accessories shall be a complete system by one manufacturer.

B. Spray Polyurethane Foam Installation: Spray polyurethane foam applicator shall be certified by Thermal and Air Barrier Wall System manufacturer.

C. Applicator Qualifications:

1. The air barrier Applicator shall be, during the bidding period as well as for the duration of the installation, officially recognized as a Certified Installer by the manufacturer. The Applicator shall carry liability insurance and bonding.
2. Each worker who is installing air barriers must be either a Certified Applicator.
3. Each Lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Lead Certified Applicators shall perform or directly supervise all air/vapor barrier work on the project.

1.04 SYSTEM DESCRIPTION

A. Furnish and install an exterior wall system that effectively controls thermal, air and water performance and provides continuity of the building envelope enclosure. The system shall include the following:

1. Insulated sheathing secured to the exterior of the wall assembly.
2. Spray polyurethane foam applied to the interior wall cavity.
3. Joint, penetration and gap sealing material for sealing component joints, penetrations through the wall system and gaps between the building envelope enclosure components and wall opening frames.

B. Performance Characteristics:

1. Thermal Performance:
   a. Exterior Insulation: ASTM C518, Stabilized R-value of 6.5 per inch of thickness with a minimum six month exposure capability to outdoor elements and 15 year thermal warranty.
   b. Inter Spray Polyurethane Foam: ASTM C518, 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 45 degree F ambient and substrate application temperature is R6.4/inch and 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 60 degree substrate and ambient application temperature is R6.1/inch.
      1) Core Density: ASTM D1622, Nominal 2.0 pcf.
      2) Acceptable adhesion to substrate based on specific minimum application temperature.
2. Air Barrier Performance: When tested in accordance with ASTM E2357, at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2 L/sm2) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25psf.
3. Water Penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.
4. Mold Resistance: Thermal wall and air barrier system components shall provide non-food source for fungal growth.

C. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:

1. Exterior Insulation:
   a. Class 1 (less than and or equal to 25 flame Spread Index and less than 450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
   b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.
2. Spray Polyurethane Foam:
   a. Class 1 (less than and or equal to 25 flame Spread Index and less than 450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
   b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.
3. System complies with ASTM E2357-05: Test Method for determining Air Leakage of Air Barrier Assemblies.
4. System complies with NFPA 285-06: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.

D. Fire Resistance:

1. System complies with NFPA 285 2006: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
2. Fire-stopping measures, per code, should be included at the floor line in the stud cavity when the wall assembly extends beyond the edge of the floor line.

E. All joints, penetrations and gaps of the thermal and air barrier wall system shall be made watertight and air-tight.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver thermal wall system materials in manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.

B. Store, protect and handle thermal wall system materials in accordance with the manufacturer's recommendations to prevent damage, contamination and deterioration. Keep materials free of dirt and other foreign matter.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Install thermal wall system work only when weather conditions are in compliance with manufacturer's specific environmental requirements and conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

B. Spray Polyurethane Foam:

1. Do not proceed with installation of spray polyurethane foam until sheathing substrate construction is complete and openings and penetrating items have been installed and sealed.

2. Do not proceed with installation of spray polyurethane foam until substrate surface temperatures accepting the spray polyurethane are above the manufacturer's recommended minimum surface temperatures.
3. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
4. Do not apply spray polyurethane after the 6 months expiry date printed on the label of each container.
5. Ventilate area to receive spray polyurethane foam by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions
6. Provide temporary enclosures to prevent spray and noxious vapors from contaminating air beyond application area.
7. Protect workers as recommended by spray polyurethane foam manufacturer.
8. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
9. Dispose of waste foam daily in location designated by Engineer and empty drums in accordance with foam manufacturer's instructions.

1.07 WARRANTY

A. Submit the following warranties:

1. Exterior insulation warranty: Six month exposure and 15 year thermal warranty.
2. Flashing Tape: Limited Warranty.
3. Spray Polyurethane Foam: Limited Warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of design is the THERMAX Wall System by The Dow Chemical Company http://building.dow.com/na/en/thermaxtws/consider/index.htm. Provide entire system or equal system by others.

B. Exterior Insulated Sheathing: Acceptable Products: The Dow Chemical Company "THERMAX Exterior Insulation" or equal system.

1. Panel size: 4'-0" wide x 8'-0" or 12'-0" long, square edge.
2. Wall Panel: Thickness and Stabilized R-Value: Nominal 0.625 inch thickness, R-4.1
3. Wall Panel (Alternate): Thickness and Stabilized R-Value: Nominal 1.55 inch thickness, R-10.1
4. Roof Panel: Thickness and Stabilized R-Value: Nominal 4.0 inch thickness, R-25.5.

C. Spray Foam Wall Insulation: The Dow Chemical company "STYROFOAM Spray Polyurethane Foam CM2060 or CM2045 or equal system.

1. Formulation required will be dependent upon surface temperature of substrate. Refer to manufacturers recommendations.
   a. Styrofoam Spray Polyurethane Foam CM2045:
      1) Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.

2) Maximum/Normal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: R9.2.

b. Styrofoam Spray Polyurethane Foam CM2060:
1) Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.4/inch.
2) Maximum/Normal 1.5 inch thickness: Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: R9.6.

2.02 MATERIALS

A. Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed white or blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:

1. ASTM C1289 Type 1, Class 1.
2. Compressive Strength (ASTM D1621): 25 psi, minimum.
3. Long-Term Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): R-6.5 per 1 inch, RSI 1.06 per 25 mm of thickness with 15 year thermal warranty.
4. Flexural Strength (ASTM C203): Minimum 40 psi.
5. Water Absorption (ASTM C209): Maximum.1.0 percent by volume.
6. Water Vapor Permeance (ASTM E96): Less than 0.3 perms.
7. Maximum Use Temperature: 250 degrees F.

B. Spray Polyurethane Foam Air Barrier: Two-component spray polyurethane cellular plastic foam, complying with the following methods and meeting the following physical properties:

1. Core Density (ASTM D1622): Nominal 2pcf
2. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.
3. Flame Spread (ASTM E84, Class A): 25 or less.
4. Smoke Developed (ASTM E84, Class A): 450 or less.
5. Compressive Strength minimum (ASTM D1621, 10 percent parallel to rise): 25 psi.
6. Closed Cell Content (ASTM D2856): minimum 90 percent.
7. Water Absorption by Volume maximum. (ASTM D2842): 5.0 percent.
8. Water Vapor Permeability maximum. (ASTM E96): 3.0 perm-inches.

C. Accessories:

1. Fasteners: Provide insulated sheathing manufacturer's recommended organic-polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
   a. Acceptable Products: Wind-lock Corporation "ci-Lock Steel Series Selection" with 1-3/4 inch diameter high-grade plastic washers.
2. Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through the insulation layer.
   a. Acceptable Products: The Dow Chemical Company "Weathermate Straight Flashing 4 inch width high-density polytheylene (HDPE) film facer with 100 percent butyl rubber adhesive.

3. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
   a. Acceptable Products: The Dow Chemical Company "Weathermate Straight Flashing 6 inch and 9 inch", high-density polytheylene (HDPE) film facer with 100 percent butyl rubber adhesive, at straight opening heads, jambs and sills.

   b. When greater widths are required for through wall flashings 100 percent butyl rubber adhesive is recommended.
4. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
   a. Acceptable Products: The Dow Chemical Company "Great Stuff Pro Gaps & Cracks" single-component polyurethane insulating foam sealant.
   b. Acceptable Products: The Dow Chemical Company "Great Stuff Pro Window & Door" single-component polyurethane low-pressure foam sealant.
5. Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate.
6. Acceptable Products: The Dow Chemical Company "Weathermate Sill Seal" Foam Gasket.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.

   1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within thermal wall system alignment tolerances and requirements.
   2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
   3. Verify that items required to penetrate the thermal wall system are placed and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.
   4. Do not proceed with thermal and air barrier wall system installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSULATION INSTALLATION

A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

   1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.

2. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8 inch from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 1.75 inches diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.

3. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.
4. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.
5. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
6. After base flashing, which may include a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing, install flashing 6 inch or 9 inch, high-density polytheylene (HDPE) film facer with 100 percent butyl rubber adhesive to the exterior sheathing and lapped over the top edge of the base flashing.

3.03 SPRAY POLYURETHANE FOAM INSTALLATION

A. Preparation:

1. Mask and cover adjacent areas to protect from overspray.
2. Apply primers for special conditions as recommended by manufacturer.
3. Cover wide joints with transition sheet membrane as specified in Section 07 27 50.
4. Clean work area prior to application of sprayed insulation.
5. Verify substrate temperature meets manufacturer's requirements for specific formulations used.
6. Ensure that all stud cavity fire-stopping is installed prior to application of spray foam.

B. Application: Spray apply polyurethane foam in accordance with ASTM C1029 and manufacturer's installation guidelines; complying with preparation methods listed.

1. Apply spray polyurethane foam by picture framing around the interior studs at the insulated sheathing - steel stud interface and one pass across all board joints and penetrations
2. Finish applying spray polyurethane foam with one pass not exceeding 1.5 inches in thickness. Two passes are acceptable to reach maximum thickness of 1.5 inch.
3. Avoid formation of sub-layer air pockets.
4. Apply spray polyurethane foam in overlapping layers, in a manner to obtain a smooth, uniform surface. Total thickness as indicated.
5. Maintain 3 inch clearance around heating vents, recessed lighting fixtures, and other heat sources.
6. Do not apply spray polyurethane foam to inside of exit openings or electrical junction boxes.
7. Maintain a continuous layer of spray foam from floor to floor to roof to complete air barrier.
8. Site Tolerances: Maximum Variation in Applied Thickness - minus 1/4 inch plus 5/8 inch.

3.04 CLEANING AND PROTECTING

A. Remove overspray from non-prescribed surfaces in accordance with manufacturer's instructions and without causing damage to surfaces.

B. Protect installed system in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 61 00 SHEET METAL ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes factory formed, prefinished standing seam metal roof panels with concealed fasteners and related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing, underlayment and attaching devices as shown and / or required for a complete weathertight metal roofing system.

1.02 RELATED SECTIONS

A. Section 07 42 45 - Aluminum Composite Panel System

B. Section 07 42 65 Thermal Air Barrier Systems

C. Section 09 05 15 - Color Design.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM 1592-95 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

B. Underwriters Laboratories (UL Classified Tests):

1. UL 580 - Test for Wind-Uplift Resistance of Roof Assemblies.
2. UL 790 - Test for Fire Resistance of Roof Covering Materials.
3. UL 2218 - Impact Resistance Test.

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. SMACNA Architectural Sheet Metal Manual.

1:04 SYSTEM DESCRIPTION

A. Performance Requirements: Provide sheet metal roofing that has been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer's performance criteria without defects, damage, failure of infiltration of water.

1. UL 90 Rating (minimum): Wind Uplift Approval Conforming to Underwriters Lab. (UL) Section 580 Specifications and Complying with 2006 International Building Code requirements and local codes, whichever are more stringent. Comply with IBC and local Hurricane Wind Zone requirements
2. Static Air Infiltration: Completed roof system shall have a maximum of .06 cfm/sf with 6.24 kPa air pressure differential as per ASTM E283/1680.
3. Water Infiltration: No evidence of water penetration at an inward static air pressure differential of not less than 6.24 psf (43 kPa) and not more than 12.0 psf (83 kPa) as per ASTM E331/1646.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of roofing material and accessory required.

B. Shop Drawings: Submit detailed drawings showing layout of panels and fasteners, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing terminations, and penetrations of metal work. Indicate material type, Thickness, finish and color.

C. Samples: Submit a two-foot by two-foot representative sample of each type of panel and accessory indicating panels, standing seams, closure, edge trim and flashing complete with factory finish and color if product is not one of those specified.

D. Certification: Submit certification prepared, signed, and sealed by a Professional Engineer registered in the State of Mississippi, verifying that roof system meets or exceeds wind uplift requirements as specified herein.

E. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1646 and ASTM E-1680.

F. 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.

G. Submit written proof from manufacturer that installer is approved to install their materials.

H. Submit executed Warranty per Section 01 77 00 – Closeout Procedures for Owner's signature.

1.06 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. Installer: Company specializing in Architectural Sheet Metal Products, with five (5) years minimum experience, who has completed work similar to that indicated for this project and with a record of successful in-service performance. 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. Installer shall be approved by the roofing manufacturer in writing to install their materials.

1.07 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness. Panels should be stored on edge in a clean, dry place. One end shall be elevated to allow moisture to run off. Panels with strippable film must not be stored in the open exposed to the sun. Stack all materials to prevent damage and to allow for adequate ventilation.

1.08 WARRANTY

A. Paint Finish: Paint finish shall have a 20-year guarantee against cracking, peeling and fade (Not to exceed 5 N.B.S. units).

B. Weather Tightness: The entire installation (clips, panels, fasteners, rakes, eaves, ridge/valley flashing conditions, 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. This warranty shall be identified as neither Non-Depreciating, Non-prorated, (No Dollar Limit) nor have exclusions that identify valleys, curbs, and flashings. Provide written warranty, signed by metal roofing manufacturer and his authorized installer, agreeing to replace / repair defective materials and workmanship during the warranty period with NO COST to the Owner. Warranty period begins at the Date of Completion as determined by MDOT.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Petersen Aluminum Corp., 1005 Tonne Road, Elk Grove Village, IL 60007. Tel: (800) 323-1960.

B. Equivalent products by the following manufacturers are acceptable:

1. ACI Building Systems, Inc., Batesville, MS Tel. 662-563-3613.
2. Architectural Metal Systems, Eufaula, AL. Tel. (334) 687-2032.
3. Englert, Inc., Perth Amboy, NJ, Tel: (732) 826-8614.
4. Firestone Metal Products, Jackson, MS, Tel: (800) 426-7737.
5. MBCI, Hernando, MS, Tel: (800) 206-6224.

C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 62 14-Product Options and Substitution Procedures.

2.02 SHEET MATERIALS

A. Materials: Sheet Steel shall be PAC-CLAD 24 gage-minimum, G-90 Galvanized ASTM A 653, or (24 gage-minimum, prefinished Galvalume ASTM 792 Grade 50B with an AZ-50 coating).

B. Finish: Finish shall be PPG Duranar ULTRA-Cool IR or equal coating applied by the manufacturer on a continuous coil coating line. Top side dry film thickness of 0.5 mil clear coat over 0.75 mil fluoropolymer topcoat, over 0.20 mil prime coat, to provide a total dry film thickness of 1.45 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the finish supplier.

1. Minimum energy performance of the roof material and finish shall be: Outside shortwave (solar) absorptivity, 0.75 maximum, Reflectance of 0.25 minimum, Outside longwave (thermal) emissivity, 0.85, Inside shortwave absorptivity, 0.45, and Inside longwave (thermal) emissivity, 0.85

C. Color: Shall be as indicated in Section 09 05 15 for color selection. Color design selected from standard and premium colors of Petersen Aluminum. Equivalent systems, if submitted, Shall Match Selected Color.

D. Film: Strippable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film shall be removed before installation.

2.03 ACCESSORY MATERIALS

A. Concealed fastening clips: G-90 galvanized steel, spaced 18-inches on center, unless closer spacing is required by design wind loads.

B. Fasteners: (TITE-LOC PLUS) galvanized steel, non-penetrating high performance clips for roofing application and UL Classified 90 rated (wind uplift) assemblies.

C. Sealant: Extruded vinyl weatherseal

D. Underlayment: Peel and Stick Membrane shall be installed over entire roof substrate. Membrane shall be equal to Certainteed Wintergard™ HT, Grace Ice & Water shield HT, Henry Blueskin® PE 200 HT, or Imetco DryDek™. Provided underlayment must be approved and warranted as part of the complete roofing system.

2.04 FABRICATION

A. Panels: All panels shall be seamless. Panels beyond 60 feet must be manufactured at the project location by factory personnel using manufacturer's roll forming equipment.

B. Panels fabricated by a portable roll former will require Project Engineer / MDOT Architect's prior approval.

C. All exposed adjacent flashing and accessories shall be of the same material and finish as the roof panels. All flashing, hem exposed edges on underside 1/2 inch. Fabricate in accordance with standard SMACNA procedures and details. All roof sections requiring flashing less than 25 feet should be continuous lengths. Roof sections requiring closures greater than 25 feet shall be flashed using the fewest pieces possible.

2.05 PREFORMED METAL ROOFING SYSTEM:

A. Shall be Equal to Petersen Aluminum Corp. Tite-Loc Plus Panel system.

B. System shall include, but is not limited to the following components:

1. Standing Seam Metal Roof Panels with Striations.
2. Preformed Metal Valley Flashing.
3. Preformed Metal Hip Flashing.
4. Preformed Metal Vented Ridge Cap.
5. Concealed fastening clips and fasteners.
6. Miscellaneous Metal Trim Necessary for a Complete System Installation.

C. Tite-Loc Plus Panel roof panels with striations shall have 12 inches on center maximum seam spacing, roll-formed in continuous lengths from eave to ridge, with a minimum standing seam height of 2 inches.

D. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1646 and ASTM E-1680.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine trusses to ensure proper attachment to framing.

B. Inspect roof structure to verify deck is clean and smooth, free of depressions, waves or projections, properly sloped to valleys or eaves.

C. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

D. Installer shall examine substrate and conditions under which Work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF UNDERLAYMENTS

A. Install using methods recommended by manufacturer in accordance with local building code.

B. Peel and Stick Membrane: Install one layer of membrane lapped, staggered, and applied horizontally from eave to ridge over approved roof substrate. Run membrane underlayment horizontally lapped so water sheds; secure in place. Lap ends 4 inches

minimum; stagger end laps of each layer 36 inches minimum. Repair or replace any torn membrane to maintain a continuous membrane ahead of installation of metal roofing.

C. Vent Pipes: At vent pipes, install a 24 inch minimum square piece of Peel and Stick Membrane lapping over roof deck underlayment; seal tightly to pipe.

C. Vertical Walls: At vertical walls, install leak barrier membrane extending 6 inches minimum up the wall and 12 inches minimum on to the roof surface lapping over roof deck underlayment.

D. Metal Drip Edge: At rake edges, install metal drip edge flashing over Peel and Stick Membrane and roof deck underlayment; set tight to rake boards; lap joints 2 inches minimum and seal with plastic cement; secure with nails.

3.03 INSTALLATION OF PANELS

A. Comply with Drawings, manufacturer's instructions, and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing roof panels.

D. Remove protective strippable film prior to installation of roof panels.

E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.

F. Install sealants for preformed roofing panels as specified on shop drawings.

G. Do not allow panels or trim to come into contact with dissimilar materials.

H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.

I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.

J. Thoroughly clean and touch-up areas scarred during installation with a touch-up paint approved by panel manufacturer. Only minor scratches and fastener heads shall be touched-up; all other damaged material shall be replaced.

3.04 CLEANING

A. Clean grease, finger marks, and stains from panels in accordance with manufacturer's recommendations.

B. Remove all scrap and construction debris from the site.

END OF SECTION

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Flashing and sheet metal work as indicated on the Drawings and provisions of this specification. The types of work include the following:

B. Metal flashing and counter flashing.

C. Gutter and downspouts.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit 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. 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.

C. Shop Drawings: Submit shop drawings showing layout, joining, profiles, and anchorage of fabricated work, including major counter flashing and expansion joint systems, and roof accessories; layouts at l/4 inch scale, details at 3 inch scale.

D. Qualification Data: Submit 2 copies for firms and persons that demonstrate capabilities and experience. Include a list with ten completed Project names and addresses, and name and addresses of Architects and Owners.

1.04 PROJECT CONDITIONS

A. Coordinate with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, with five (5) years minimum experience, who has completed sheet metal work similar to that indicated for this project and with a record of successful in- service performance.

B. Mock-Up: Prior to installing, construct mock-up to demonstrate aesthetic effects as well as qualities of materials and execution.

PART 2 - PRODUCTS

2.01 FLASHING AND SHEET METAL MATERIALS

A. Shall be 0.040-inch thick aluminum, mill finish. ASTM B209 (ASTM B 209M), 3003-H14.

1. Use where concealed from view only.

2.02 GUTTERS, DOWNSPOUTS, AND FLASHING

A. General: Shall be shop fabricated in accordance with SMACNA standards to sizes and profiles shown on the drawings. Pre-finished aluminum, minimum 0.040-inch thick, colors as selected, Kynar 500 (70 percent PVDF), 20 year coating. Equal to Petersen Aluminum Corp., Elk Grove Village, IL Tel. (800) 722-2523. Equivalent products by ACI Building Systems, Inc., Batesville, MS Tel. 662-563-3613 and Firestone Metal Products, Jackson, MS. Tel. (800) 426-7737 are acceptable.

B. Gutters: Shall be free floating design supported without penetration by suspension from a gutter cleat. Gutters shall be formed in continuous sections of profile and size indicated.

C. Gutter screen: Provide minimum 20-gage perforated stainless steel cleat/screen system as manufactured by NorthClad Rainscreen Solutions, or equal products by Gutter Trojan or Rhino Gutter Guard. Holes to be 3/8 inch minimum on a 1/2 inch stagger. Provide 8 inch wide cleanouts at 10’-0” on center. Provide 2 inch wide 16-gage minimum straps spaces at no more than 18 inches on center.

D. Downspouts: Provide round downspouts in sizes indicated. Fabricate brackets to match color, finish, and thickness of downspouts.

2.03 FASTENERS

A. Same metal as flashing / sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

B. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed; comply with FS TT-S-007, TT-S-00230, or TT-S-00l543.

C. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

3.02 ACCESSORIES INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, and with vapor barriers, roof insulation, roofing and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

B. Gutter supports shall be spaced at 48 inches on center, constructed of same material as gutters.

C. Downspout straps shall be spaced 6 feet on center maximum (minimum of 3 required per downspout).

D. Separate metal from incompatible metal or corrosive substrates by coating concealed surfaces with asphalt mastic as recommended by manufacturer.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances, which might cause corrosion of metal or deterioration of finishes.

B. 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.

C. Flashings and sheet metal with any 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 SECTION INCLUDES

A. Firestopping as indicated on the drawings, specified herein, and/or required for completion of the work. Firestopping shall be required at all rated fire and smoke "fire barrier" walls.

1.02 SUBMITTALS

A. Submit manufacturer's product data, specifications and installation procedures for each type of firestopping and accessory required. Submit detailed location where each will be used. Submit UL data for assemblies where shown on the Drawings.

1.03 QUALITY ASSURANCE

A. Penetrations and miscellaneous openings in rated fire and smoke "fire barrier" walls shall be protected in accordance with NFPA 101, Life Safety Code, Chapter 6, Features of Fire Protection. All openings for air-handling ductwork or air movement, pipes, conduits, bus ducts, cables, wires, air ducts, and ducts and similar building service equipment that pass through or penetrate in any way a rated fire or smoke "fire barrier" wall or floor shall be protected. All firestopping materials used shall conform to ASTM E814, ASTM E119, and UL 1479 and tested in accordance with NFPA 90A and NFPA 251 as part of a rated assembly.

1.04 FIRE AND SMOKE PARTITIONS AND RELATED ASSEMBLIES

A. Based on Underwriters Laboratories (UL) systems and tests and are designed in accordance with UL fire resistance ratings. Contractor shall comply with the applicable UL requirements for fire and smoke partitions and assemblies shown on the drawings.

B. Materials not conforming to these firestopping specifications shall not be used. Materials that are not UL rated and approved shall not be allowed. Materials containing asbestos are not acceptable and shall not be used in this project.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in manufacturer's original unopened containers and store in weathertight enclosure. Handle and store all materials so as to prevent inclusion of foreign materials, breakage or damage by water.

1.04 WORKMANSHIP

A. Materials and workmanship not conforming to provisions of the Specifications and manufacturer's printed instructions shall be rejected at any time during the course of the work. Rejected materials shall be removed from the site at the time of rejection. Rejected workmanship shall be corrected immediately after rejection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Hilti, Inc., Tulsa, OK. Tel. (800) 879-8000.
2. International Protective Coatings Corp., Hatfield, PA. Tel. (800) 334-8796.
3. 3M Fire Protection Products, Saint Paul, MN. Tel. (800) 328-1687.
4. United States Gypsum Company, Chicago, IL. Tel. (880) 874-4968.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SEALANT

A. Equal to Hilti, Inc. FS-One.

2.03 CAULKING AND PUTTY

A. Equal to 3M Brand Fire Barrier CP- 25 Caulk and Putty 303.

2.04 PENETRATION SEALANTS

A. Equal to 3M Fire Barrier Penetration Sealing Systems 7902 and 7904 series as required.

2.05 INSULATION

A. Equal to United States Gypsum Company “Therafiber” Safing Insulation, 4 pcf density, unfaced.

2.06 INTUMESCENT FIRESTOPPING

A. Equal to Hilti, Inc. FS-One, CP 642 and FS 657 Fire Block as required.

2.07 ACCESSORIES

A. Provide backing / filling materials, retainers, collars, clamps, sleeves, primers and other necessary items of types and duration required by regulatory requirements and / or as recommended by product manufacturer for the specific substrates, surfaces and applications.

2.08 FINISHES

A. Concealed locations: Manufacturer’s Standards.

B. Exposed to View Locations: “Custom” Colors as selected by Project Engineer / MDOT Architect unless Manufacturer’s Standards closely matches finish of penetrated surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of firestopping materials for small openings, cracks, crevices, and penetrations shall be in accordance with manufacturer's printed instructions.

B. Verify application required and location for each type of firestopping to be used and conform to manufacturer's exact instructions for specific applications.

C. After installation of all Work, including but not limited to ductwork, fire and smoke dampers, communication cabling, electrical conduit, etc., properly seal all openings, cracks, crevices and penetrations throughout the entire project, to maintain fire ratings shown.

D. Install fireproof sealant at all penetrations through rated walls and floors and at top and bottom on each side of rated walls.

E. Install approved metal sleeves with fireproof sealant at all communication and control wiring passing through rated walls throughout the entire project.

F. Install firestopping at fire and smoke walls and floors where construction passes through those areas.

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation of substrate surfaces to receive materials.

B. Sealant and joint backing (backer rod) materials and installation in the following general locations (even though not shown on the Drawings):

1. Exterior and interior wall joints, including control / expansion joints and abutting like or similar materials (in walls, ceilings, and roof construction) that have spaces between in excess of 3/16 inch (except where less restrictive tolerances are indicated or where the condition is specifically the responsibility of others).
2. Abutting dissimilar materials, exterior and interior.
3. Exterior and interior wall openings (including 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).
4. Joints in pavement and walks.
5. Other locations, not included above but, specifically required by manufacturers of installed materials / products (except that sealing materials for glazing are under provision of other Section.).

C. Accessories: Including, but not limited to, primer, cleaner, backer rod, bond breaker, and masking tape.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures and Section 09 05 15 – Color Design.

1.03 DEFINITIONS

A. Wherever the words "caulk" or "seal" occur, they shall be interpreted to mean "effectively seal the indicated joint with a material to render it air and watertight." "Caulk" shall indicate the use of the interior materials specified hereinafter and "Seal" shall indicate the use of the exterior materials.

1.04 WORK OF OTHER SECTIONS

A. Caulking and sealing may be performed as Work of other Sections when specified. However, all Work shall conform to the requirements of this Section.

1.05 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of sealant required. Product data shall include chemical characteristics, limitations, and color availability.

1.06 QUALITY ASSURANCE

A. Applicator: Company specializing in the work of this Section with minimum 3 years documented satisfactory experience.

B. Manufacturer's Certificate: Provide manufacturer's letter of certification that products meet or exceed specified requirements and are appropriate for uses indicated.

C. Installation: Conform to Sealant and Waterproofers Institute requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver caulking and sealant material to the site in original unopened packages with manufacturer's labels, instructions and product identification and lot numbers intact and legible.

B. Store materials under cover, protected from inclement weather and adverse temperature extremes, in original containers or unopened packages, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438. Tel: (800) 523-6688.

B. Equivalent products by the following manufacturers are acceptable:

1. Dow Corning Corporation, Midland, MI. Tel: (800) 322-8723
2. GE Silicones, Waterford, NY. Tel: (518) 233-2639.
3. Sonneborn Building Products, Shakopee, MN. Tel: (800) 433-9517.
4. Tremco, Inc., Beachwood, OH. Tel: (800) 562-2728.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SEALANT TYPES AND USE SCHEDULE

A. Type 1: Use for interior locations, sealing around 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.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Open cell polyurethane foam or closed cell polyethylene foam, compatible with sealant, sized and shaped to provide proper compression upon insertion in accordance with manufacturer's recommendations.

D. Bond Breaker: Pressure sensitive adhesive polyethylene, TEFLON, or polyurethane foam tape.

E. Masking Tape: Pressure sensitive adhesive paper tape.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer must examine areas and conditions under which this Work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

A. Cleaning: Clean joint surfaces, using joint cleaner as necessary, to remove dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, frost or other matter that might adversely affect adhesion of sealant. Rake joints out to a depth equal to one-half the width.

B. Masking: Mask areas adjacent to joints.

C. Priming: If required, prime substrate surfaces following manufacturer's instructions.

D. Mixing: When required, mix components of sealant materials in accordance with manufacturer's instructions to achieve required characteristics of sealant.

3.03 APPLICATIONS

A. Mixing, application, surface condition, weather condition shall be as recommended by the manufacturer. Do not use material that has exceeded the recommended pot life.

B. Install backing material in joints using blunt instrument to avoid puncturing. Do not twist the backing rod while installing. Install backing rod so that joint depth is 50 percent of joint width, but a minimum of 1/8-inch deep and a maximum of 3/8-inch deep.

C. Apply sealant in joints using a pressure gun with nozzle cut to fit joint width. Ensure sealant is deposited in a uniform, continuous bead without gaps or air pockets.

D. Tool joints to the required configuration within 10 minutes of sealant application. Remove masking materials immediately after tooling.

3.04 CLEANING AND REPAIRING

A. Do not allow sealant or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means necessary to eliminate evidence of spillage.

B. When using flammable solvents, avoid heat, sparks and open flames. Provide necessary ventilation. Follow all precautions and safe handling recommendations from the solvent manufacturer and pertinent local, state and federal regulations.

C. Leave finished work in a neat, clean condition with no evidence of spillovers onto adjacent surfaces.

D. Repair or replace defaced or disfigured finishes.

3.04 CURE AND PROTECTION

A. Cure sealant and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Sealant Supplier / Applicator shall advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at Time of Completion.

END OF SECTION

SECTION 07 95 00 PRE-COMPRESSED JOINT SEALANT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the Drawings and requirements of the Specifications. Preformed sealant shall be silicone, pre-coated, preformed, pre-compressed, self-expanding, sealant system.

1.02 RELATED SECTIONS

A. 03 30 00 Cast-In-Place Concrete

B. 03 41 10 Structural Precast Concrete

1.03 SUBMITTALS

A. Product Data: Provide product data sheets and all test reports.

B. Submit joint detail drawings indicating pertinent dimensions, general construction, details at joints between vertical and horizontal runs, etc.

C. Submit color samples for color selection.

1.04 QUALITY ASSURANCE

A. Product shall be certified by independent laboratory test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product shall meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals – equal to 200 mph winds (ASTM E330-02-procedure A).

B. Shall be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.

C. Shall be certified by independent laboratory test report to ASTM E90-09 and to meet or exceed an STC 52 in STC 56 wall and OITC 38 rating in an OITC 38 wall.

D. Shall be certified in writing to be:

1. Capable of withstanding 150 degree F for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (minus 50 percent of nominal material size) without evidence of any bledding of impregnation medium from the material.
2. The same sample after the heat stability test and after first being cooled to room temperature shall subsequently self-expand to the maximum of movement capability dimension of the basis of design product (plus 50 percent of nominal material size) within 24 hours at room temperature 68 degrees F.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in manufacturer's original, intact, labeled containers. Handle and protect as required to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's requirements.

1.06 QUALITY ASSURANCE

A. The general contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to the joints and their work cannot compromise the achievement of watertightness at the joints in any way.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on Seismic Colorseal manufactured by Emseal Joint Systems, Ltd., 25 Bridle Lane, Westborough, MA 01581, Tel: 800-526-8365

B. Equivalent products by the following manufacturers are acceptable:

1. MM ColorJoint / SIF Series by MM Systems Corp., 50 MM Way, Pendergrass, GA 30567, Tel: 866-506-6929.
2. VF Joint System by Construction Specialties, Inc., 6696 Route 405, Muncy, PA 17756, Tel: 800-233-8493

2.02 PRE-COMPRESSED JOINT SEALANT

A. Provide watertight exterior joints in all vertical and horizontal concrete joints in vertical-plane walls, including but not limited to joints between tilt up panels and joints between tilt up panels and other concrete structure elements including the roof panels/slab.

B. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.

C. Material shall be capable of movements of plus 50 percent, minus 50 percent (100percent total) of nominal material size.

D. Silicone external color facing to be factory applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement muse be created in the silicone coating. Silicone coating shall be available in a wide range of colors.

E. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification and structural requirements.

F. Material shall be supplied precompressed to less than the joint size, packaged in shrink wrapped lengths (sticks) with a mounting adhesive on one face.

G. Directional changes and terminations into horizontal plan surfaces shall be provided by factory manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg on each side of the direction change.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The contractor shall provide a properly formed and prepared joint openings.

B. The contractor shall clean the joints of all contaminants immediately prior to the installation of the joint system. Repair spalled, irregular or unsound joint surfaces. Remove protruding roughness to ensure joint sides are smooth.

C. Ensure there is sufficient depth to receive the full depth of the material being installed plus at least 1/4 inch for the application of corner beads.

D. Refer to manufacturer's installation guide for step by step instructions.

E. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

3.02 CLEANING AND PROTECTION

A. Protect the system and its components during construction.

B. Subsequent damage to the joint system shall be repaired per manufacturer's recommended procedures or replaced.

C. After work is complete, clean exposed surfaces with a suitable cleaner approved by the manufacturer that will not harm or attack the finish.

END OF SECTION

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hollow metal Work, including but not limited to, the following:

1. 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.

1.02 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 08 14 00 - Wood Doors.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing.

E. Section 09 05 15 - Color Design.

F. Section 09 90 00 - Painting and Coatings.

G. Under the Alternate, exterior doors and frames shall refer to Section 08 11 14 Windstorm Impact Resistant Steel Doors and Frames – Alternate.

1.03 QUALITY ASSURANCE

A. In addition to complying with all pertinent codes and regulations, manufacture labeled doors in accordance with specifications and procedures of Underwriters' Laboratories, Inc. In guarantee and shop drawings, comply with nomenclature established in American National Standards Institute publication A123.1, latest edition, "Nomenclature for Steel Doors and Steel Door Frames".

B. Work is subject to applicable portions of the following standards:

1. ANSI A115 "Door and Frame Preparation for Door Locks and Flush Bolts", American National Standards Institute.
2. ANSI A123.1 "Nomenclature for Steel Doors and Steel Door Frames", American National Standards Institute.
3. NFPA 80 "Fire Doors and Windows", National Fire Protection Association.
4. NFPA 101 "Life Safety Code", National Fire Protection Association.

C. Hollow metal doors and frames shall comply with the specifications for Custom Hollow Metal Doors and Frames, National Assoc. of Architectural Metal Manufacturers (NAAMM) Standard CHM 1-74, and the Steel Door Institute, SDI 100-80.

D. For exterior doors and frames, comply with IBC and local Hurricane Wind Zone requirements for all gauges, anchors, etc. Provide Data To Indicate Compliance.

1.04 SUBMITTALS

A. Product Data: Submit schedule and manufacturer's technical product data / literature.

B. Provide data to indicate compliance with local Hurricane code requirements.

C. Shop Drawings: Shop drawings shall indicate door and frame elevations, frame configuration, anchor types and spacing, reinforcement, location of cut-outs for hardware, and glazing.

D. 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.

1.05 PRODUCT IDENTIFICATION

A. Deliver doors and frames and other work of this section properly tagged and identified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle all metal doors and frames in a manner to prevent damage and deterioration.

B. Provide packaging, separators, banding, spreaders, and individual wrappings as required to completely protect all metal doors and frames during transportation and storage.

C. Store doors upright, in a protected dry area, at least 4 inches off the ground and with at least 1/4 inch air space between individual pieces, protect all pre-finished and hardware surfaces.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Steelcraft Manufacturing Company, 9017 Blue Ash Road, Cincinnati, OH 45242 Tel. (513) 745-6400.

B. Equivalent products by the following manufacturers are acceptable:

1. Amweld Building Products, Inc., Garrettsville, OH. Tel. (330) 527-4385.
2. Ceco Door Products, Brentwood, TN. Tel. (615) 661-5030.
3. Republic Builders Products, McKenzie, TN. Tel. (901) 352-3383.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 FABRICATION

A. Fabricate hollow metal units rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Unless otherwise indicated, provide countersunk flat Philips or Jackson heads for exposed screws and bolts.

B. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping per final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware".

C. Locate finish hardware in accordance with approved shop drawings.

2.03 FRAMES

A. Frames for exterior openings 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. Frames for interior openings shall be commercial grade cold rolled steel conforming to ASTM A366-68 or commercial grade hot rolled and pickled steel conforming to ASTM A569-66T. Metal thickness shall be 16 gage minimum for frames in openings 4 feet or less in width; 14 gage minimum 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 on 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 inches by 10 inches minimum.
b. Strike reinforcements - 12 gage.
c. Flush bolt reinforcements - 12 gage.

d. Closer reinforcements - 12 gage.
e. Reinforcements for surface-mounted hardware - 12 gage.

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.

2.04 HOLLOW METAL DOORS

A. Doors shall be made of commercially quality, level, cold rolled steel conforming to ASTM A366-68 and free of scale, pitting or other surface defects. Face sheets for interior doors shall be18 gage minimum. Face sheets for 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.

B. Design and Construction: Doors shall be custom made, of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 13/4 inches unless otherwise noted. Doors shall be strong, rigid and neat in appearance, free from warp or buckle. Corner bends shall be true, straight and of minimum radius for the gage of metal used.

C. Stiffen face sheets with continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gage minimum, spaced 6 inches apart and securely attached to face sheets by spot welds 5 inches on center. Spaces between stiffeners shall be sound-deadened insulated full height of door with an inorganic non-combustible batt-type material.

D. Join door faces at their vertical edges by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

E. Top and bottom edges of doors shall be closed with a continuous recessed 16 gage minimum steel channel, extending the full width of the door and spot welded to both faces. 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.

F. Edge profiles shall be provided on both vertical edges of doors as follows:

1. Single-acting swing doors - beveled 1/8 inch in 2 inches.
2. Double-acting swing doors - rounded on 2-1/8 inch radius.

F. Hardware reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accord with the approved hardware schedule

and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closures, etc.) is to be applied, doors shall have reinforcing plates. Minimum gages for hardware reinforcing plates shall be as follows:

1. Hinge and pivot reinforcement - 7 gage.
2. Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gage.
3. Reinforcements for all other surface mounted hardware - 16 gage.

G. 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.

H. 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.

I. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum in any direction, including a diagonal direction.

2.05 LABELED DOORS & FRAMES

A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings, and as scheduled on Drawings. Such doors and frames shall be Underwriters' Laboratories, Inc. labeled or other nationally recognized agency having a factory inspection service.

B. When door or frame specified to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Project Engineer / Architect shall be advised before fabricating work on that item is started.

2.06 HARDWARE LOCATIONS

A. Hinges:

1. Top – 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.
4. 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. Unit and integral type locks and latches – 3’- 2” to centerline of knob.

C. Deadlocks – 5’- 0” to centerline of cross bar.

D. Panic hardware – 3’-1” to centerline of cross bar.

E. Door pulls – 3’-6” to center of grip.

G. Push-pull bars – 3’-1” to centerline of bar.
H. Arm pulls – 3’-11” to centerline.

I. Push plates – 4’- 0” to centerline of plate.

J. Roller latches – 3’-9” to centerline.

K. All of the above dimensions from paragraph 2.07(B) through 2.07(J) are from finished floor and shall comply with ADA and AHJ requirements.

2.07 CLEARANCES

A. Edge clearances:

1. Between doors and frame, at head and jambs - 1/8 inch.
2. At door sills: where no threshold is used - 1/4 inch maximum above finished floor; where threshold is used - 3/4 inch maximum above finished floor.
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 INSPECTION

A. Examine areas and conditions where hollow metal Work is to be installed and notify Project Engineer of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hollow metal units and accessories in accordance with approved Shop Drawings, manufacturer's data, and Specifications.

B. Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or masonry construction. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

C. Placing frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. At wood stud partitions, attach wall anchors to studs with tapping screws. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
2. Make field splices in frames as detailed on final Shop Drawings, welded and finished to match factory work.
3. Remove spreader bars only after frames or bucks have been properly set and secured.
4. Door installation: Fit hollow metal doors accurately in their respective frames, with the following clearances:
   a. Jambs and head: 3/32 inch.
   b. Meeting edges, pairs of doors: 1/8 inch.
   c. Bottom: 1/4 inch, where no threshold or carpet.
   d. Bottom: at threshold or carpet: 1/8 inch.
   e. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

END OF SECTION

SECTION 08 11 14 WINDSTORM IMPACT RESISTANT STEEL DOORS AND FRAMES - ALTERNATE

PART 1- GENERAL

1.01 SECTION INCLUDES

A. This Section includes requirements for exterior steel doors and frames designed to meet tornado and hurricane resistant requirements of FEMA 361.

1.02 RELATED SECTIONS

A. Section 03 41 10 – Structural Pre-Cast Concrete

B. Section 06 10 00 – Rough Carpentry

C. Section 00 87 00 – Hardware

D. Section 00 90 00 – Painting and Coatings

E. Section 08 43 14 – Windstorm Impact Resistant Aluminum Storefront & Glazing-Alternate

1.03 SUBMITTALS

A. Submit manufacturer's brochures, technical data, installation, maintenance and operating instructions.

B. Submit Shop drawings indicating door and frame elevations, frame configuration, anchor types and spacing, reinforcement, location of cut-outs for hardware, and glazing.

C. Submit test data and calculations substantiating that materials and products comply with requirements of this Section and project requirements.

1.04 QUALITY ASSURANCE

A. Steel Doors and Frames shall meet all standards as established by the following:

1. Door and Hardware Preparation ANSI 115.
2. Life Safety Codes NFPA-101 (Latest edition).
3. Fire Doors and Windows NFPA-80 (Latest edition).
4. Steel Door Institute ANSI/SDI-100 (Latest edition)
5. Underwriters Laboratories UL10B fire testing.
6. FEMA 361 Design and Construction Guidance for Community Shelters , Second Edition, August 2008

B. Installer shall be experienced in the installation of doors and frames in accordance with FEMA 361 and shall have completed projects similar to the work of this project.

C. Steel Doors and frames shall be manufactured to high quality standards in manufacturing facilities with annual certified conformance to ISO9001.

D. The contractor shall hold a pre-installation meeting to include the Installer, Hardware Supplier, Architect and Owner. Coordinate to occur with monthly progress meeting.

1.05 DELIVERY, STORAGE AND HANDLING

A. Doors and frames must be properly marked with door opening mark number to correspond with the schedule.

B. Deliver all steel doors with corrugated edge protection and palletized to provide protection during transit and job storage.

C. Inspect doors and frames upon delivery for damage. Minor damage shall be repaired, provided the repair is equal to new work and acceptable to the architect.

D. Store doors and frames at the job site under cover. Place units on wood sills on the floor in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity chamber. If the wrapper on the door becomes wet, remove the carton immediately. Provide a 1/4 inch space between stacked doors to promote air circulation.

PART 2- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide doors and frames equivalent to Ceco 1-3/4 inch Storm Pro 361 Tornado Resistant Door and Frame with Multi Point Exit Device.

B. Equivalent products by the following manufacturers are acceptable:

1. Curries Company Storm Pro 361 Door and Frame Series
2. Steelcraft Paladin PW 14 Door and FP 14 Frame Series

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 DOORS

A. Sheets are to be made of commercial quality hot dipped zinc coated 14-gage cold rolled steel face sheets with a 12-gage liner that complies with ASTM A924 A60. Doors shall be reinforced, stiffened, insulated, and sound deadened with continuous 20-gage vertical steel stiffeners space not more than 6 inches apart. The stiffener ends shall be welded together at the top and bottom ends.

B. Vertical edges will join the face sheets by a continuous weld extending the full height of the door. Welds are to be ground and filled to make them invisible and provide a smooth flush surface.

C. Hinge reinforcement to be full height reinforcement channel not less than 14-gage. Exit devices reinforcement to be not less than 14-gage. Door closers reinforcement to be not less than 12-gage.

D. Reinforce tops and bottoms of all doors with an inverted continuous steel channel not less than 14 gage, extending the full width of the door and welded in place. Doors shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are NOT acceptable.

E. Doors are to be completely filled with rigid foamed-in-place polyurethane core chemically bonded to all interior surfaces.

F. All doors to conform to ANSI-A250.4 Level “A” criteria and shall be tested to 1,000,000 operating cycles and 23 twist tests. Certification of Level “A” doors is to be submitted with approval drawings.

2.03 FRAMES

A. Materials:

1. To be 14-gage hot dipped zinc coated steel that complies with ASTM designations A924 A60.
2. All frames are to be assembled so that the face miter seam is “closed and tight”. Weld the face seam, grind and dress the weld area smooth. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.
3. Frame assembly for both single doors and paired openings, shall be tested and must comply with the FEMA 361 Design and Construction Guidance for Community Shelters and have available verifiable third party conformance test results.

B. Fabrication

1. Provide steel frames for doors to the size and design as shown on the architectural drawings.
2. All finished work shall be strong and rigid, neat in appearance, square, true and free of defects.
3. Jamb depths, trim, profile and backbends to be as scheduled and shown on approved shop drawings.
4. Hardware reinforcements shall be in accordance with the minimum standard gages as listed in SDI-100.
5. Frames shall be mortised, reinforced, drilled and tapped at the factory for template mortised hardware only, in accordance with approved hardware schedule and template provided by the hardware contractor. Where surface mounted hardware is to be applied, frames shall have reinforcing plates only, all drilling and tapping to be done in the field by others.
6. Hinge reinforcement to be not less than 7-gage.

C. Anchors:

1. Anchors for masonry walls to be of the masonry “T” type. Quantity of anchors installed as required for system performance.
2. Dust boxes/mortar guards to be no less than 26-gage.
3. All frames that are to be welded are to have a steel spreader during shipping and handling. Spreader bars are for bracing only and are not be used to size the frame opening.
4. Except on weatherstripped frames, drill the stop for 3 silencers on strike jambs of single frames and 2 silencers on heads of double door frames.

2.04 HARDWARE PREPARATION

A. Locate hardware on doors and frames in accordance with the system manufacturer’s specific location.

B. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.

C. Doors shall be mortised, reinforced and function holes provided at the factory in accordance with the hardware schedule and templates provided by the hardware supplier. Through bolt holes, attachment holes, or drilling and tapping for surface hardware, shall be done by others in the field.

D. Provide all doors and frames receiving electrified hardware with wiring harness and concealed plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and electric hinge.

2.05 PERFORMANCE CRITERIA

A. Shelter entry doors and their frames shall resist the design wind pressures for components and cladding as described in Section 1 and the missile impact loads of Section 2 of the National Performance Criteria for Tornado Shelters Federal Emergency Management Agency Mitigation Directorate, latest edition. Only single opening and paired opening doors, and their frames, which can resist calculated design wind pressures and laboratory tested missile impacts, are acceptable.

1. Door systems, both single doors and paired openings, shall be tested and must comply with the FEMA 361 Design and Construction Guidance for Community Shelters and have available verifiable third party conformance test results.

B. All doors shall have sufficient points of connection to their frame to resist design wind pressure and impact loads. Unless specifically designed for, each door shall be attached to their frame with a minimum six points of connection.

2.06 FINISH

A. Doors and frames are to be cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory-applied coat of rust inhibiting primer. The finish to meet the requirements for acceptance stated in ANSI A224.1 “Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces.” The prime finish is not intended to be the final layer of protection from the elements. Field painting using a good grade of paint to be provided in accordance with the recommendations of the door and frame manufacturer. For specialty types of finished coatings, the paint supplier should also be consulted.

PART 3- EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions where hollow metal Work is to be installed and notify Project Engineer of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hollow metal units and accessories in accordance with approved Shop Drawings, manufacturer's data, and the requirements of this Section. Installation shall be in accordance with the requirements of FEMA 361 and related documents.

B. Frames:

1. Prior to installation, all frames must be checked for rack, twist and out of square conditions.
2. Fill frame jambs and head with mortar and install per manufacturers specific system installation instructions.
3. SDI-105, “Recommended Erection Instructions for Steel Frames” and SDI-110 “Standard Steel Doors and Frames for Modular Masonry Construction” shall indicate the proper installation procedures.

C. Doors

1. Install doors plumb and in true alignment in a prepared opening and fasten them to achieve the maximum operational effectiveness and appearance.
2. Proper door clearance must be maintained in accordance with SDI-110, maximum door undercut shall be 3/8 inch.
3. Where necessary, only metal hinge shims are acceptable to maintain clearances.
4. Install Doors per manufacturers specific system installation instructions and in accordance with “Installation Guide for Doors and Hardware” published by DHI is recommended for further details.
5. Hardware must be applied in accordance with hardware manufacturer’s templates and instructions.

3.03 CLEANING AND PROTECTING

A. Clean and protect doors and frames in accordance with manufacturer’s directions.

END OF SECTION

SECTION 08 14 29 PREFINISHED WOOD DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent and location of each type of wood door is shown on the Drawings and in Schedules. Louvers for wood doors, including furnishing and installation, are specified under this Section.

B. Types of doors required include solid core flush wood doors with veneer faces.

1.02 RELATED SECTIONS

A. Section 08 80 00 – Glazing.

B. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Product Data: Indicate door core material and construction; veneer species, type and characteristics.

B. Shop drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, identify cutouts for glazing and louvers, and installation instructions. Indicate by transmittal form that copy of each instruction has been transmitted to the installer

1.04 QUALITY ASSURANCE

A. Comply with the requirements of the following standards unless otherwise indicated.

B. Non-Fire Rated Wood Doors: AWI “Architectural Flush Doors” of the Architectural Woodwork Institute.

C. Fire-Rated Wood Doors: Where fire-resistance classifications are shown or scheduled for wood door assemblies, provide doors which comply with requirements of NFPA No. 80 "Standard for Fire Doors and Windows" and which have been tested and rated with single point hardware by UL. Provide UL Label on each door and panel.

1.05 PRODUCT 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. Manufacturer to provide a written warranty covering the life of the 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. Algoma Hardwoods, Inc., Algoma, WI. Tel. (800) 678-8910.
2. Marshfield Door Systems, Inc., Marshfield, WI. Tel. (800) 869-3667.
3. TruStile Doors, LLC, Denver, CO. Tel. (888) 286-3931.
4. VT Industries, Inc., Holstein, IA. Tel. (800) 827-1615.

C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS AND COMPONENTS

A. Wood Doors: Provide wood doors complying with the applicable requirements of AWI 8th Edition, Version 1.0, 2003 for the kinds and types of doors indicated and as further specified. Provide manufacturer's standard 2 ply face panels complying with AWI PC-5 ME, unless otherwise specified. Provide same exposed surface material on both faces of each door, unless otherwise indicated.

B. Fire-rated Doors: Provide exposed faces and edges to match non-fire-rated doors in the same area of the building, unless otherwise shown or scheduled. Provide trim for openings (if any) which have been tested and listed for the kind of door and rating indicated.

2.03 GENERAL FABRICATION REQUIREMENTS

A. Wood Doors: Cut and trim openings through doors and panels. Comply with applicable requirements of referenced standards.

B. Light Openings: Factory cut openings. Trim openings for non-fire rated doors with solid wood moldings of profile shown.

2.04 INTERIOR FLUSH WOOD DOORS

A. Core Construction: Solid core construction shall be solid wood block, wood particleboard, or mineral with wood lock blocks. Doors shall be Type II water resistant BCNO. Provide manufacturer's standard 2 face panels

B. Exposed Surfaces for Transparent Finish: Where solid core interior wood doors are shown or scheduled to receive a transparent finish, provide manufacturer's standard thickness face veneers complying with AWI 8th Edition, Version 1.0, 2003 of the following quality:

1. Custom Grade “A” face veneers of Plain Sliced Select Cherry.
2. Sharp contrast of shades shall NOT be permitted. Provide exposed edges and other exposed solid wood components of same species as face veneers.

C. Factory Finished Doors: Reference AWI Section 1300, G-21 and Section 09 05 15 Color Schedule.

D. Transom and Side Panels: Where transom panels or side panels of wood are shown in same framing systems as wood doors, provide panels that match quality and appearance of associated wood doors, unless otherwise indicated. Fabricate matching panels with same construction, exposed surfaces and finish as specified for associated doors.

2.05 PREFITTING AND PREPARATION FOR HARDWARE

A. Comply with tolerance requirements of AWI for pre-fitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware schedules and doorframe approved Shop Drawings and with hardware templates and other essential information required ensuring proper fit of doors and hardware. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall 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. Install fire-rated doors in corresponding fire-rated frames in accordance with the requirements of NFPA No. 80.

3.02 PREPARATION

A. Condition doors to average prevailing humidity in installation area prior to hanging.

3.03 INSTALLATION

A. Install wood doors in accordance with manufacturer's instructions and approved Shop Drawings. Fit doors to frame for proper fit and uniform clearance at each edge and machine for hardware. Seal cut surfaces after fitting and machining. Bevel non-fire rated doors 1/8 inch in 2 inches at lock and hinge edges. Bevel fire rated doors 1/16 inch in 2 inches at lock edge.

B. Door Clearances: Fit to frames and machine for hardware for proper fit and uniform clearance at each edge.

1. For non-fire rated doors, provide following clearances:

   a. 1/8 inch at jambs and heads.
   b. 1/8 inch at meeting stiles for pairs of doors.
   c. 1/2 inch from bottom of door to top of decorative floor finish or covering, except where threshold is shown or scheduled provide 1/4 inch clearance from bottom of door to top of threshold.

2. For fire-rated doors, provide clearances complying with limitations of authority having jurisdiction.

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 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

B. Related Sections:

1. Section 01 91 13 Commissioning
2. Section 07 92 00 Joint Sealants
3. Section 08 71 00 Door Hardware
4. Section 08 80 00 Glazing
5. Section 28 10 00 Electronic Access Control
6. Section 28 16 00 Intrusion Detection

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum framed storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to applicable Project area Codes, Laws, and Regulations.
   a. Refer to Structural drawings for Basic Wind Speed, Importance Factor, and Exposure Category of Project.

B. Storefront System Performance Requirements:

1. Wind Loads: Provide storefront system, including anchorage, capable of withstanding wind load design pressures, inward and outward, as calculated and required by Project area Codes, Laws, and Regulations.
2. Air infiltration: The test specimen shall be tested in accordance with ASEM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² at a static pressure differential of 6.24 psf.
3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.
4. Uniform Load: A static air design load of 65psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/180 of the span of any framing member. At a 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 0.4% of their clear spans shall occur.
5. Windborne Debris Impact Resistance Performance: Shall be tested in accordance with ASTM E 1886 and information in ASTME 1996 and / or AAMA 506
   a. Large Missile Impact: For aluminum framed systems located within 30 feet of grade.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installations for each type of aluminum storefront indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples: Submit two twelve inch long sections of extrusion of formed shapes in color indicated. Submit two six inch flat squares of color indicted showing any variations in color and texture of finish.

D. Product Test Reports: Submit certified test reports showing compliance with specified performance characteristics and local Codes, Regulations, and Laws.

E. Fabrication Sample: Of each vertical to horizontal intersection of aluminum framed systems, made from 12 inch lengths of full size components and showing details of the following:

1. Joinery including concealed welds
2. Anchorage
3. Expansion provisions
4. Glazing
5. Flashing and drainage

F. Door Hardware Schedule: Prepared by or under the supervision of the supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, security hardware, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An 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. Source limitations: Obtain aluminum framed storefront system through one source from a single manufacturer.

D. Pre-installation Conference: Conduct pre-installation conference at the project site to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.

1. Warranty Period: Two years from Date of Substantial Completion of the project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacture'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 protection from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront materials against damage from elements, construction activities, and other hazards before, during, and after installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on Kawneer Company IR501 (Non-Thermal) Storefront System, center plane glazing, 2-1/2 inches x 5 inches. Tel. (770) 449-5555.

B. Equivalent products by the following manufacturers are acceptable:

1. Vistawall Architectural Products, Terrell, TX. Tel. (972) 551-6100.
2. Traco, Cranberry Township, PA. Tel (724) 776-7000.

C. Substitutions shall fully comply with the specified requirements and Section 01 62 14 Product Options and Substitution Procedures.

2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070 inch wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials to be non-corrosive and compatible with aluminum members, trim, hardware, anchors, and other components. Where exposed, fasteners shall be stainless steel.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions or zinc-coated steel complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

G. Glazing Systems:

1. Glazing: Insulated glass as specified in 08 80 00 Glazing.
2. Glazing gaskets: Manufacturer's standard compression types; replacable, extruded EPDM rubber.
3. Spacers and setting blocks: Manufacturer's standard elastomeric type.
4. Bond-Breaker tape: Manufacturer's standard TFE-flourocarbon or polyethylene material to which sealants will not develop adhesion.
5. Glazing Sealants: As recommended by manufacturer for joint type and as follows:
   a. Weatherseal sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural sealant, weatherseal-sealant, and aluminum framed system manufacturers for this use.

2.03 ENTRANCE DOOR

A. Equal to Kawneer 350 IR pair of doors, 1-3/4 inch deep with 3-1/2 inch vertical stiles and top rails and 10 inch bottom rails.

1. Square glass stops with an interior silicone seal for 9/16 inch laminated impact resistant glazing.
2. Single acting with offset pivots.
3. Tested to meet current codes, project area regulations and laws, requiring protection of openings in wind borne debris regions.
4. Dual moment limited lifetime warranty corner construction.
5. Finish shall match framing system.

2.04 HARDWARE (HW1A)

A. Top, bottom, and intermediate pivots: Cast aluminum alloy with steel pins and iolite bearings (ball bearing bottom pivots).

B. Adjustable astragal and bottom rail sweep. Sealair bulb polymeric weather stripping in door frames.

C. Overhead closers: Equal to LCN 4040 Parallel Arm with Cush-N-Stop and custom power coat metal cover to match frame.

D. Deadlocks: Mortised maximum security type, with 1 inch minimum length pivoted bolt, stainless steel strike.

E. Keyed cylinders: 5-pin tumbler, with cast aluminum face.

F. Magnetic Locks: Refer to section 28 10 00 Electronic Access Control and (Section 28 16 00 and Intrusion Detection

G. Pull Handles: Equal to Kawneer style CO-12 stainless steel US 32D.

H. Panic Device: Electrified Rim Exit by Sargent DG2 43 53 54 55 WS 8876-12v ETP, US32D.

I. Thresholds: Extruded aluminum in clear anodized finish, complete with anchors and clips, coordinate with pivots. Size and shape as indicated in the drawings.

2.05 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of all aluminum frame systems, refer to 07 92 00 Joint Sealants.

2.06 FABRICATION

A. Framing members, general: Fabricate components that, when assembled, have the following characteristics:

1. Profiles which are sharp, straight, and free of defects or deformations.
2. Accurately fit joints; make joints flush, hairline and weatherproof.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of lazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible.

B. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.07 ALUMINUM FINISHES

A. Factory finishing equal to Kawneer Permafluor (70% PVDF), AAMA 2605, Flouropolymer Coating.

B. Color: Bone White.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other build-in components to ensure a coordinated, weather tight installation.

1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

2. Adjacent Surfaces:
   a. Masonry surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   b. Wood framing/nailers: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
   c. Metal surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   d. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with drawings, shop drawings, and manufacturer's written instructions for installing aluminum framed storefront systems, accessories, and other components.

B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant for weather tight construction.

D. Install aluminum framed storefront sytem and components to drain condensation, water penetrating joints, and moisture migrating to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Field Tests: Refer to Commissioning Specification sections for testing requirements.

B. Manufacturer's field services: Upon Owner's request, provide periodic site visit by manufacturer's field service representative.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation and again just prior to Substantial Completion. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 43 14 WINDSTORM IMPACT RESISTANT ALUMINUM STOREFRONT AND GLAZING - ALTERNATE

PART 1 - GENERAL

1.01 SUMMARY

A. Work of this Section includes requirements for aluminum storefront framing, doors, glazing, and installation meeting the design requirements for FEMA 361 tornado and hurricane shelters.

B. Related Sections:

1. Section 01 91 13 Commissioning
2. Section 07 92 00 Joint Sealants
3. Section 08 71 00 Door Hardware
4. Section 08 80 00 Glazing
5. Section 28 10 00 Electronic Access Control
6. Section 28 16 00 Intrusion Detection

1.02 SUBMITTALS

A. Submit manufacturer's brochures, technical data, installation, maintenance and operating instructions.

B. Submit test data and structural calculations substantiating that materials and assemblies comply with FEMA 361 requirements for project specific location.

C. Submit shop drawings indicating all components of the window system and attachments to substrate.

D. Submit installer’s qualifications including references, manufacturer’s letter or certification approving the installer, and list of completed similar FEMA 361 projects indicating competency in the installation of windstorm impact resistant products similar in design and configuration to the work of this project.

E. Samples:

1. Submit a completely fabricated sample of a window unit (minimum 16 inches square) including jamb, head, and sill, framing and glazing as required to meet requirements.
2. Submit a completely fabricated sample of a glazed door unit (minimum 16 inches square) including frame. Glazing shall be as required to meet specified requirements.

1.03 QUALITY ASSURANCE

A. Manufacturer shall have a minimum five (5) years documented experience manufacturing products specified in this section.

B. Installer shall have a minimum of three (3) years experience in the installation of products similar in scope and design to the work of this section and shall have completed a minimum of 3 similar projects. The storefront manufacturer shall approve installer.

1.04 DESIGN REQUIREMENTS

A. Conform to Design and Construction Guidance for Community Safe Rooms, FEMA 361, Second Edition / August 2008. Products of the section shall meet or exceed the requirements of FEMA 361 for tornado and hurricane impact and wind loading resistance.

B. Meet or exceed ANSI/ASTM E 330 –Structural performance for exterior windows, curtain wall and doors by uniform static air pressure differential.

C. Meet or exceed CPSC 16 CRF 1201-Safety standards for glazing materials

D. Windows, door, and glazing systems shall be designed to comply with and be tested in accordance with the following:

1. General Conformance: ICC/NSSA Standard for the Design and Construction of Storm Shelters, ICC 500-2008, Chapter 8.
2. Impact Resistance: ASTM E 1886-04, “Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
3. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.24 pounds per square foot.
4. Water Resistance, (static): 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.
5. 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.
6. Uniform Load: 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.
7. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 73 for frame,
8. 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The products of the following manufacturer are specified to establish a level of quality:

1. United States Bullet Proofing, Inc.; 6201 Branch Court; Upper Marlboro, MD 20774; Tel:(800) 363-8328 Website: usbulletproofing.com

B. Equivalent products of the following manufacturers are acceptable upon compliance with the requirements of this Section:

1. Armortex, Inc (800) 880-8306
2. Action Bullet Resistant, Inc. (800) 962-8088

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 STOREFRONT DOORS AND FRAMES

A. Specifications are based on: USAD 1000 - Forced Entry/Bullet/Blast Resistant Aluminum Door and Frame (Double Door) as manufactured by United States Bulletproofing, Inc.

2.03 STOREFRONT WINDOW UNITS AND SIDELITES

A. Specifications are based on: USAW 400 - Bullet/Blast Resistant Fixed Aluminum Window System as manufactured by United States Bulletproofing, Inc.

2.04 IMPACT RESISTANT GLAZING

A. Provide 1-1/2 inch thick minimum Glass Clad Polycarbonate equal to United States Bulletproofing, Inc. or at thickness and makeup as required to meet specified and calculated impact resistance in accordance with FEMA 361.

2.05 FINISH

A. Aluminum components shall have a Kynar Fluropon finish.

B. Color: Bone White.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.

B. 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. Install framing system in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.

B. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.

C. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall, sill, end dam flashing, and other components of construction.

D. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

E. Provide alignment attachments and shims to permanently fasten system to building structure.

F. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

G. Install storefront systems in accordance with ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.03 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount. Refer to commissioning specifications for additional requirements.

B. Testing shall be performed by a qualified independent testing agency. Refer to Division 1 Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.

1. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, which ever is greater.
2. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf.

C. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.04 PROTECTING AND CLEANING

A. Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. 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 51 23 STEEL WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Fire Rated Horizontal Sliding Steel Windows – 45-Minute UL Labeled.

B. Related Sections

1. Section 07 92 00 Joint Sealants
2. Section 08 80 00 Glazing

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal sliding steel windows shall conform to the HS-C30 voluntary specifications in AAMA/NWWDA 101/I.S.2-97 and be designed to meet the following performance requirements. Fire rated windows shall bear the Underwriters Laboratories, Inc. label including the manufacture's file number for the indicated rating.

1. Structural Performance: Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330 at a static pressure of 45 PSF. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause the window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/NWWDA 101/I.S.2-97 for the window type specified in this section.
2. Air Infiltration: Air infiltration shall not exceed 0.12 SCFM per square foot of window area at a static air pressure difference of 1.57 PSF as established by AAMA/NWWDA 101/I.S.2-97 when tested in accordance with ASTM E 283.
3. Water Resistance: When tested in accordance with ASTM E 547, there shall be no water leakage at a static air pressure difference of 4.5 PSF.

1.03 SUBMITTALS

A. Product Data: Include construction details, cut sheets, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installations for each type of steel window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples: Submit two sets of manufacturer's standard color samples for color selection.

D. Product Test Reports: Submit certified test reports showing compliance with specified performance characteristics and local Codes, Regulations, and Laws.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An 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.

B. Manufacturer Qualifications: Manufacturer with at least ten years experience in the manufacture of similar type steel windows.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of steel window openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.

1. Warranty Period: Three years from Date of Completion of the project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacture'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. Handle and store per manufacturer's recommendations.

C. Storage and Protection: Store materials protection from exposure to harmful weather conditions and at weather and humidity conditions recommended by manufacturer. Handle steel windows and components to avoid damage. Protect steel window materials against damage from elements, construction activities, and other hazards before, during, and after installation. Store in shipping containers under

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on Series 900 Horizontal Sliding Windows as manufactured by D.V. Fyre-Tec, Inc.; 701 Centennial Road, Wayne, NE 68787; Tel: 800-377-3261; web: www.fyre-tec.com.

B. Equivalent products by the following manufacturers are acceptable:

1. Optimum Window Manufacturing; Tel: 845-647-1900
2. Nissen & Company; Tel: 626-579-5666.

C. Substitutions shall fully comply with the specified requirements and Section 01 62 14 Product Options and Substitution Procedures.

2.02 STEEL WINDOW TYPES

A. Horizontal sliding steel windows shall be designed for factory glazing, and for glass types scheduled on drawings. Units shall be complete with glass and glazing provisions to meet requirements of window performance. Glazing material shall be compatible with steel and shall not require painting.

B. Fire-rated windows shall conform to UL-9 and shall be labeled with a ¾ hour fire tested rating. Units shall be designed and fabricated to meet glass sizes, window sizes, and opening dimensions established by NFPA 80. Hardware shall conform to NFPA 80 requirements. All operable fire-rated windows shall be self-closing and latching by means of a heat activated fusible link operator.

2.03 MATERIALS

A. Steel Frames and Inserts

1. Steel frames and inserts shall be fabricated from roll-formed galvanized lock-forming quality steel per ASTM A 653.
2. Frame and insert corners shall be mitered and welded. Integral muntins shall be galvanized roll-formed fitted and welded.
3. Operable insert/sash shall be supported on two field adjustable roller trucks consisting of corrosion resisting steel with integral ball bearing rollers. Rollers are to be supported and operate on a stainless steel track.

B. Installation kits

1. Provide attachable fin installation kits for all windows.
2. Provide subframe installation kits for all windows.

C. Formed Component Parts

1. Formed component parts shall be hot rolled sheet steel conforming to ASTM A 569, commercial quality with a minimum of 0.15 percent carbon.
2. Sheet steel shall be zinc coated (galvanized) by the hot dip process in accordance with ASTM A 653 or ASTM A 924.

D. Screws and Bolts: Screws and bolts shall conform to ASTM B 766, ASME B18.6.3 and ASME B18.6.4.

E. Fasteners: Fastening devices shall be window manufacturer’s design made from non-magnetic stainless steel, cadmium plated steel, zinc plated steel, nickel/chrome- plated steel or magnetic stainless steel.

F. Window Anchors: Anchors for installing windows shall be stainless steel or hot dip zinc coated steel conforming to ASTM A 123.

G. Glass and Glazing: Fire Rated Glass as specified in 08 80 00 Glazing

2.04 FABRICATION

A. Fabricate windows in accordance with approved shop drawings.

B. Frame sections shall be one piece sections with corners mitered, welded, and dressed smooth.

C. Required muntins shall be securely welded to the frame members and at all intersections.

D. All windows shall be factory glazed with glazing as specified and in accordance with the requirements of the International Building Code and NFPA 80.

2.05 FINISHES

A. Prime Coat: Steel windows, fins, mullions, cover plates, and associated parts shall be cleaned, pre-treated with iron phosphate and factory painted manufacturer's standard primer coat in a dry film thickness of not less than 0.025 mm (1.0 mil).

B. Finish Coat: Steel windows, fins, mullions, cover plates, and associated parts shall be factory powder coated and cured with a manufacturer's standard color in a dry film thickness of not less than 0.050 mm (2.0 mil).

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PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances.

1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
2. Adjacent Surfaces:
   a. Wood framing/nailers: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
   b. Metal surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   c. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with drawings, shop drawings, and manufacturer's written instructions for installing steel windows, accessories, and other components. Install in compliance with NFPA 80 and NFPA 101.

B. Install steel windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to other adjacent construction.

C. Steel surfaces in close proximity with masonry, concrete, wood, aluminum and dissimilar metals other than stainless steel, zinc, cadmium, or small areas of white bronze shall be protected from direct contact.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Clean steel window surfaces immediately after installation and again just prior to Substantial Completion in accordance with window manufacturer's recommendation. Alkaline, abrasive, or brick wash agents shall not be used. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation and again just prior to Substantial Completion. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect installed products and finished surfaces from damage during construction.

E. Touch-up any abraded surface of the window finish with air dry paint furnished by the window manufacturer so the repair is undetectable.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The work in this section includes furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors. Except items, which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.

B. Related Documents: Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 specification sections apply to this section.

C. Related Sections

1. 06 10 00 – Rough Carpentry
2. 08 11 13 – Hollow Metal Doors and Frames
3. 08 14 29 – Prefinished Wood Doors
4. 08 41 13 – Aluminum-Framed Entrances and Storefronts
5. 08 41 14 – Windstorm Impact Resistant Aluminum Storefront and Glazing - Alternate
6. 28 10 00 – Electronic Access Control

1.02 REFERENCES

A. Standards

1. AIA A201 1997 – General Conditions of the Contract
2. ANSI-A250.4 – Steel Doors and Frames Physical Endurance
3. ANSI A156.1 – Butts and Hinges
4. ANSI A156.2 – Bored Locks and Latches
5. ANSI A156.3 – Exit Devices
6. ANSI A156.4 – Door Controls – Door Closers
7. ANSI A156.5 – Auxiliary Locks and Associated Products
8. ANSI A156.6 – Architectural Door Trim
9. ANSI A156.7 – Template Hinge Dimensions
10. ANSI A156.8 – Door Controls – Overhead Holders
11. ANSI A156.13 – Mortise Locks and Latches
12. ANSI A156.15 – Closer Holder Release Devices
13. ANSI A156.16 – Auxiliary Hardware
14. ANSI A156.18 – Material and Finishes
15. ANSI A156.26 – Continuous Hinges
16. UL10C – Positive Pressure Fire Tests of Door Assemblies

B. Codes

1. NFPA 101 – Life Safety Code
2. IBC 2003 – International Building Code
3. FBC– Florida Building Code
4. ANSI A117.1 – Accessible and Usable Buildings and Facilities
5. ADA – Americans with Disabilities Act

1.03 SUBMITTALS

A. General Requirements

1. Submit copies of finish hardware schedule in accordance with Division 01, General Requirements.

B. Schedules And Product Data

1. Schedules to be in vertical format, listing each door opening, and organized into “hardware sets” indicating complete designations of every item required for each door opening to function as intended. Hardware schedule shall be submitted within two (2) weeks from date the purchase order is received by the finish hardware supplier. Furnish four (4) copies of revised schedules after approval for field and file use. Note any special mounting instructions or requirements with the hardware schedule. Schedules to include the following information:
   a. Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
   b. Handing and degree of swing of each door.
   c. Door and frame sizes and materials.
   d. Keying information.
   e. Type, style, function, size, and finish of each hardware item.
   f. Elevation drawings and operational descriptions for all electronic openings.
   g. Name and manufacturer of each hardware item.
   h. Fastenings and other pertinent information.
   i. Explanation of all abbreviations, symbols and codes contained in schedule
   j. Mounting locations for hardware when varies from standard.
2. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.
3. Submit separate detailed keying schedule for approval indicating clearly how the owner’s final instructions on keying of locks has been fulfilled.

C. Samples

1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.

D. Templates

1. Furnish a complete list and suitable templates, together with finish hardware schedule to contractor, for distribution to necessary trades supplying materials to be prepped for finish hardware.

E. Electronic Hardware Systems

1. Provide complete wiring diagrams prepared by an authorized factory employee for each opening requiring electronic hardware, except openings where only magnetic hold-open devices are specified. Provide a copy with each hardware schedule submitted after approval.
2. Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval.
3. Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval.

4. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordinating related work.
5. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.
6. For each item of electrified hardware specified, provide standardized molex plug connectors to accommodate up to twelve (12) wires. Molex plug connectors shall plug directly into through-door wiring harnesses, frame wiring harnesses, electric locking devices and power supplies.

F. Operations And Maintenance Manuals

1. Upon completion of construction and building turnover, furnish two (2) complete maintenance manuals to the owner. Manuals to include the following items:
   a. Approved hardware schedule, catalog cuts and keying schedule.
   b. Hardware installation and adjustment instructions.
   c. Manufacturer's written warranty information.
   d. Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.

1.04 QUALITY ASSURANCE

A. Substitutions: All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements.

B. Supplier Qualifications

1. A recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the project's vicinity for a period of at least five (5) years.
2. Hardware supplier shall have office and warehouse facilities to accommodate this project.
3. Hardware supplier shall have in his employment at least one (1) Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project's hardware and requirements to the owner, architect and contractor.
4. Hardware supplier must be an authorized factory distributor of all products specified herein.

1.05 FIRE-RATED AND WINDSTORM OPENINGS

1. Provide door hardware for fire-rated and windstorm rated openings that comply with NFPA 80, ANSI A250.13 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.
2. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
   a. Hardware required for fire doors shall be listed with Underwriters Laboratories for ratings specified.
   b. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

3. All sets indicated to be FEMA compliant shall be tested with the specified door and frame system to meet or exceed the FEMA 361 testing standards and requirements and be approved for use by the door and frame manufacturer as part of the tested, compliant and approved system.

1.06 DELIVERY, STORAGE AND HANDLING

A. Marking and Packaging

1. Properly package and mark items according to the approved hardware schedule, complete with necessary screws and accessories, instructions and installation templates for spotting mortising tools. Contractor shall check deliveries against accepted list and provide receipt for them, after which he is responsible for storage and care. Any shortage or damaged good shall be made without cost to the owner.
2. Packaging of door hardware is the responsibility of the supplier. As hardware supplier receives material from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set and door numbers to match the approved hardware schedule. Two or more identical sets may be packed in same container.

B. Delivery

1. The supplier shall deliver all hardware to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor. Inventory door hardware jointly with representatives of hardware supplier and hardware installer/contractor until each is satisfied that count is correct.
2. No keys, other than construction master keys and/or temporary keys are to be packed in boxes with the locks.
3. At time of hardware delivery, door openings supplier in conjunction with the contractor shall check in all hardware and set up a hardware storage room.

C. Storage: Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of work will not be delayed by hardware losses both before and after installation.

1.07 WARRANTY

A. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
1. Mortise locksets: Seven (7) years
2. Exit Devices: Five (5) years
3. Door closers: Ten (10) years
4. Securitron (and approved equals) electrified hardware: Unlimited Lifetime

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Only manufacturers as listed below shall be accepted. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

B. All hardware on FEMA 361 compliant door/frames shall be fully tested as part of the door/frame assembly. Provide approved tested manufacturers. – Alternate.

2.02 MATERIALS

A. Screws and Fasteners: All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

B. Hanging Devices

1. Hinges:
   a. Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior reverse bevel doors. Unless otherwise scheduled, supply one (1) hinge for every 30" of door height. Hinges shall be a minimum of 4-1/2 inches high and 4 inches wide; heavy weight hinges (.180) shall be supplied at all doors where specified.
      1) Specified Manufacturer: McKinney
      2) Approved Substitutes: Bommer, Hager, Stanley
2. Electric Hinges:
   a. Electric hinges shall be provided with molex standardized plug connectors to accommodate up to twelve (12) wires. Plug connectors shall plug directly into molex through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a mortar guard for each electric hinge specified.
      1) Specified Manufacturer: McKinney QC Series
      2) Approved Substitutes: NONE

C. Flush Bolts and Accessories

1. All manual and automatic flush bolts to be furnished as specified.
   a. Specified Manufacturer: McKinney
   b. Approved Substitutes: Quality, Rockwood, Trimco

D. Cylinders and Keying

1. Cylinders
   a. Where specified, high security cylinders shall be supplied Patented thru 2027. Provide Patented High security keys able to operate both the appropriate conventional and high security cylinder within the same master key system while the keys for the conventional cylinders will not operate the high security cylinders. The high security cylinder can be easily re-configured by the Owner to void existing keys without disturbing the pinning of the master key system. If the master key system is compromised by the loss of a top-level master key, the system can be changed through a simple realignment of the barrel/plug components. The existing keys are then voided from operating the cylinder. Stamp all change keys with keyset symbol (VKC), but do not stamp with key section or bitting number.
      1) Specified Manufacturer: Sargent Degree
      2) Approved Substitutes: Corbin Russwin Pyramid PHS, Yale U5000 Series
2. Keying
   a. All locks and cylinders shall be construction master-keyed. All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the owner. The factory shall key all locks and cylinders. Furnish the following key amounts:
      1) Two (2) change keys per lock
      2) Three (3) grand master keys
      3) Six (6) master keys per master level
      4) Fifteen (15) construction/temporary keys

b. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.
c. Specified Manufacturer: Sargent
d. Approved Substitutes: Corbin/Russwin, Yale, Medeco

3. Key Cabinet
   a. Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project. Locate as directed by Architect.
      1) Specified Manufacturer: MMF
      2) Approved Substitutes: Lund, or equal
4. Key Control Software
   a. A comprehensive key management software package shall be supplied. Software package shall include free one year technical support and free upgrades to software as it becomes available. Software shall have customized query, reporting and search capability and shall allow for tracking of all issued keys. Display of key-holder photographs and signatures shall be allowed.
      1) Specified Manufacturers: Sargent Key Wizard
      2) Approved Manufacturers: Corbin Russwin, Yale

E. Locking Devices

1. Mortise Locksets
   a. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. All functions shall be manufactured in a single sized case formed from 12 gage steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a 0.125 inch minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2-3/4 inches backset with a one-piece 3/4 inch anti-friction stainless steel latchbolt. The deadbolt shall be a full 1 inch throw made of stainless steel and have 2 hardened steel roller inserts. All strikes shall be non-handed with a curved lip. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.
      1) Specified Manufacturer: Sargent 8200 Series
      2) Approved Substitutes: Corbin Russwin ML2000 Series, Schlage L9000 Series, Yale 8800 Series
2. Lockset Strikes
   a. Strikes shall be non-handed and available with curved lip, full lip or ASA type strikes as required. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.

F. Exit Devices

1. Conventional Devices – Push Rail
   a. Where indicated, multi point auto deadlocking exit devices shall be part of an integrated door, frame and hardware assembly UL-approved to FEMA 361 guidelines. Devices shall be ANSI A156.3, Grade 1 Certified and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072” thick. Push rails shall be constructed of 0.062” thick material. Painted or anodized aluminum shall not be considered heavy duty and is not acceptable. Lever trim shall be available in finishes and designs to match that of the specified locksets.
      1) Specified Manufacturer: Sargent WS80 Series
      2) Approved Substitutes: Yale 7180F Series, Corbin Russwin FE5400, Von Duprin WS98 Series

2. Electrified Devices
    a. Electrified exit devices shall conform to all traditional exit device standards as specified above. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
    b. Options for delayed egress exit devices to be specified in the hardware sets. Devices to conform to NFPA 101 - Special Locking Arrangements for delayed egress. Nuisance delay to be available as standard for either zero (0) or two (2) seconds. Internal latchbolt monitoring, and a standard 10-second delay for "Authorized Entry" to be standard features on every device. Delayed egress feature to be available throughout all styles and sizes of exit devices including: Panic and Fire rated Rim, Wide and Narrow Stile, Mortise, Surface Vertical Rod, and Concealed Vertical Rod.
    c. All exit devices, both fire labeled and non-labeled devices, requiring electric dogging shall be held in the "dogged" or retracted position. All exit devices with electric latch retraction shall provide for a remote means of unlocking for momentary or maintained periods of time.
    d. Exit devices with electrified trim shall be fail-secure unless otherwise specified.
    e. Where specified exit devices shall be provided with a switch to monitor push rail or signal remote location and latchbolt monitoring.
    f. Provide an in-line power controller w/ appropriate power supply to activate each electrified exit devices.
        1) Specified Manufacturers: Sargent
        2) Approved Manufacturers: Corbin Russwin, Von Duprin, Yale

G. Door Closers

1. Surface Mounted Closers – Heavy Duty
    a. All door closers shall be ANSI 156.4, Grade 1 Certified. All closers shall have aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
        1) Specified Manufacturer: Sargent 351 Series
        2) Approved Substitutes: Corbin Russwin DC8000 Series, LCN 4040XP Series

H. Door Trim And Protective Plates

1. Kick plates shall be .050 gauges and two (2) inches less full width of door, or as specified. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule.
    a. Specified Manufacturer: Rockwood
    b. Approved Substitutes: Quality, McKinney, Trimco

I. Door Stops And Holders

1. Wall Mounted Door Stops
    a. Where a door is indicated on the plans to strike flush against a wall, wall bumpers shall be provided. Provide convex or concave design as indicated.
        1) Specified Manufacturers: Rockwood
        2) Approved Substitutes: Quality, McKinney, Trimco

2. Overhead Stops/Holders
   a. Where specified, overhead stops/holders as shown in the hardware sets are to be provided. Track, slide, arm and jamb bracket shall be constructed of extruded bronze and shock absorber spring shall be of heavy tempered steel. Overhead stops shall be of non-handed design.
      1) Specified Manufacturers: Rixson 1/2/9/10 Series
      2) Approved Substitutes: Sargent 690/1530/590/1540 Series

J. Gasketing And Thresholds

1. Provide continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
2. Provide threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA).
   a. Specified Manufacturers: Pemko
   b. Approved Substitutes: McKinney, Reese, Zero

K. Silencers: Furnish rubber door silencers all hollow metal frames; two (2) per pair and three (3) per single door frame.

L. Electronic Products And Accessories

1. Power Supplies
   a. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED's shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
      1) Specified Manufacturer: Securitron BPS
      2) Approved Substitutes: Folger Adams

2.03 FINISHES

A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Where specified hardware shall have an antimicrobial coating which permanently suppresses the growth of bacteria, algae, fungus, mold and mildew applied. The finish shall control the spread and growth of bacteria, mold and mildew and shall be FDA listed for use in medical and food preparation equipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

3.02 INSTALLATION

A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.

1. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute (DHI.)
2. NWWDA Industry Standard I.S.1.7, “Hardware Locations for Wood Flush Doors.”

B. All hardware shall be applied and installed in accordance with best trade practice by an experienced hardware installer. Care shall be exercised not to mar or damage adjacent work.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

D. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.03 FIELD QUALITY CONTROL

A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: “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.”

B. Prior to the installation of hardware, manufacturer's representatives for locksets, closers, and exit devices shall arrange and hold a jobsite meeting to instruct the installing contractor's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Architect and Owner.

C. The hardware supplier shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

D. The manufacturer’s representative shall do a final inspection prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

3.04 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore to proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Instruct owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of any electronic devices.

3.05 PROTECTION

A. Contractor shall protect all hardware, as it is stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

3.06 HARDWARE SCHEDULE

A. The following schedule is furnished for whatever assistance it may afford the Contractor; do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware heading, provide door or item with hardware same as required for similar purposes. Hardware supplier is responsible for handing and sizing all products as listed in the hardware heading. Quantities listed are for each pair of doors, or for each single door.

B. Manufacturer's Abbreviations:

MK - McKinney
RO - Rockwood
SA - Sargent
RF - Rixson
PE - Pemko
SU - Securitron

HARDWARE SCHEDULE

HW1A NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors: 101A, 101B
Description: AL – PR

1	Cylinder	Best 1E72 OR 1E74 613
2	Mag Lock	SECURITRON M62-DCBLK
1	Request exit	SECURITRON XMS PKG
1	Power Supply	SECURITRON BPS-24-1
1	Card Reader	SECURITRON RP-40

Balance of hardware by Door manufacturer; Refer to Electronic Access Control and Intrusion Detection sections for security hardware information and installation of Mag Lock, Card Reader, Wire and Cable pulls.)

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position.
Key overide allows entry
Free egress at all times

HW1B – Alternate NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors: 101A – Alternate
Description: FEMA - AL - PR

5	Hinge	SP3386 4-1/2" x 4-1/2"	US32D	MK
1	Hinge	SP3386 QC-12 4-1/2" x 4-1/2"	US32D	MK
1	Removable Mullion	DG2 HCL980	PC	SA
1	Electrified Rim Exit	DG2 43 53 54 55 WS AD8574-12v ETP	US32D	SA
1	Rim Exit Device	DG2 43 WS AD8510 ETP	US32D	SA
1	Card Reader	By Div 26		
2	Door Closer (surface w/stop arm)	351 CPS X Mtg Plate	EN	SA
1	Threshold	1715AK MSES10SS		PE
2	Gasketing	5110BL		PE
1	Rain Guard	346C		PE
1	Astragal Set	18061CNB		PE
1	Switch	3287		SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C306P		MK
1	Power Supply	BPS-12-1		SU

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position. Free egress at all times

HW2A NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors 133B, 149A
Description: PR

2	Con't Hinge	PBB CH51 x Length required		
1	Removable Mullion	DG2 HCL980	PC	SA
1	Electric Exit Device	DG2 43 53 54 55 WS 8876-12v ETP	US32D	SA
1	Exit Device	43 WS 8810 ETP	US32D	SA
2	Card Reader	By Div 26		
2	Door Closer (surface w/stop arm)	351 CPS X Mtg Plate	EN	SA
1	Threshold	1715AK MSES10SS		PE
1	Gasketing	5110BL		PE
1	Rain Guard	346C		PE
1	Gasketing	S773D		PE
2	Sweep	345C		PE
1	Astragal Set	18061CNB		PE
1	Switch	3287		SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C306P		MK
1	Power Supply	BPS-12-1 SU		

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position. Key overide allows entry
Free egress at all times

HW2B – Alternate NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors: 133B, 149A
Description: FEMA - PR

5	Hinge	SP3386 4-1/2" x 4-1/2"	US32D	MK
1	Hinge	SP3386 QC-12 4-1/2" x 4-1/2"	US32D	MK
1	Removable Mullion	DG2 HCL980	PC	SA
1	Electric Exit Device	DG2 43 53 54 55 WS 8876-12v ETP	US32D	SA
1	Exit Device	43 WS 8810 ETP	US32D	SA
2	Card Reader	By Div 26		
2	Door Closer (surface w/stop arm)	351 CPS X Mtg Plate	EN	SA
1	Threshold	1715AK MSES10SS		PE
1	Gasketing	5110BL		PE
1	Rain Guard	346C		PE
1	Gasketing	S773D		PE
2	Sweep	345C		PE
1	Astragal Set	18061CNB		PE
1	Switch	3287		SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C306P		MK
1	Power Supply	BPS-12-1		SU

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position.
Key overide allows entry
Free egress at all times

HW3A NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors: 103A, 104A, 106A, 107A, 128B
Description: Sgl

1	Con't Hinge	PBB CH51 x Length required		
1	Electric Exit Device	DG2 43 53 54 55 WS 8876-12v ETP	US32D	SA
1	Card Reader	By Div 26		
1	Door Closer (surface w/stop arm)	351 CPS X Mtg Plate	EN	SA
1	Threshold	1715AK MSES10SS		PE
1	Rain Guard	346C		PE
1	Gasketing	S773D		PE
1	Sweep	345C		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C306P		MK
1	Power Supply	BPS-12-1		SU

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position.
Key overide allows entry
Free egress at all times

HW3B – Alternate NOTE: These doors shall be coordinated with the security vendor prior to purchase and install to ensure compatibility with the other security elements throughout the building.
Doors: 103A, 104A, 106A, 107A, 128B
Description: FEMA - Sgl

3	Hinge	SP3386 4-1/2" x 4-1/2"	US32D	MK
1	Hinge	SP3386 QC-12 4-1/2" x 4-1/2"	US32D	MK
1	Electric Exit Device	DG2 43 53 54 55 WS 8876-12v ETP	US32D	SA
1	Card Reader	By Div 26		
1	Door Closer (surface w/stop arm)	351 CPS X Mtg Plate	EN	SA
1	Threshold	1715AK MSES10SS		PE
1	Rain Guard	346C		PE
1	Gasketing	S773D		PE
1	Sweep	345C		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C306P		MK
1	Power Supply	BPS-12-1		SU

Notes: Presenting a valid credential to the reader will release the electrified trim and allow access. Lever relocks upon closing. RX (request to exit) switch in rail shunts device to allow for free egress. Latchbolt monitor switch in rail monitors door position. Door position switch in inactive door monitors door position.
Key overide allows entry
Free egress at all times

HW4
Doors: 131A, 134A
Description: PR - Rated

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt Set	1842/1942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (storeroom)	DG2 8204 LNP	US26D	SA
1	Surface Overhead Stop	10-X36	689	RF
1	Door Closer (surface w/stop arm)	351 PS	EN	SA
2	Kick Plate	K1050 8"	US32D	RO
1	Gasketing	S773D		PE
1	Astragal	S772D		PE

HW5
Doors: 130A
Description: PR - Meeting - Rated

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt Set	1842/1942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
2	Door Closer (surface)	351 UO	EN	SA
2	Kick Plate	K1050 8"	US32D	RO
1	Mortise Lock (classroom)	DG2 8237 LNP	US26D	SA
2	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE
1	Astragal	S772D		PE

HW6
Doors: 108A, 113A, 129A, 135A, 136A, 144A, 148A
Description: TMC, Elec, Janitor, Storage - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (storeroom)	DG2 8204 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW7
Doors: 109A, 111A, 114A, 120A, 121A, 124A, 126A, 127A, 137A, 139A, 145A
Description: Office - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (office)	DG2 8205 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW8
Doors: 130B, 146A
Description: Meeting - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (classroom)	DG2 8237 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW9
Doors: 122A, 123A
Description: Shower - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (privacy)	LB 49 8265 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Mop Plate	K1050 4"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW10
Doors: 125A, 128A, 147A
Description: Passage - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (passage)	8215 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW11
Doors: 118A, 119A, 140A, 142A
Description: Restroom - Rated

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (passage)	8215 ALP	US32D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Mop Plate	K1050 4"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW12
Doors: 133A
Description: PR - Mech - OH

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt Set	1842/1942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (storeroom)	DG2 8204 LNP	US26D	SA
1	Surface Overhead Stop	10-X36	689	RF
1	Door Closer (surface w/stop arm)	351 PS	EN	SA
2	Kick Plate	K1050 8"	US32D	RO
1	Gasketing	S773D		PE
1	Astragal	S772D		PE
2	Silencer	608		RO

HW13 (Not Used)

HW14
Doors: 132A
Description: PR - Work

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt Set	1842/1942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (classroom)	DG2 8237 LNP	US26D	SA
1	Surface Overhead Stop	10-X36	689	RF
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE
1	Astragal	S772D		PE

HW15
Doors: 150A
Description: PR - Stor

6	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (classroom)	DG2 8237 LNP	US26D	SA
2	Surface Overhead Stop	10-X36	689	RF
2	Flush Bolt	555/557	US26D	RO
2	Silencer	608		RO

HW16
Doors: 116A, 117A
Description: Stor

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (storeroom)	DG2 8204 LNP	US26D	SA
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

HW17
Doors: 146B
Description: Meeting

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (classroom)	DG2 8237 LNP	US26D	SA
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW18
Doors: 112A, 115A
Description: Clos

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (passage)	8215 LNP	US26D	SA
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

HW19
Doors: 125B
Description: Break

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (passage)	8215 LNP	US26D	SA
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

HW20
Doors: 141A, 143A
Description: Shower

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (privacy)	LB 49 8265 LNP	US26D	SA
1	Door Closer (surface)	351 UO	EN	SA
1	Kick Plate	K1050 8"	US32D	RO
1	Mop Plate	K1050 4"	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D		PE

END OF SECTION

SECTION 08800 GLAZING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Glass and glazing for doors, windows, unframed mirrors, Aluminum Storefront and Entrances and other glazed openings, interior and exterior locations.

1.02 RELATED SECTIONS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 14 29 - Prefinished Wood Doors.

1.03 QUALITY ASSURANCE

A. Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

B. Prime Glass Standard: FS DD-G-45l.

C. Heat-Treated Glass Standard: FS DD-G-l403.

D. Safety Glass Standard: CPSC l6 CFR l20l.

E. Fire rated glass: Underwriters Laboratories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect glass during transit, storage and handling to prevent scratching or breakage of glass. Replace all broken or damaged glass at no additional cost to Owner.

1.05 PROJECT CONDITIONS

A. Meet with Glazier and other trades affected by glass installation, prior to beginning of installation. Do not perform work under adverse weather or job conditions. Install liquid sealant when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following prime glass manufacturers are acceptable:

1. AFGD Glass, Inc., Atlanta, GA. Tel. (800) 766-2343.
2. Guardian Industries Corp., Carleton, MI. Tel. (800) 521-9040.
3. PPG Industries, Inc., Pittsburgh, PA. Tel. (800) 377-5267.
4. Technical Glass Products, Kirkland, WA. Tel. (800) 426-0279.
5. Viracon, Owatonna, MN Tel 800-533-2080
6. Zeledyne, Tulsa, OK. Tel. (800) 331-2607.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14 - Product Options and Substitution Procedures

2.02 INSULATING GLASS

A. Material: Provide 1-5/16 inch VRE1-67 radiant low-E insulating Glass by Viracon or equal. Shall consist of 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, including doors.

B. Provide tempered safety glass for panes where required by Code.

C. Characteristics: Other requirements specified for glass characteristics, air space, sealing system, sealant spacer material, corner design and desiccant are as follows:

1. Thickness of Interior Pane: 1/2 – inch clear HS, Laminated 0.100 SGP (Stormguard)
2. Thickness of Exterior Pane: 1/4 – inch clear HS
3. Airspace Thickness: 1/2 - inch.
4. Sealing System: Manufacturer’s standard 1-5/16 inch sealing system.
5. Spacer Material: Manufacturer's standard metal-white.
6. Desiccant: Manufacturer's standard, either molecular sieve or silica gel.
7. Corner Construction: Manufacturer's standard.
8. Exterior Pane: Provide VRE Low-E coating on 2nd (air space) surface
9. Interior Pane: Clear/clear.
10. Unit Performance Requirements for VRE 1-59
    a. Transmittance Visible Light: 50%
    b. Transmittance Ultra-Violet:1%
    c. Reflectance Visible Light – Exterior: 30%
    d. Reflectance Visible Light – Interior: 18%
    e. U-Value, Summer: 0.27 Btu/(hr x sqft x F)
    f. U-Value, Winter: 0.29 Btu/(hr x sqft x F)
    g. Shading Coefficient: 0.38
    h. Solar Heat Gain Coefficient: 0.33
11. Warranty: Manufacturer’s Ten year.

2.03 TEMPERED SAFETY GLASS

A. Provide prime glass of color and type indicated, which has been heat treated to strengthen glass in bending to not less than 4.5 times annealed strength. Provide tempered glass produced by manufacturer’s special process which eliminates tong marks.

B. Provide clear 1/4 inch thick glass in interior doors and interior windows where not required to be fire rated.

2.04 IMPACT RESISTANT GLASS

A. See Section 08 43 14 – Tornado/Hurricane Resistant Aluminum Storefront. (Alternate)

2.05 FIRE RATED GLASS

A. Clear, wireless, laminated, minimum 1/4 inch thick impact safety rated glass ceramic equal to “Firelite Plus” as manufactured by Technical Glass Products, conforming to applicable U.L. fire ratings as indicated or required for rated wall or adjacent door and frame assembly. Fire tested and rated, passes required Hose Stream Test, high impact safety (CPSC 16CRF1201 Cat. II).

2.06 LAMINATED GLASS

A. Laminated glass shall consist of two (2) layers of 1/4 inch glass, Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select) with a .030 inch polyvinyl butaryl (pvb) interlayer. Total thickness shall be approximately 1/2 inch. Laminated glass shall have an STC rating of 39 or better. Glass shall conform to the requirements of ASTM 1172-91.

2.07 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.

2.08 SETTING MATERIALS

A. Provide all necessary primers, sealants, channels, setting blocks, etc. with items to be glazed. Conform to requirements set forth in FGJA Glazing Manual.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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.

B. Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

3.04 GLAZING

A. Install setting blocks of proper size in sill rabbet, located 1/4 of glass width from each corner. Set blocks in thin course of heel-bead compound, if any.

B. Provide spacers inside and out, of proper size and spacing, for glass sizes larger than 50 united inches, except where gaskets or pre-shimmed tapes are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

C. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

D. Force sealant into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

E. 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.

F. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discoloration.

G. 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.

3.05 DOOR LITES

A. 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. Door lites at tornado debris impact resistant doors shall be debris impact resistant in accordance with FEMA 361 guidelines.

3.06 MIRRORS

A. Install unframed mirrors with a combination of metal clips and construction adhesive securely attached to the wall studs and/or concealed blocking.

3.07 CURE AND PROTECTION

A. Protect glass from breakage immediately upon installation, by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces. Cure sealant for high early strength and durability.

B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

3.06 CLEANING

A. Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish Date of Completion in each area of Project. Comply with glass product manufacturer's recommendations for final cleaning.

B. The General Contractor shall be responsible for removal of protective materials and cleaning with plain water, or water with soap or household detergent as approved by the glass manufacturer. The General Contractor shall be held responsible for damages resulting from the use of other cleaning material.

END OF SECTION

SECTION 08 90 00 FIXED LOUVERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior extruded aluminum louvers with insect/bird screens and soffit vents as indicated on the Drawings including indications of sizes and locations.

1.02 RELATED SECTION

A. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.

B. Shop Drawings: Submit Shop Drawings for the fabrication and erection of louver units and accessories. Include plans, elevations and details of sections and connections to adjoining Work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

C. Samples: Submit 6-inch square samples of each required finish. Prepare samples on metal of same gage and alloy to be used in Work. Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.

1.04 QUALITY ASSURANCE

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 500L-99. Louvers shall be licensed to bear AMCA Certified Ratings Seal.

B. SMACNA Recommendations: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

C. Field Measurements: Verify size, location and placement of louver units prior to fabrication, wherever possible.

D. 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. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.05 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. Substitutions shall fully comply with specified requirements and Section 01630-Product Options and Substitution Procedures

2.02 WALL LOUVERS

A. Drainable Blade Fixed Louver: 6 inch deep extruded aluminum louver equal to C/S Model A6097H.

B. Performance Data:

1. Free Area: 52.1 percent for a 48 inch x 48 inch size.
2. Free Area Size: 8.34 square feet.
3. Maximum Recommended Air Flow Thru Free Area: 990 feet per minute
4. Air .Flow: 8256 cubic feet per minute.
5. Maximum Pressure Drop: 0.16 inches.
6. Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m^2) of free area at an air flow of 1,023 feet per minute (312 m/min) free area velocity when tested for 15 minutes.

2.03 MATERIALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer to provide required finish.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T52. Blade and frame thickness shall be 0.125 inch minimum.

C. Fastenings: Use same material as items fastened, unless otherwise indicated. Fasteners for exterior applications may be hot-dip galvanized, stainless steel or aluminum. Provide types, gages, and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

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: SSPC-Paint 12 (cold-applied asphalt mastic).

2.04 FABRICATION, GENERAL

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. Provide 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. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.

E. Provide sill extensions and loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior. Setback dimension is 3-3/4 inches to 6 inches.

F. Join frame members to one another and to stationary louver blades. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

G. Finish: Kynar 500 (70% PVDF) finish to be selected by MDOT Architect from full range of standard and premium colors. Refer to Section 09 05 15 for color.

2.05 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, operable dampers or fans.

2.06 SOFFIT VENT

A. Provide product equal to Fry Reglet SV-75-V-300. Custom finish shall match adjacent metal panels.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorage. Coordinate delivery of such items to Project Site.

3.02 INSTALLATION

A. Locate and place louver units plumb, level and in proper alignment with adjacent Work. Use concealed anchorage wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.

B. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealant and joint fillers, as indicated.

C. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective Work. Return items that cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units, at Contractor's option.

D. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

E. Refer to Section 07 92 00 for sealant in connection with installations of louvers.

END OF SECTION

SECTION 09 05 15 COLOR DESIGN

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. A coordinated comprehensive Color System in which requirements for materials specified in other Sections of this Specification and / or shown on the Drawings are identified for quality, color, finish, texture and pattern.

1.02 MANUFACTURER'S TRADE NAMES

A. Manufacture's trade names and number designations used herein identify colors, finishes, textures and patterns for materials and products specified in the technical sections of the Specifications. Wherever such products are referred for selection or approval in other sections, such products shall be understood to be referenced to this Section. If no selection is listed herein for products, the Project Architect shall be contacted for a color selection. Subject to approval of the Project Architect, products of other manufacturers will be considered, provided they are equivalent to the quality, colors, finishes, textures and patterns listed and meet the requirements of the Specifications and Drawings.

1.03 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

1.04 SAMPLES

A. At least three samples/sample sets shall be submitted for approval prior to applying or installing any finishes or items that are not included in this Section. One sample will be retained by the Engineer/Architect and two will be returned with the submittal so that one may be retained on site at all times. Upon receipt of samples, the Architect may make revisions to the Color schedule. Upon final color selection, a sample of the selected color and finish will be maintained on site and readily available upon demand. Returned office sample shall be protected for inclusion in the close out documents. See appropriate technical Sections for additional submittal requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials are specified in other Sections of the Specifications. Any reference by trade name or manufacturer shall be considered as establishing a standard of quality and color range for selection and shall in no way limit competition.

2.02 MANUFACTURERS

A. The following manufacturers were used in preparing the Color Schedule:

SECTION / MATERIAL	MANUFACTURER / NUMBER & COLOR NAME
04 20 00 – Brick	Dark red brick to match adjacent Project Office in color and texture.
04 20 00 – Concrete Masonry Veneer	Continental– #1100 smooth face texture

04 20 00 – Mortar	Custom color to match CMV exactly - use at brick and at CMV
04 20 00 – Weep Vents	CavClear - White
06 40 00 – Plastic Laminate Apron	PL#1 – Formica; #5878-58 Possum Warp (Plastic Laminate Apron at Restroom vanities)
06 40 00 – Cabinets at Break Rooms	PL#2 – Formica, 6214-58 Seagrass Strand (Plastic Laminate for cabinet doors and fronts at Break Rooms).
06 40 00 – Plastic Laminate Countertops	PL#3 – Formica; #7215-58 Earthen Terra (Plastic Laminate countertops at Office, Admin, and Print)
06 40 00 – Plastic Laminate Cabinets	PL#4 – Formica, #5881-58 Chocolate Warp (Plastic Laminate cabinet doors and fronts at Office, Admin, and Print)
06 40 00 – Solid Surface Counters	SS#1: Corian; Canyon; Matte Finish (Countertops at Restrooms)
06 40 00 – Solid Surface Counters	SS#2: Corian; Fawn; Matte Finish (Countertops at Break Rooms)
06 40 00 – Solid Surface Window Stools	SS#3: Corian; Canvas; Matte Finish
06 40 00 – Architectural Millwork Hardware	All exposed metal components: Oiled Bronze
06 40 00 – Edgemold	Edgemold T-Edge; Color to be selected
06 40 00 – Grommet	To match edgemold
06 40 00 – Workstation Support Bracket	Paint to match adjacent wall finish
07 42 15 – Aluminum Composite Panel System	To match Kawneer Bone White
07 42 15 – All Trim Pieces	To match Kawneer Bone White
07 62 00 – Metal Flashing	Match adjacent metal finishes
07 62 00 – Gutters and Downspouts	To match Kawneer Bone White
07 61 00 – Metal Roofing	Duranar ULTRA-Cool Hartford Green 872G32
07 61 00 – Metal Trim (at roof side of gutter)	Duranar ULTRA-Cool Hartford Green 872G32
07 92 00 – Joint Sealants	Sonneborn-Match adjacent lighter color
08 11 13 – Interior Metal Doors and Frames	Paint color P#1; Gloss Finish
08 11 13 – Exterior Metal Doors and Frames	Paint color P#5; Gloss Finish
08 11 14 – Tornado Resist. Steel Drs & Frames	Paint color P#5; Gloss Finish
08 14 29 – Wood Doors	Graham Natural Solutions Pre-Finished doors; Veneer: Plain Sliced Select Cherry; Finish: #300 Medium Brown
08 43 14 – Tornado Resistant Alum Storefront	To Match Kawneer- Bone White
08 44 15 – Aluminum Storefront	Kawneer – Bone White
08 71 00 – Door Hardware	Brushed Stainless Steel /Satin Chrome as shown
08 80 00 – Glazing	Interior Pane: Clear; Exterior Pane: “Green” by Viracon
09 31 13 – Ceramic Wall Tile	CT#1 – Dal-Tile; #K775 Matte Biscuit (General Wall Tile at Restroom walls)
09 31 13 – Accent Ceramic Wall Tile	CT#2 – Dal-Tile; #0744 Matte Artisan Brown (Accent Tile at Restroom walls)
09 31 13 – Ceramic Floor Tile and base	CT#3 – Dal-Tile; Colour Scheme, #B929 Biscuit Speckle (Floor tile and base at Ice, Janitor, and Shower)
09 31 13 – Grout (Walls)	Laticrete; Color: #24 Natural Grey (1/16” grout joint)
09 30 19 – Paver Floor Tile and PT Base	PT#1 – Dal-Tile; City View, #CY01(1) Harbour Mist (General tile and base at Corridors and Restrooms)
09 30 19 – Accent Paver Floor Tile	PT#2 – Dal-Tile; City View, #CY09(2) Downtown Nite (Accent tile at Corridors)

09 30 19 – Grout (Paver Tile)	Laticrete; Color: #24 Natural Grey (1/8" grout joint)
09 51 00 – ACT Ceilings	Armstrong; No. 770 Cortega, Square Edge; White
09 65 00 – Resilient Floor	VCT#1 – Mannington, Solid Point #337 Toasted Sesame
09 65 00 – Resilient Floor	VCT#2 – Mannington, Solid Point #313 Prairie (Accent VCT at Offices and Break as shown on plan)
09 65 00 – Resilient Floor	VCT#3 – Mannington, Solid Point #365 Aspen (Accent VCT at Break as shown on plan)
09 65 00 – Rubber Base and Edge Strips	RB#1 -- Johnsonite; #29 Moon Rock (4")
09 69 13 – Access Flooring	to be selected when submitted
09 90 00 – Paint – (General Wall Paint)	P#1 – Sherwin Williams; SW6155 Rice Grain; Eggshell Finish at Walls
09 90 00 – Paint – (Accent Wall Paint)	P#2 – Sherwin Williams; SW6164 Svelte Sage; Eggshell Finish
09 90 00 – Paint – (Accent Wall Paint)	P#3 – Sherwin Williams; SW7045 Intellectual Gray; Eggshell Finish
09 90 00 – Paint – (Gypsum Board Ceilings)	P#4 – Sherwin Williams; SW7008 Alabaster; Flat Finish
09 90 00 – Paint – (Exterior Metal Doors/Frames)	P#5 – To be selected
09 90 00 – Paint – (Exterior Impact Louver)	P#6 – To be selected to match brick
09 90 00 – Paint – (Exterior Rails)	P#7 – To be selected
09 90 00 - Paint - (Exterior Bollards)	P#8 - To be selected
09 90 00 - Paint - (Exterior Lintels at brick)	Match P#6
09 90 00 - Paint - (Exterior steel columns)	P#9 - To be selected
09 90 00 - Paint - (Misc Exterior)	P#10 - To be selected
09 90 00 - Paint - (Alt #1 - Exterior steel at well, mechanical, generator, etc.	P#11 - To be selected
10 11 00 – Visual Display Board	All finishes to be selected when submitted.
10 21 14 – Toilet Partition	PL#1 – Formica; #5878-58 Possum Warp
10 20 00 – Louvers	Custom Kynar color to be selected to match P#6
10 20 10 – Impact Resistant Louvers	Custom Kynar color to be selected to match P#6
10 21 16 – Shower Units	to be selected when submitted
10 26 13 - Corner Guards	to be selected when submitted
10 14 00 – Specialty Signs (Int)	to be selected when submitted
10 14 16 – Plaques	As indicated in 10 14 16 Plaques
10 56 13 – Metal Storage Shelves	to be selected when submitted
10 57 13 – Coat Rack	Nickel Chrome as indicated
10 73 16 – Pre-Engineered Canopies	to be selected when submitted
11 31 15 – Appliances	As indicated in 11 31 15 Appliances
12 21 15 – Horizontal Blinds	to be selected when submitted
12 21 16 – Rolling Blackout Shades	to be selected when submitted

PART 3 - EXECUTION

3.01 EXECUTION

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

END OF SECTION

SECTION 09 21 18 SUSPENDED GYPSUM BOARD SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The extent of the suspended gypsum board drywall system is shown on the Drawings and in schedules. The types of work required include the following:

1. Ceiling suspension systems.
2. Drywall system face-type gypsum board work.
3. Trim and accessories that are installed prior to or concurrent with gypsum board.

1.02 SUBMITTALS

A. Submit product data and installations instructions for each gypsum board drywall system required, including other data as may be required to show compliance with these specifications. Distribute a copy of each installation instructions to the installer.

1.03 QUALITY ASSURANCE

A. 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.

B. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.

C. Manufacturer: Obtain gypsum board, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board, by one of the following:

1. Certain Teed 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.

1.04 PRODUCT HANDLING

A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.05 PROJECT CONDITIONS

A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

PART 2 - PRODUCTS

2.01 CEILING SUPPORT MATERIALS

A. Main Runners: 1-1/2 inch steel channels, either cold-rolled at 0.475 pounds per foot or hot-rolled at 1.12 pounds per foot, rust-inhibitive paint finish.

B. Furring Members: Screw-type hat-shaped furring channels of 25 gage zinc-coated steel; comply with ASTM C 645.

C. Furring Members: Screw-type “Cee” shaped studs of depth indicated, of 25 gage zinc-coated steel; comply with ASTM C 645.

D. Hanger Wire: Galvanized, soft-temper steel wire complying with ASTM A 641, Class 1 coating, prestretched; sized in accordance with ANSI A42.4 unless otherwise indicated.

E. Hanger Anchorage: Comply with ANSI A42.4 for concrete inserts, clips, bolts, screws and other devices applicable to the indicated method of structural anchorage for ceiling hangers. Size devices for 3 by calculated load supported, except size direct-pull concrete inserts for 5 by calculated load.

F. Furring Anchorage: Galvanized, 16-gage wire ties, manufacturer’s standard wire-type clips. Bolts, nails or screws as recommended by furring manufacturer and complying with ANSI A42.4.

2.02 GYPSUM BOARD PRODUCTS

A. Specified in Section 09 29 00 – Gypsum Board.

2.03 TRIM ACCESSORIES

A. Provide 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. Semi-Finishing Type: Manufacturer’s standard trim units that are not to be finished with joint compound (non-beaded).

C. Plastic Edge Trim: Manufacturer’s standard rigid or semi-rigid PVC moldings of the semi-finishing type, shaped to provide resilient contact of gypsum board edges with other work; friction-fit, or pressure-sensitive adhesive mounting.

2.04 JOINT TREATMENT MATERIALS

A. ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

B. Joint Tape: Perforated type.

C. Joint Compound: Provide chemical hardening type for bedding and filling, ready-mixed vinyl type or non-case in-type for topping.

2.05 MISCELLANEOUS MATERIALS

A. Laminating Adhesive: The type and grade of adhesive or compound recommended by the gypsum board manufacturer, for laminating gypsum board together in applications as indicated.

B. Fastening Adhesive: The type and grade of adhesive recommended by the gypsum board manufacturer for fastening board to structural supports or substrates as indicated.

C. Gypsum Board Fasteners: Comply with GA-216, and with gypsum board manufacturer's recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION

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 reviewed by the proper governing authorities, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

3.02 INSTALLATION REQUIREMENTS

A. Comply with ANSI A42.4 as applicable to the type of substrate and drywall support system indicated; and comply with the Gypsum Association GA-203 for installation of furring members.

B. Coordinate and integrate where possible, the installation of trim accessories with the installation of gypsum board. 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.

C. Secure hanger wires to structural supports by wire-typing directly to structure where possible, otherwise tie to inserts, clips and other anchorage devices or fasteners as indicated. Wire-tie hanger wires to main runners.

D. Space main runners 4 feet on center and space hangers at 4 feet on center along runners, except as otherwise indicated.

E. Level main runners to a tolerance of 1/4 inch in 12 feet, measured both lengthwise in each runner and transversely between parallel runners.

F. Space furring members at 24 inches on center except as otherwise indicated.

3.03 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 29 00 GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gypsum board work with a tape-and-compound joint treatment system known as "drywall finishing" work. The types of work required include the following:

1. Gypsum board including screw-type metal support system.
2. Gypsum board applied to metal and wood framing and furring.
3. Gypsum backing boards for application of other finishes.
4. Drywall finishing (joint tape-and-compound treatment).

1.02 SUBMITTALS

A. Submit manufacturer’s technical product data, installation instructions and recommendations for products specified.

1.02 QUALITY ASSURANCE

A. Where work is indicated for fire resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL.

B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.

C. Allowable Tolerances: 1/8 inch offsets between planes of board faces, and 1/4 inch in 8 ft. for plumb, level, warp and bow.

D. Manufacturer: Obtain gypsum boards, framing and fasteners, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

1.03 PRODUCT HANDLING

A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.05 PROJECT CONDITIONS

A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Obtain gypsum board, framing and fasteners, trim accessories, adhesives and joint treatment products from one of the following:

1. Certain Teed 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.

2.02 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, 2-1/2 inches deep and 1-5/8 inches deep, except as otherwise indicated or specified herein. Provide stud manufacturer's standard accessories such as clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system. Runners shall match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work. Provide double 20-gage studs at all openings and doorjambs and at door and opening headers.

C. Furring Members: ASTM C 645; 20-gage, hat-shaped. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

D. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.

2.03 GYPSUM BOARD PRODUCTS

A. To the extent not otherwise indicated, comply with GA-216, as specified and recommended. Exposed gypsum board shall be Type X, fire rated type with tapered long edges and as follows:

1. Edge Profile: Special rounded or beveled edge.
2. Sheet Size: Maximum length available that will minimize end joints.
3. Thickness: 5/8 inch, except where otherwise indicated.
4. Water-resistant Type (WR-1): Provide at all 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 ceramic tile, equal to 5/8 inch thick Durock by USG.

2.03 TRIM ACCESSORIES

A. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

B. Where metal moldings are specifically called out on the drawings, provide the appropriate item from below:

1. Edge Trim - USG No. 200-A.
2. Control Joint - USG No. 093.

2.04 JOINT TREATMENT MATERIALS

A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

B. Joint Tape: Perforated type.

C. Joint Compound: On interior work provide chemical hardening type for bedding and filling, ready-mixed vinyl-type or non-casein-type for topping. On exterior work provide water- resistant type.

2.05 MISCELLANEOUS MATERIALS

A. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board. Gypsum board fasteners shall comply with GA-216. Provide anti-corrosive type at exterior applications.

PART 3 - EXECUTION

3.01 INSTALLATION OF METAL SUPPORT SYSTEMS

A. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions. Furnish concrete inserts, steel deck hanger clips, and similar devices to other trades for installation well in advance of time needed for coordination with other work. Isolate stud system from transfer to structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work. Terminate partition stud systems one foot above finished ceiling, braced each side at 45 degrees at 4 feet on center, except where indicated to be extended to structural support or substrate above. Space studs 16 inches on center except as otherwise indicated.

B. Door Frames: Install additional jamb studs at door frames as indicated, but not less than 2 studs (minimum 20 gage) at each jamb. Space jack studs over doorframes at same spacing as partition studs, with bottom runner secured to doorframe.

C. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported directly on gypsum board alone.

3.02 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed. In addition to compliance with GA-216 and ASTM C 840, comply with manufacturer's instructions and requirements for fire resistance ratings (if any), whichever is most stringent.

B. Install sound attenuation blankets and insulation as indicated, prior to gypsum board unless readily installed after board has been installed.

C. Install wall/partition boards vertically to avoid end- butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

D. Cover both faces of steel studs with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls that are properly braced internally. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than eight (8) square foot area, and may be limited to not less than 75 percent of full coverage.

E. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

F. Floating construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.

G. Space fasteners in gypsum boards in accordance with GA-2l6 and manufacturer's recommendations, except as otherwise indicated.

3.03 SPECIAL GYPSUM BOARD APPLICATIONS

A. Install exposed gypsum board by fastening with screws.

B. Wall Tile Base: Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install water-resistant cement based backing board.

C. At kitchen cabinet walls and similar "wet" areas without ceramic tile, install water-resistant gypsum board.

D. Apply with uncut long edge at bottom of work, and space 1/4 inch above fixture lips. Seal ends, cut-edges and penetrations of each piece with water-resistant sealant before installation.

3.04 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

B. Install metal corner beads at external corners of drywall work.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U- type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints.) Install metal control joint (beaded type) where indicated or required for proper installation.

3.05 INSTALLATION OF DRYWALL FINISHING

A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners heads, surface defects and elsewhere as required to prepare work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound specified herein and recommended by manufacturer.

B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.

C. Apply joint compound in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.

D. Base for Ceramic Tile: Do not install drywall finishing where ceramic tile and similar rigid applied finishes are indicated.

E. Unless otherwise indicated, install drywall finishing at all gypsum board exposed to view and to receive finishes, and where not exposed to view and above ceilings install at all fire rated and smoke, sound, air, conference, exam, toilet, private office, mechanical and electrical room walls.

F. Finishing Gypsum Board Assemblies: Level 4 finish, unless otherwise indicated; Level 1 finish for concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and Level 2 finish where panels form substrates for tile, Level 5 finish is required in areas with a gloss or epoxy finished coating.

3.06 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protection of the gypsum drywall Work from damage and deterioration during the remainder of the construction period.

END OF SECTION

SECTION 09 31 13 THIN-SET CERAMIC TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Thin set ceramic mosaic floor tile, glazed cove base, wall tile and accessories.

1.02 RELATED SECTIONS

A. Section 07 26 00 – Vapor Retarders (Floor protection paper).

B. Section 09 29 00 – Gypsum Board (For cement based backer board).

C. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit manufacturer's product data and written instructions for recommended installation and maintenance practices for each product specified.

B. Submit 2 samples of types and colors of tile and grout required in similar pattern of tile shown on Drawings, mounted on not less than 12 inches square plywood or hardboard and grouted as required.

C. Submit one full size sample of each tile accessory and marble threshold. Submit samples of trim and other units if requested by the Project Engineer / MDOT Architect. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.04 QUALITY ASSURANCE

A. Furnish tile conforming to the Standard Grade Requirements of ANSI A137.1.

B. When using setting and grouting materials manufactured under TCA license, include identification, and formula number on each container. Provide materials obtained from only one source for each type of tile, grout and color to minimize variations in appearance and quality.

C. Install ceramic tile in accordance with manufacturers instructions and applicable installation specifications of the Tile Council of America's "Handbook for Ceramic Tile Installation", latest edition.

1.05 PRODUCT 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. Maintain 50 degrees F. temperature continuously during and after installation as recommended by tile manufacturer but not less than 7 days. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. American Olean Tile Company, Lansdale, Pennsylvania
2. Dal-Tile Corporation, Dallas, Texas
3. Floor Gres Ceramiche, Italy
4. Florida Tile Industries, Lakeland, Florida.
5. Lone Star Porcelain Mosaic Tile, Dallas, Texas
6. United States Ceramic Tile Co., East Spatra, Ohio

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS

A. Ceramic Floor Tile: 6 inches by 6 inches, cushioned edge, unglazed, color provided at Section 09 05 15-Color Design.

B. Ceramic Cove Base Tile: 6 inches by 12 inches, cushioned edge, bright glaze, cove base round top, color provided at Section 09 05 15-Color Design.

C. Glazed Wall Tile: Size 4-1/4 inches by 4-1/4 inches by 5/16 inch, cushioned edge, bright glaze, color provided at Section 09 05 15-Color Design.

D. Trim And Special Shapes: Provide necessary units with rounded internal and external corners, and rounded internal and external corner units of same material and finish as field tile, and as follows:

1. Base: Sanitary cove units.
2. External Corners: Bullnose shapes, with a radius of not less than 3/4 inch, unless otherwise shown.
3. Internal Corners: Field-butted square, except use square corner, combination angle and stretcher type cap.

E. Marble Thresholds: Provide sound Group "A" marble with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Color of marble threshold to be selected by the Project Engineer / MDOT Architect from manufacturer’s full range of standard colors. Bevel shall meet ADA requirements.

F. 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.

G. Grout: ANSI A 118.3, with Tile Contractor’s Association certification of conformance. Equal to Laticrete Type SpectraLOCK Pro Grout. Color provided at Section 09 05 15-Color Design.

1. Equivalent products by Mapei and Bostik are acceptable. Color of grout to be selected by the MDOT Architect from manufacturer’s full range of standard colors.

PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine the substrate and the conditions under which ceramic tile is to be installed and notify the contractor in writing of any conditions detrimental to the proper and timely completion of the Work.

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

3.02 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. Handle, store, mix and apply proprietary setting and grouting materials in compliance with the manufacturer's instructions.

C. Extend tile Work into recesses and under equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate Work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

D. 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, and fixtures so that plates, collars, or covers overlap tile.

3.03 JOINTING PATTERN

A. Unless otherwise shown, lay tile in grid pattern. Align joints where adjoining tiles on floor, base, walls and trim are the same size. Layout tile Work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown. There shall be no cut tile in the vertical plane of the tile.

3.04 COLOR PATTERN

A. Install pattern as indicated on the drawings. Typical pattern is indicated on a typical wall to be installed on all walls of indicated spaces.

3.05 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. 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. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. 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. Protect installed tile Work by covering with floor protection paper during the construction period to prevent damage and wear. Prohibit all foot and wheel traffic from using tiled floors for 7 days after installation. Before final inspection, remove protective covering and rinse neutral cleaner from all tile surfaces.

END OF SECTION

SECTION 09 31 19 THIN-SET PAVER TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tile includes ceramic surfacing units made from clay or other ceramic materials. Extent of tile work is indicated on the Drawings and schedules.

B. Types of tile work in this section include Unglazed Paver Tile - Thin set.

1.02 RELATED SECTIONS

A. Section 07 26 00 – Vapor Retarders (Floor protection paper).

B. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Product Data: Submit manufacturers' descriptive literature and installation instructions for all materials used in the work of this section. Provide color charts consisting of actual tiles or sections of tiles showing full range of colors available for each type of tile specified. Include samples of grout and accessories requiring color selection.

B. Shop Drawings: Verify project conditions and submit a scaled layout of tile including all details, patterns, locations of thresholds, equipment, grid and expansion joints (if any).

C. Samples: For each type of tile and each color required, submit two panels not less than 24 inches square on plywood or hardboard backing with joints grouted.

D. Quality Control: Reports from an independent testing laboratory indicating that each type of tile furnished meets the performance requirements specified above.

1. Certificates: Submit Master Grade Certificate for each type of tile, signed by the manufacturer and the installer.
2. Certified Test Reports: Submit certified test reports from a qualified independent testing laboratory evidencing compliance of tile and tile setting products with requirements specified based on comprehensive testing of current products. Include in reports testing laboratory's interpretation of test results relative to specified requirements.

E. Contract Closeout: Provide Maintenance Data and Manufacturer's recommendations on cleaning.

1.04 QUALITY ASSURANCE:

A. Provide materials obtained from one source where possible for each type and color of tile, grout, and setting materials with the following performance requirements:

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.
2. Water Absorption: Impervious when tested in accordance with ASTM C 373-88.
3. Bond Strength: 50 psi or greater when tested in accordance with ASTM C 482-81 (1986).

4. Breaking Strength: Average of 250 lbs. or greater when tested in accordance with ASTM C 648-84 (1989).
5. Abrasive Hardness: Index of 100 or greater when tested in accordance with ASTM C 501-84.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup. Maintain temperatures at not less than 50 degrees F. (10 degrees C.) in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

C. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tile: Equal to Dal-Tile, City View; Refer to Section 09 05 15 Color Design for color selection.

B. Manufacturers of Dry-set and Latex-Portland Cement Mortars:

1. Laticrete International
2. Hydroment/Bostik Const. Products
3. C-Cure Corporation

C. Manufacturers of Grouts:

1. Laticrete International
2. Hydroment/Bostik Const. Products
3. C-Cure Corporation

D. Manufacturers of Waterproof Membranes:

1. Laticrete International
2. Hydroment/Bostik Const. Products
3. C-Cure Corporation

2.02 PRODUCTS, GENERAL

A. Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Colors, Textures and Patterns: For tile, grout and other products requiring selection of colors, surface textures or other appearance characteristics, provide products to match characteristics indicated. Provide tile trim and accessories which match color and finish of adjoining flat tile.

D. Unglazed Paver Tile: Provide flat tile complying with the following requirements:

1. Type: Porcelain Ceramic
2. Nominal Facial Dimensions: 12 inches by 24 inches at PT#1; 24 inches by 24 inches at PT#2
3. Nominal Thickness: 5/16 inch.
4. Face: As selected with modified cushion edges

E. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1. Size: Coordinated with sizes and coursing of adjoining flat tile, where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes for thin-set installations:
   a. Base: Coved, 6 inches by 12 inches.
   b. External Corners: Surface bullnose.
   c. Internal Corners: Field-butted square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.

F. Setting Materials: Provide Latex-Portland Cement Mortar complying with ANSI A118.4 having a latex additive (water emulsion) of styrene butadiene rubber serving as a replacement for part or all of gauging water, added at job site to prepackaged dry mortar mix supplied or specified by latex manufacturer, for thin set floor tile applications on each type of substrate indicated. Provide primer-sealer as recommended by mortar manufacturer.

1. Waterproof Membrane: Provide trowel applied liquid waterproofing membrane, extra heavy duty type, consisting of cold applied liquid latex-rubber and reinforcing fabrics or urethane and reinforcing fabrics to form a seamless integral membrane at the substrate at the floor and base.

G. Latex-Portland Cement Grout: Manufacturer’s standard latex portland cement grout complying with ANSI A 118.6, with Tile Contractor's Association Adhesive and Sealant Council certification of conformance, for floor tile.

H. Mixing Mortars and Grout: Mix mortars, grouts, and waterproof membrane to comply with requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

I. Organic Adhesive: Manufacturer’s standard organic adhesive bond coat, complying with ANSI A 136.1, with Tile Contractor's Association Adhesive and Sealant Council certification of conformance, for base tile set on each type of substrate indicated. Provide primer-sealer as recommended by adhesive manufacturer.

2.03 METAL PROTECTIVE EDGE TRIM

A. Paver tile to Carpeting: Provide a 304 stainless steel metal edge trim equal to Schluter-Scheine-E at all areas where carpeting meets paver tile, at expansion joints and other locations where edge of tile is exposed to abuse. Size shall be in accordance with trim manufacturer's recommendations for thickness of tile materials used. Install in strict accordance with manufacturer's instructions.

B. Paver tile to VCT or concrete: Provide a 304 stainless steel metal edge trim equal to Schluter-Scheine-EUBG at all areas where paver tile meets vinyl composition tile or paver tile requires transition to concrete. Size shall be in accordance with trim manufacturer's recommendations for thickness of tile materials used. Install in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive tile work and conditions under which tile will be installed. Do not proceed with tile work until surfaces and conditions comply with requirements indicated in referenced tile installation standard.

B. Pre-installation meeting between Project Engineer, Architect, Contractor and tile Subcontractor shall be held prior to installation to verify tile patterns, jointing, and other items. Coordinate with monthly progress meetings.

3.03 INSTALLATION, GENERAL

A. Comply with applicable parts of ANSI A108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile".

B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with latest TCA installation methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.

C. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

D. Install metal protective edge trim in accordance with approved layouts where carpeting meets paver tile. Install according to manufacturer’s instructions.

E. 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 that plates, collars, or covers overlap tile.

F. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, 1/4 inch wide and as allowable by applicable TCA standards and manufacturers printed instructions.

G. Grout tile to comply with the requirements and installation standards of ANSI A108.10, ANSI A108.6 as applicable, and to provide an even, uniform grout surface between units. Grout shall be uniform and consistent in color and appearance.

3.04 FLOOR INSTALLATION METHODS

A. Paver Tile: Install tile to comply with requirements indicated below for setting bed method, TCA installation method related to types of subfloor construction and grout types.

1. Latex-Portland Cement Mortar: Method F113-95
2. Concrete Subfloor, Interior: TCA F113 and TCA F115
3. Grout: ANSI A108.6

B. For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards.

3.05 CLEANING AND PROTECTION

A. Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures form effects of acid cleaning. Flush 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 floors. Protect installed tile work with floor protection paper during construction period to prevent staining, damage and wear. Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09 51 00 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Lay-in acoustical panels (2’ by 2’ Grids) for metal ceiling suspension systems.

B. Suspended metal grid system complete with wall trim.

1.02 RELATED SECTIONS

A. Section 07 21 00 – Thermal Insulation.

B. Section 09 29 00 – Gypsum Board.

C. Division 23 for Mechanical Requirements.

D. Division 26 for Electrical Requirements.

1.03 SUBMITTALS

A. Manufacturer's product specifications, samples, 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. 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.

1.04 QUALITY ASSURANCE

A. Installer shall be a company with not less than 3 years of documented successful experience in installation of acoustical ceilings similar to requirements for this Project and acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer (required for approval).

1.05 PROJECT CONDITIONS

A. Do not install interior 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.

1.06 PROJECT 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. Any additional components required shall be furnished and installed by this contractor.

1.07 MAINTENANCE STOCK

A. At time of completing installation, deliver stock of maintenance material to Owner. Furnish full size units matching units installed, packaged with protective covering for storage, and identified with appropriate labels. Furnish amount equal to 2 percent of acoustical units and exposed suspension installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS

A. 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' by 2' grid-size panels, with white washable finish.

B. Mineral Fiber Acoustical Tile: Provide units with Intersept 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. 770 Cortega Square Edge; Armstrong World Industries, Inc.
2. Van-157 Vantage 10 Trim Edge ; CertainTeed/BPB Celotex.
3. No. 2210 Radar ClimaPlus Square Edge; U.S. Gypsum Co.

2.02 CEILING SUSPENSION MATERIALS

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. Chicago Metallic Corp. Donn Corp.
   b. W. J. Haertel Div.; Leslie-Locke.
   c. National Rolling Mills Co. Roblin Building Products Roper.
   d. Eastern Building Systems.

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, white unless otherwise selected by MDOT Architect.

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

3.04 INSTALLATION

A. Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to the Work.

B. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. 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. 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.

C. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units. 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.

D. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations. 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.

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. 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 SECTION INCLUDES

A. Vinyl Composition Tile (V.C.T.) Flooring, Vinyl Base, and Accessories.

1.02 RELATED SECTIONS

A. Section 07 26 00 – Vapor Retarders (Floor protection paper).

B. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit manufacturer's product data and written instructions for recommended installation and maintenance practices for each type of resilient flooring and accessories.

B. Submit complete line of color samples for selection.

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 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. Maintain 70 degrees F. temperature continuously during and after installation as recommended by flooring manufacturer but not less than 48 hours. Maintain a minimum lighting level of 50 fc during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

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

B. Equivalent products by the following manufacturers are acceptable:

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

C. Alternate manufacturers: Products produced by other manufacturers that fully meet or exceed the specified requirements may be considered under provisions of Section 01 62 14-Product Options and Substitution Procedures.

2.02 TILE FLOORING

A. Vinyl Composition Tile: ASTM F 1066: Composition 1, Class 2, Premium Visual Tile, as manufactured by Mannington Commercial or equal.

B. Size: 12 inches by 12 inches.

C. Thickness: 1/8 inch gage.

D. Color: Color to be selected by Project Engineer / MDOT Architect from manufacturer's full range of Premium colors. Refer to Section 09 05 15 – Color Design for selected finishes.

2.03 ACCESSORIES

A. Provide rubber base complying 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. 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.

C. Carpet Edge Guard, Nonmetallic: Extruded or molded rubber carpet edge guard for carpet to VCT transitions, manufactured by rubber base manufacturer. Color to match rubber base material.

D. Adhesives (Cements): As recommended by flooring manufacturer to suit material and substrate conditions.

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

3.02 PREPARATION

A. Acclimate tile and base to job site conditions for at least 48 hours prior to installation. Prior to laying flooring, broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed Work.

B. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.

C. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive.

3.03 INSTALLATION

A. 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.

B. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces, door reveals, and into closets and similar openings.

C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

1. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers.
2. Tightly cement edges to perimeter of floor around corners and to corners. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

D. Tile Flooring: Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown. Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tiles are not acceptable.

1. Tightly cement tile to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.
2. NOTE: Lay tile with Grain In All Tiles Running In The Same Direction.

E. Accessories: 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. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown. Comply with manufacturer's written instructions for installing resilient base.

3.04 PATTERN

A. Pattern shall be installed as indicated in the drawings. Tile shall be centered such that no less than half a tile shall be along any edge and joints shall align with adjacent colors.

3.05 CLEANING AND PROTECTION

A. Initial Cleaning: Remove excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer.

B. 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. Sweet or vacuum thoroughly, and remove residual adhesive with a clean white cloth dampened with cleaners as recommended by flooring manufacturer.
4. Apply 3 coats of manufacturers recommended high-quality cross-linked acrylic floor polish, allowing 60 minutes drying time between applications.

C. Protection: Protect installed flooring from damage by covering with floor protection paper.

D. Finishing: After completion of project and just prior to final inspection of Work, scrub the floor using a good quality non-alkaline cleaner and a floor machine of 170-250 rpm equipped with a green or blue scrubbing pad.

1. Thoroughly rinse the floor (avoid flooding the floor) and allow the floor to dry completely.
2. Apply 3 coats of manufacturers recommended high-quality, cross-linked acrylic floor polish, allowing 60 minutes between applications.
3. After polish is completely dry, spray buff using a diluted (7 - 8 percent solids) floor polish. Before the liquid is dry, buff with a floor machine equipped with a white or tan buffing pad or a soft brush at 170-700 rpm. Buff until the liquid is dry and a thin glossy film remains.
4. Protect completed Work from traffic and damage until acceptance by the Owner.

END OF SECTION

SECTION 09 68 13 TILE CARPETING

PART 1 - GENERAL.

1.01 SUMMARY

A. This Section includes requirements for modular carpet tile and related products. The extent of each type of carpet tile is indicated on the drawings.

1.02 SUBMITTALS

A. Submit samples of each modular carpet tile product specified. Each carpet tile sample shall have manufacturer's label securely attached.

B. Submit modular carpet tile layout drawings clearly indicating modular carpet location, direction, and pattern direction. Indicate placement of cut tiles. Indicate all walls, built-in cabinets and other objects that must interface with carpet tile installation.

C. Submit manufacturer's literature, product data and specifications on all modular carpet tile and accessories.

D. Submit installation instructions for all modular carpet tile products and accessories.

E. Submit maintenance and cleaning instructions, including frequency and recommended methods of cleaning as approved by both carpet tile and fiber manufacturers. Submit independent test reports and certifications that products comply with the following:

1. ASTM E 648 - Radiant Panel
2. NFPA 258 or ASTM E 662 - Smoke Density
3. CPSC FF 1 70 or ASTM D 2859-Flammability
4. AATCC 16 E – Lightfastness
5. AATCC 165 – Crocking
6. AATCC 134 - Electrostatic Propensity
7. AACHEN Test DIN STD 54318 - Dimensional Stability
8. Wetfastness: AATCC 107 for measuring shade change under specific conditions. Acceptable rating no worse than three (3) on the grey scale.

F. Submit installer qualifications including, experience record, manufacturer certification, and list of installations similar in size, scope, and complexity to the work of this project

1.03 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years experience in manufacturing modular carpet tile systems. Manufacturer’s published product literature shall clearly indicate general compliance of products with requirements of this Section. Installations of manufacturer’s products shall generally meet the requirements of this Section. Secondary backing system must be applied by manufacturer. Final determination and qualification of manufacturer rests solely with the Architect.

B. Installer/subcontractor shall have not less than five (5) years experience in modular carpet tile systems installation and shall have successfully completed projects of similar size and scope of the work of this section. Installer shall be certified by the manufacturer of the modular carpet manufacturer. Installation shall be under direct observation of an experienced supervisor thoroughly familiar in this type of work. Mechanics executing the work shall be qualified and experienced in all facets of the work to be performed.

C. Product Performance Testing:

1. Static - 3.0 KV when tested under the standard shuttle test. 70 degrees F - 20 percent R.H.
2. Flammability - Passes DOC-FF-1-70 pill test
3. Flooring Radiant Panel Test - Meets NFPA Class 1 when tested under ASTM E-648 glue down.
4. Smoke Density - NBS Smoke Chamber NFPA-258 Less than 450.

1.04 PRODUCT DELIVERY AND STORAGE

A. Deliver carpeting materials in protective wrapping. Store inside, protected from weather, moisture and soiling.

1.05 PROJECT CONDITIONS

A. Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer. Carpet to be installed over access flooring.

1.06 GUARANTEE

A. Provide manufacturing warranty signed by manufacturer agreeing to repair or replace product with defective workmanship including edge ravel, de-lamination, shrinkage, curling, and doming for a period of one (1) year from date of substantial completion.

B. Provide Wear warranty by manufacturer for fiber loss of not more than ten percent (10%) in ten (10) years from the date of substantial completion.

C. Provide Static warranty of 3.0 KV at 20 percent R.H. and 70 degrees F. by manufacturer for the life of the product.

D. Provide Adjustment warranty by the installer for the guarantee period and within fifteen (15) days written notice, reset and repair any areas of faulty workmanship by the installer.

1.07 REPLACEMENT MATERIALS AND ADDITIONAL STOCK

A. After completion of work, deliver to the project site ten (10) full pieces of each carpet tile. Furnish replacement materials from the same manufactured dye lot as the materials installed. Replacement materials shall be in protective wrapping and properly labeled and identified.

PART 2 - PRODUCTS

2.01 CARPET TILE

A. Provide CPT 1 as manufactured by Tandus Flooring, or equal.

1. Style Circlet 02888, Color Balsawood 14201

2.02 CARPET TILE ACCESSORIES

A. Adhesive shall be as required by the manufacturer for the substrate.

B. Provide miscellaneous materials as recommended by manufacturer of modular carpet and selected by installer to meet project circumstances and requirements.

PART 3- EXECUTION

3.01 PRE-INSTALLATION REQUIREMENTS

A. Field verify dimensions prior to beginning installation of modular carpet tiles. Check all other field conditions affecting the work.

B. Examine substrate to verify allowable moisture content. Institute corrective measures as recommended by manufacturer if moisture content exceeds the allowable moisture content.

C. Examine substrate for alkalinity. Institute corrective measures as required by manufacturer if ph reading is greater than allowed.

D. Notify contractor in writing of any conditions which are detrimental to proper installation of carpet tile or prevent satisfactory completion of the work. Do not proceed with installation until such conditions are corrected.

E. Clear away debris and scrape cementitious deposits from concrete surfaces to receive modular carpet. Patch and level as necessary. Thoroughly remove dust by vacuuming and wet mopping. Apply concrete sealer which is compatible with adhesive to be used and acceptable to carpet manufacturer.

F. Store carpet tile modules and adhesive in a heated room at a minimum temperature of 68 degrees F at least three (3) days prior to installation.

G. Coordinate modular carpet tile installation with other work to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.02 INSTALLATION

A. Comply with modular carpet tile manufacturer's recommendations for installing product specified. Should manufacturer's recommendations vary with any of the specifications listed below, notify the Architect for final determination.

B. Allow proper set up time for adhesive as required by manufacturer.

C. Determine the center of the room using standard tile laying methods. The center chalk lines, dividing the room into quadrants should be off center, if necessary, to ensure that perimeter modules will be half size or larger on principle walls.

D. Install carpet with pile inclination using the arrows marked by the manufacturer on the back of each module.

E. Install carpet in a temperature of no less than 68 degrees F.

F. Cut and fit carpet tiles tightly and neatly into breaks and recesses, alcoves, closets, against bases, permanent cabinets and equipment, under open bottom items and removable flanges including heating convectors. The accumulated tightness as a result of loose joints shall not be greater than 1/4 inch over eleven (11) modules. Carpet tile shall run fully under the console furniture.

G. Install carpet tile edge guard where edge of modular carpet is exposed to traffic. Maintain smooth transition.

3.03 CLEANING AND PROTECTION

A. Remove and dispose of debris, carpet scraps, cartons, and other foreign materials. Remove spots and smears of adhesive from carpet surface with approved cleaning agent. Replace any tiles which cannot be cleaned.

B. Vacuum carpet tile several times using commercial cylinder brush type vacuum cleaner and/or commercial pile lifter or as specified by carpet manufacturer. Remove any protruding face yarn with sharp scissors, do not pull.

C. Advise contractor of required protection methods and materials needed until substantial completion of project to insure that modular carpet tile will not be damaged.

D. Deliver specified overrun and usable scraps of carpet tile to Owner's designated storage space, properly packed and identified.

3.04 INSPECTION

A. Upon completion of the installation, inspect installation and verify that work is complete, properly installed and acceptable. Remove and replace all work not found acceptable at the Installers expense and to the satisfaction and acceptance of the Architect.

END OF SECTION

SECTION 09 69 00 ACCESS FLOORING

PART 1- GENERAL

1.01 SUMMARY

A. This Section includes requirements for six inch deep raised access flooring with a static dissipative finish.

1. Access flooring work includes interchangeable panels, understructure, labor, material, equipment, and accessories for a complete installation.

1.02 QUALITY ASSURANCE

A. Installer shall have a of minimum 5 years experience in the installation of access floors of comparable size and complexity.

B. Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Clearly mark units for assembly and coordinated installation.

1.03 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Submit certified test data for each type and size of panel indicated.

C. Submit two samples of floor panels and understructure components.

D. Submit two sets of samples for floor finish selections.

E. Submit shop drawings for the fabrication, installation and erection of floor system and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

F. Submit floor plan layout including starting point, edge details at intersecting surfaces, and anchoring of pedestal bases to subfloor.

G. Submit Certificates for:

1. Independent test indicating compliance with specified design criteria when tested in accordance with CISCA ARecommended Test Procedures for Access Flooring@.
2. Seismic calculations in accordance with local and state building codes. Submit signed copy of calculations with above submittals.

H. Submit installer’s qualifications including references.

1.04 STORAGE

A. Provide a secure and dry storage area to receive, unload, store, and access to installation areas.

B. Installation Environment: 40 to 90 degrees F, and approximately 35 to 70 percent relative humidity, 24 hours a day during and after installation.

1.05 DESIGN PERFORMANCE AND CERTIFICATION OF PRODUCT

A. Provide access flooring system consisting of movable assemblies composed of interchangeable modular floor panels supported on pedestals forming accessible under floor cavities.

B. Tolerances:

1. Manufacturing Tolerances:
   a. Nominal Panel size - +/- 0.015 inch or less
   b. Panel Flatness - +/- 0.020 inch or less
   c. Panel Squareness - +/- 0.015 inch or less
   d. Panel interchangeability - all panels except panels meeting special conditions
2. Installation Tolerances:
   a. Finish installation - level within +/- 0.060 inch in 10 feet and +/- 0.100 inch for entire floor area.

PART 2- PRODUCTS

2.01 MANUFACTURERS

A. Provide products by one of the following manufacturers:

1. TecCrete >Corner Lock= Access Floor System as manufactured by Haworth, Inc., Grand Rapids, MI 49512.
2. Concore 2500 with bolted Stringers Access Floor System as manufactured by Tate Access Floors, Inc.
3. CCS2500 Concrete Core Steel Panel system as manufactured by Access Floor Corp.
4. Or approved equal

2.02 MATERIALS

A. Floor Panels shall be integrated steel pan construction with exposed top surface of high strength lightweight concrete fill.

1. Nominal 24 inches square x 1 1/8 inch deep, manufactured with hot dipped galvanized steel pan having shear tabs that integrally bond to the concrete fill. Manufacture panel corners to receive pedestal head positioning dome with a corner lock ground insert. Manufacture panel to accept a flush fit metal fastener which securely fastens each panel corner to the pedestal head.
2. Floor panel surface shall be factory applied 1/8 inch thick, static dissipative, high pressure laminate. High pressure laminates shall be finished with the edge trim. Panels shall have a maximum electrical resistance of 10 ohms or less from the top edge of the panel to the understructure, less surface covering, as tested according to NFPA 99 modified.
3. Floor surface shall be maintained level and at a height of six inches above the finished floor of the recessed floor area.

B. Panel Loading and Requirements

1. Concentrated load: 1,250 pounds on one square inch at any location with a top surface deflection not to exceed 0.10 inch and a permanent set not to exceed 0.010 inch.
2. Uniform Load: 650 pounds with minimum top surface defection not to exceed 0.040 inch.
3. Ultimate Load: 1800 pounds per square inch without failure.

4. Rolling Load:
   a. on casters - 1200 pounds
   b. on rubber wheels - 800 pounds
5. Impact Load: 150 pounds on 1 square inch minimum dropped from a height of 36 inches.
6. Heat Transmission: bottom surface temperature exposure to 1600 degrees F for 15 minutes shall not increase top surface temperature more than 150 degrees above ambient temperature.
7. Flame Spread: Meets or exceeds ASTM E:84 Class 1: Flame spread of 5 or less and smoke development of 10 or less per NFPA.
8. Panel weight: not less than 40 pounds to minimize footfall and nosie transmission from below or above panels.

2.03 PANEL UNDERSTRUCTURE

A. Pedestal assembly shall be hot dipped galvanized steel

B. Base shall be minimum 16 square inches, underside stamped or embossed to adhere to sub floor with manufacturer=s recommended adhesive.

C. Threaded stud shall be 3/4 inch diameter steel.

D. The head assembly shall be designed so that the panels will be held in place with or without corner-lock fasteners.

E. Pedestal assembly shall provide an adjustment range of +/- 1 inch when finished floor height is 6 inches or more, adjustable at 1/64 inch increments without rotating pedestal head.

F. The assembly shall provide a mechanical means to lock the floor in a level plane and adjustments shall be capable of being made without special tools.

G. For corner-lock system, the head of the all-steel assembly shall be designed to accept a metal fastener to mechanically lock the panels in place.

H. Pedestal assembly shall support not less than 6,000 pounds axial load and shall resist an average 1,000 inch-pound overturning moment when bonded to a clean concrete slab.

2.04 STRINGERS

A. Stringer shall capture panels and be capable of supporting a 450 pound concentrated load at mid span with less than 0.010 inch permanent set after the load is removed.

B. Stringers shall be individually and rigidly fastened to the pedestal with one machine screw for each foot of stringer length. Bolts shall provide positive electrical contact between the stringers and pedestals. Connections depending on gravity or spring action are unacceptable

C. Stringer shall be either 2 foot x 2 foot pattern and shall be secured by a fastener.

2.05 ACCESSORIES

A. Furnish ramps, steps, lateral bracing, fascia, handrails, cutouts and miscellaneous items where indicated.

B. Provide modular power system, including in-floor service outlets for power, communications, and data wiring in locations as shown on Drawings.

PART 3- EXECUTION

3.01 PREPARATION

A. Examine and verify sub-floor for dryness, temperature, moisture, cleanliness, unevenness, or irregularities that will affect installation.

1. Verify stored material and installed areas meet recommended environmental conditions.
2. Verify floor level to within 1/8 inch in 10 feet.

B. Coordinate layout drawings, diagrams, templates, instructions, and directions for installation.

3.02 FIELD QUALITY CONTROL

A. Take random panel from shipment at construction site and test panel for compliance if directed by Architect.

3.03 INSTALLATION

A. Establish pedestal locations and coordinate with mechanical and electrical work.

1. Mark pedestal locations as required for layout of electrical or communication raceways.

B. Coordinate with work of other trades to maintain integrity of the installed flooring. No traffic is permitted on completed floor areas for 48 hours until pedestal adhesive is set.

C. Installation shall be by factory trained installers.

D. Clean floor and remove dust, and or debris, before start of work and continuing during work to ensure proper bonding of pedestals to floor.

E. Complete installation level within 0.060 inch in 10 feet and 0.100 inch entire floor.

F. Protect finish work from damage, contamination, or overloading until work is turned over to Owner. If damaged, replace damaged panels, and or sections, with new materials.

END OF SECTION

SECTION 09 72 15 VINYL WALL COVERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vinyl coated fabric wallcovering as shown on the Drawings and Schedules.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design
B. Section 09 29 00 – Gypsum Board.
C. Section 09 90 00 – Painting and Coatings

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of wallcovering and installation materials including adhesives. Transmit additional copy of each instruction to the installer.

B. Certifications: Test data certifying that the products meet the flame spread ratings and smoke development values specified herein in accordance with ASTM E – 84 Tunnel Test. (Surface burning characteristics of building materials) Class "A" Fire Rated: Flame Spread 0-25 inclusive; Smoke Developed 0-50 inclusive.

C. Samples: Submit samples of each type of wallcovering to illustrate the range of color and pattern variation. Review of samples will be for design, color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

D. Maintenance Instructions: Submit wallcovering manufacturer's printed instructions for maintenance of the installed work. Include name of manufacturer, material brand name, color and texture designation, and precautions for the use of cleaning materials and methods that could damage the wallcovering.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, 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.

B. Interface with Other Sub-Systems: Coordinate all components with adjacent or pertinent components of other systems to assure workable details, connections, clearances and tolerances. Before starting the Work and from time to time as Work progresses, examine shop drawings and installation of others insofar as it applies to work in this section. Notify the Project Engineer/Architect immediately in writing if any conditions exist which will prevent satisfactory results of the installation. Should Work start without such notification, it shall be construed as acceptance by the Contractor of all claims or questions as to the suitability of others to receive the Work.

1.05 PROJECT CONDITIONS

A. Maintain a constant minimum temperature of 60 degrees F. at areas of installation for a minimum of 72 hours before, and 48 hours after the application of wallcovering.

1.06 DELIVERY, STORAGE AND HANDELING

A. Comply with the manufacturer's instructions and recommendations and as herein specified. Deliver materials to the project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire hazard classification. Store materials in original undamaged packages or containers. Do not store wallcovering in an upright position.

B. Store in an approved cool, dry location. Maintain temperature above 40 degrees F.

1.07 REPLACEMENT MATERIALS AND EXTRA STOCK

A. After completion of work, deliver to the project site not less than 5 lineal yards of each type, color and pattern of wallcovering installed. Furnish replacement materials from the same manufactured sequence as the material installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Illusion and Excursions, Jackson, MS.

B. Equivalent products by the following manufacturers are acceptable:

1. KOROSEAL Wallcovering, Fairlawn, OH.
2. VERSA Wallcovering, Louisville, KY.
3. EYKON Walcovering, Memphis, TN.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS

A. Provide materials bearing the UL label and markings; with Class "A" Fire Rating.

B. Comply with GSA Federal Specifications CCC-W408A&C for the type and class required. Comply with CFFA-W-101A&B Quality Standard for Vinyl Coated Fabric Wallcovering. Comply with the requirements of ASTM D 1308 b for determining stain resistance.

C. Wallcovering color, pattern and texture as selected by the Project Engineer/Architect from Type I, Light Duty or Type II, Medium Duty. Refer to Room Finish Schedule on the Drawing for types required. Three or less patterns shall be selected from the same manufacturer.

2.03 ADHESIVE

A. Provide manufacturer's recommended strippable type adhesive, primer and sealer, manufactured expressly for use with the selected wallcovering. Materials shall be mildew resistant and nonstaining. Adhesive shall permit removal of wallcovering from gypsum drywall surfaces without damage to paper facing.

2.04 DATA SHEETS/SCHEDULE: Each type of vinyl wallcovering is specified by wallcovering data sheets as follows:

VWC #1

Manufacturer:	Koroseal Wall-covering
Style:	Linden
Color:	Green Tea, 4621-89
Weight:	21 oz.
Width:	53/54 inches
Ratings:	Class “A”

This vinyl wall-covering is for walls in all interior Corridors as scheduled.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine the areas and conditions under which wallcovering is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Install specified materials only when normal temperature and humidity conditions approximate the interior conditions that will exist when building is occupied.

3.02 PREPARATION

A. Remove wallcovering materials from its packaging and allow to acclimatize to the area of installation 24 hours before application. Remove switch plates, wall plates, and surface mounted fixtures, where wallcovering is to be applied. Prime and seal substrates in accordance with the wallcovering manufacturer’s recommendations for the type of substrate material to be covered and per Section 09 90 00 Painting and Coatings.

3.03 INSTALLATION

A. Place wallcovering panels consecutively in order they are cut from rolls, including filling of spaces above or below openings. Hang by reversing alternative strips except on match patterns.

B. Apply adhesive to back of wallcovering and place in accordance with manufacturer’s instructions. Install seams vertically and plumb, and at least 6” away from any corner, horizontal seams will not be permitted. Place wallcovering continuously over internal and external corners. Overlap seams and double cut to assure tight closure. Do not use double cut method if manufacturer recommends another type method of installation. Roll, brush, or use broad knife to remove air bubbles, wrinkles, blisters and other defects. Cut wallcovering evenly to the edges of outlet boxes or supports

C. Trim selvages as required to assure color uniformity and pattern match at seams. Remove excess adhesive along finished seams using manufacturer’s recommended methods. Install wallcovering with an intimate substrate bond, smooth, clean, without

wrinkles, gaps and overlaps. Install removed plates and fixtures to assure cut edges of wallcovering are completely concealed.

3.04 CLEANUP

A. Clean up all adhesive, finger marks, and dirt off exposed surfaces wherever it occurs. Absolutely no loose wallcovering with glue on face will be permitted.

B. Upon completion of work, remove surplus materials, rubbish and debris resulting from wallcovering installation and leave areas of work in a neat, clean condition.

END OF SECTION

SECTION 09 84 14 ACOUSTICAL WALL PANELS

PART 1- GENERAL

1.01. SUMMARY

A. This Section includes factory manufactured Acoustical Panels as indicated on drawings.

1.02. SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Submit shop drawings for acoustical insulation showing fabrication and installation of Acoustical Panels including plans, elevations, sizes, sections, details of components, and attachments to other construction.

C. Submit installer qualifications.

D. Submit manufacturer's full range of Acoustical Panel fabrics. Include representative samples of installation devices and accessories, if required.

E. Submit product test reports from and based on tests performed by a qualified independent testing agency acceptable to authorities having jurisdiction, evidencing that Acoustical Panels comply with requirements specified for fire-test-response characteristics and sound absorption performance.

F. Submit product certificates signed by manufacturers of Acoustical Panels certifying that their products comply with specified requirements.

G. Submit 2 sets of color samples for all components requiring color selection. Samples shall be on actual materials and shall not be printed on paper.

1.03. QUALITY ASSURANCE

A. Provide Acoustical Panels with surface-burning characteristics as indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this Section, per ASTM E 84.

1. Classification: Class "A"
2. Flame Spread: 25 or less
3. Smoke Developed: 450 or less

B. Manufacturer shall have a minimum of 5 years experience in the production of wall and ceiling panels similar in design to the work of this project.

C. Obtain each type of Acoustical Panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

D. Panel installer shall have a minimum of five years experience in the installation of systems similar in size, scope and complexity to the work of this project.

1.04. DELIVERY, STORAGE AND HANDLING

A. Protect Acoustical Panels from excessive moisture in shipment, storage and handling. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium.

1.05. PROJECT CONDITIONS

A. Environmental Conditions: Do not begin installation until area to receive Acoustical Wall Panels has been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.

B. Field Measurements: Installing contractor to check wall surfaces and adjacent work including millwork and take accurate field measurements before fabrication and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Manufacture panels to sizes and configurations indicated. Attach facing materials, with acoustically transparent adhesive, to cores to produce installed panels with visible surfaces fully covered and free from waves, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.

B. Dimensional Tolerances of Finished Units: Overall height, width, thickness, edge straightness, chords, radii, diameters, and squareness from corner to corner of panels - Plus or minus 1/16 inch, in accordance with industry standards as established by the Acoustical Wall Panel Committee of the Ceilings and Interior Systems Construction Association (CISCA).

C. Sound Absorption Performance: Provide Acoustical Ceiling Panels with minimum noise reduction coefficients (NRC) indicated, as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

2.02. ACCEPTABLE MANUFACTURERS

A. Sound Concepts Inc, 599 Henry Avenue, Winnipeg, Manitoba, Tel: (204) 783-6297, Fax (204) 783-7806.

B. Or Equal.

2.03. MATERIALS

A. Provide fabric covered “Reflect” Impact Resistant Acoustical Panels.

2.04. ACOUSTICAL WALL PANELS

A. Fabric Faced Acoustical Wall Panels: Manufacturer's standard panel construction consisting of facing material laminated to front, edges and back to minimum 1 inches of the fiberglass core, with acoustically transparent adhesive, to ensure against warpage and damage; corners to be tailored and heat fused; complying with the following requirements:

1. Core Densities and Construction: Impact-resistant fiberglass with a density of not less than 6 lb./cu. ft. shall constitute core material.
2. Thickness and NRC:
   a. Nominal overall thickness of 1 inch wall panels with corresponding NRC of 1.10 as tested in accordance with ASTM C-423.
3. Facing Material: As selected by the Architect from manufacturer’s full color range.

4. Panel Size: As indicated on drawings.
5. Edge Profile: Square
6. Corner Details: Square
7. Mounting: Z-clip with end angle on wood frame as indicated in the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Acoustical Wall Panels. Do not proceed with installation until satisfactory conditions have been corrected.

3.02. INSTALLATION

A. Install Acoustical Panels in locations indicated on drawings and in conformance with details and sections with surfaces and edges plumb, and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

B. Provide manufacturer’s standard Z-clip installation with end angles where indicated.

C. Cut units to be at least 50 percent of unit width, with facing material extended over cut edge to match uncut edge. Scribe Acoustical Wall Panels to fit adjacent work. Butt joints tightly.

1. Construction Tolerances: Variation from Plumb and Level - Plus or minus 1/16 inch.
2. Remove and replace panels that are damaged and are unacceptable to the Architect.

3.03. CLEANING

A. Obtain and follow cleaning instructions from the manufacturer.

3.04. PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and the Installer that ensures that Acoustical Panels are without damage or deterioration at the time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, in a manner acceptable to the Architect, prior to the time of Substantial Completion. In all cases, labor shall be for the account and responsibility of the Installer.

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.

B. The Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical Work, except as otherwise indicated.

C. “Paint” means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

D. Paint all exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available for the materials system specified.

E. Related Section: 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. Submit fan deck/chip deck for color selection if using manufacturer other than that used for color design selection.

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

1. Submit two 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. 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. At project close out, 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. Label with P# indicated in Color Design Section.

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. Sherwin-Williams Company, Cleveland, OH 44115. Tel. (800) 321-8194.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 COLORS AND FINISHES

A. Paint colors, surface treatments, and finishes will be selected from color chips submitted by contractor. Prior to beginning Work, the Architect will select color chips for surfaces to be painted. Use representative colors when preparing samples for review. Final acceptance of colors will be from samples.

B. 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. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, re-install the removed items by workmen skilled in the trades involved. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule the cleaning and painting so that contaminates from the cleaning process with not fall onto wet, newly painted surfaces.

B. Ferrous Metals:

1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
2. Touch-up shop-applied prime coats wherever damaged or bare. Where required by other Sections of these Specifications, clean and touch-up with the same type shop primer.

C. Galvanized Surfaces: Clean free of oil and surface contaminants with acceptable non-petroleum based solvent.

D. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat.

1. Prime, stain, or seal wood required being job-painted, as soon as practicable upon delivery to job. Prime edges, ends, faces, under sides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dry.
2. When transparent finish is required, use sealer as recommended by manufacturer. Seal tops, bottoms, and cutouts of unprimed wood doors with sealer immediately upon delivery to project.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.04 APPLICATION

A. Apply paint in accordance with the manufacturer's directions. Use 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 Division 15 and Division 16 Sections.

1. Mechanical items to be painted include, but are not limited to, the following:
    a. Piping, pipe hangers, and supports.
    b. Heat exchangers.
    c. Tanks.
    d. Ductwork.
    e. Motor, mechanical equipment and supports.
    f. Accessory items.
2. Electrical items to be painted include, but are not limited to, the following:
    a. Conduit and fittings.
    b. Switchgear.

I. Prime Coats: Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

L. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint Work not in compliance with specified requirements.

M. Temporary Room Identification: Identify all rooms and spaces as soon as practicable with temporary painted letters, in white or other approved contrasting color, approximately 2 inches high. Locate on the concrete floor slab at the door entrance way to each room or space. Text to include room name and number as identified in the contract documents.

N. Corridor partitions and fire walls shown or designated as rated walls shall be effectively and permanently identified with a painted sign either by stenciling or approved permanently attached appliqué, located above ceilings and in concealed spaces. Wording shall be painted red letters minimum 2 inches high on white background. Locate top edge of sign approximately six to twelve inches above ceiling, where it is visible from floor, and at a maximum spacing of 10'-0" on center on each side of all walls, occurring at least once at each intersecting wall, and as directed by Architect. Wording shall be in all capital letters as follows with wall rating inserted in the ___ as indicated on the drawings for each type and rating:

1. At all fire walls: ____ RATED FIRE WALL – PROTECT ALL OPENINGS

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. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. 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 any damage by others for protection of their Work, after completion of painting operations. At the completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 EXTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
   b. Intermediate Coat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
   c. Topcoat: Super Spec HP P29 D.T.M. Acrylic Semi-gloss
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: Super Spec HP P04 Acrylic Metal Primer
   b. Intermediate Coat: Super Spec HP P77 Waterborne Urethane
   c. Topcoat: Super Spec HP P77 Waterborne Urethane

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 and steel stairs and handrails)
   a. Prime Coat: F/C #5-56 Waterborne 100% Acrylic All Purpose Metal Primer (1.8 mils DFT)
   b. Intermediate Coat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)
   c. Topcoat: F/C Tuff-Boy 8000 Line Waterborne 100% Acrylic DTM (1.7 mils DFT)

C. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:

1. Ferrous and Zinc Coated Metal
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
   c. Topcoat: Sher-Cryl™ HPA Acrylic, B66-350 Series (2.5-4.0 mils dry)
2. Steel Shop Primed: (structural steel framing exposed to view including steel lintels and steel stairs and handrails)
   a. Prime Coat: S-W ProCryl® Universal Primer, B66-310 Series (2.0-4.0 mils dry)
   b. Intermediate Coat: S-W Centurion® Water Based Urethane, B65-700 Series (2.0-3.0 mils dry)
   c. Topcoat: S-W Centurion® Water Based Urethane, B65-700 Series (2.0-3.0 mils dry)

3.08 INTERIOR PAINTING SCHEDULE

A. Provide the following Benjamin Moore paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
   a. Prime Coat: #231 EcoSpec Interior Latex Primer Sealer
   b. Intermediate Coat: #223 EcoSpec Interior Latex Eggshell Enamel
   c. Topcoat: #223 EcoSpec Interior Latex Eggshell Enamel
2. Gypsum Drywall (in wet areas)
   a. Prime Coat: #231 EcoSpec Interior Latex Primer Sealer
   b. Intermediate Coat: #256 Super Spec Acrylic Epoxy Coating
   c. Topcoat: #256 Super Spec Acrylic Epoxy Coating
3. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: #203 Universal Wall Grip Primer
4. Ferrous and Zinc Coated Metal
   a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
   b. Intermediate Coat: #224 Eco Spec Interior Latex Semi-Gloss Enamel
   c. Topcoat: #224 Eco Spec Interior Latex Semi-Gloss Enamel
5. Exposed Structural steel and Roof Deck (shop primed steel)
   a. Prime Coat: P04 Super Spec HP Acrylic Metal Primer
   b. Intermediate Coat: #153 Super Spec Sweep Up Spray Latex Flat
   c. Topcoat: #153 Super Spec Sweep Up Spray Latex Flat
6. Painted Woodwork
   a. Prime Coat: #231 Eco Spec Interior Latex Primer Sealer
   b. Intermediate Coat: #224 Eco Spec Interior Latex Semi-Gloss Enamel
   c. Topcoat: #224 Eco Spec Interior Latex Semi-Gloss Enamel
7. Concrete Floor Sealer (Clear)
   a. Prime Coat: P27 Super Spec HP Acrylic Sealer Clear
   b. Topcoat: P27 Super Spec HP Acrylic Sealer Clear.

B. Provide the following Ferrell-Calhoun paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
   a. Prime Coat: F/C#235 Interior/Exterior 100% Acrylic Latex Undercoater (1.3 mils DFT)
   b. Intermediate Coat: F/C 3900 Line Sun-Flo Interior Latex Acrylic Eggshell (1.6 mils DFT)
   c. Topcoat: F/C 3900 Line Sun-Flo Interior Latex Acrylic Eggshell Enamel (1.9 mils DFT)
2. 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)
3. Gypsum Drywall (Under vinyl wall covering)
   a. Prime Coat: F/C #699 Waterborne 100% Acrylic Enamel Undercoater (1.6 mils DFT)

4. 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 (1.9 mils DFT)
5. 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)
6. 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)
7. 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: Skid-Tex Slip Resistant to topcoat.

C. Provide the following Sherwin-Williams paint systems for the various substrates, as indicated:

1. Gypsum Drywall(Egg Shell)
    a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 mils dry)
    b. Intermediate Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6 mils dry)
    c. Topcoat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series (1.6 mils dry)
2. Gypsum Drywall (in wet areas)
    a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 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)
3. Gypsum Drywall (Under vinyl wall covering)
    a. Prime Coat: S-W PrepRite® PreWallcoving Primer, B28W980 (1.2 mils dry)
4. 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)

5. 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
6. Painted Woodwork
   a. Prime Coat: S-W Harmony Low Odor Interior Latex Primer, B11W900 (1.3 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)
7. Concrete Floor Sealer (Clear)
   a. Prime Coat: H&C Shield Plus Ultra, Acrylic Concrete Stain/Sealer - Clear
   b. Topcoat: H&C Shield Plus Ultra, Acrylic Concrete Stain/Sealer; Clear; H&C SharkGrip Slip Resistant Additive to the topcoat.

END OF SECTION

SECTION 10 11 00 VISUAL DISPLAY SURFACES

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Visual display surfaces as described in this section. Types specified in this section include Visual Aid Boards, Markboards and Tackboards.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit manufacturer's technical data and installation instructions for each material and component parts, including data substantiating materials comply with requirements.

B. Samples: Submit two sets of full range of color samples for each type of visual display surface, surface, trim and accessories required. Provide two each 12-inch square samples of sheet materials and 12-inch lengths of trim members for color verification after selections have been made.

C. Shop Drawings: Submit for each type of visual display surface. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, and installation details.

D. Certification: Submit manufacturer's certification that all materials furnished for Project complies with requirements specified herein.

1.04 QUALITY ASSURANCE

A. Furnish all visual display surfaces by one manufacturer for entire project.

B. Fire Hazard Classification: Provide tackboard surfaces which have been tested in accordance with ASTM E-84 and have been certified as complying with the following fire hazard classifications: Flame spread, fuel contributed and Smoke developed not more than 25.

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. Draper, Inc., P.O. Box 425, Spiceland, IN 47385. Tel. (765) 987-7999.
2. March Industries, Inc., P.O. Box 509, Dover, OH 44622. Tel. (330) 343-8825.
3. NACO, 180 N. Sherman Ave., Corona, CA 91720. Tel. (909) 340-2800.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS

A. Visual Aid Board: Equal to Claridge No. 518-4PL Premier Lecture two door Cabinet Unit with satin anodized finish and custom plastic laminate exterior face, LCS marker board back panel, and tan Nucork on tackboard inside doors in colors and textures as selected by Project Engineer / MDOT Architect from manufacturer's standards, except where noted otherwise. Custom exterior plastic laminate face to match plastic laminate cabinets in the same space. Include pad of white sketching paper, map hooks, felt eraser, and assorted LCS markers. Size shall be 4 feet by 4 feet closed. Provide in locations and quantity as indicated on the Drawings.

B. Tackboard: Equal to Claridge Series 1 type “CO” factory built tackboard. Tackboard is Claridge 1/4-inch tan Nucork on 1/4 inch Hardboard, color as selected by Project Engineer / MDOT Architect from manufacturer’s standards. Size shall be 4 feet by 6 feet. Provide in locations and quantity as indicated on the Drawings.

C. Marker Board: Equal to Claridge Series 5, type “A”, with LCS II markerboard dry erase writing surface in number 92 white and clear satin anodized heavy gauge extruded aluminum trim meeting or exceeding ASTM B221 Alloy Standards. Provide units with a continuous map rail with cork insert and chalk trough. Include map hooks, felt eraser, and assorted LCS markers. Size shall be 4 feet by 10 feet. Provide in locations and quantity as indicated on the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. 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. Deliver factory-built units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Project Engineer / MDOT Architect. When overall dimensions require delivery in separate units, pre-fit at factory, disassemble for delivery, and make final joints at site. Use splines at joints to maintain surface alignment.

B. Install units in locations and mounting heights as shown on Drawings and in accordance with manufacturer's instructions, keeping perimeter lines straight, plumb, and level. Provide all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories for complete installation

C. Coordinate job-assembled units with grounds, trim, and accessories. Join all parts with neat, precision fit.

3.03 ADJUSTING AND CLEANING

A. Verify accessories required for units are properly installed and operating units are adjusted and properly functioning.

B. Clean units in accordance with manufacturer's instructions, breaking in only as recommended.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Signage for room identification system, informational and directional signage, and exterior individual building signage.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Submit manufacturer's technical data and installation instructions for each type of sign required.

B. Samples: Submit two sets of samples of each color and finish of exposed materials and accessories required for specialty signs. Printed color samples are not acceptable. Project Engineer / MDOT Architect's review of samples will be for color and texture only. When requested, furnish full-size samples of specialty sign materials.

C. Shop Drawings: Submit Shop Drawings for fabrication and erection of specialty signs. Include plans, elevations, and large-scale details of sign wording and lettering layout. Show anchorage and accessory items. Furnish location template drawings for items supported or anchored to permanent construction. For exterior letters, submit layout showing spacing on wall elevation. Submit layout drawings of each interior sign type. Submit layout drawings of each vinyl sign type. Submit full text sign schedule listing each sign for review of text.

1.04 QUALITY ASSURANCE

A. Provide each type of sign as a complete unit produced by a single manufacturer including necessary mounting accessories, fittings and fastenings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver components correctly packed to prevent damage. Store in secure area out of weather. Handle per manufacturer's instructions.

1.06 WARRANTY

A. Provide manufacturer's standard one-year warranty covering manufacturing defects. Warranty shall be one year from substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by ASI Sign Systems, Inc., 3890 W. NW Hwy, Suite 102, Dallas, TX 75220. Tel. (800) 274-7732.

B. Equivalent products by the following manufacturers are acceptable:

1. Matthews International Corp., Pittsburgh, PA. Tel. (800) 628-8439.
2. Metal Arts, Mandan, ND. Tel. (701) 663-6535.
3. Mohawk Sign Systems, Inc., Schenectady, NY. Tel. (518) 370-3433.
4. Scott Sign Systems, Inc., Sarasota, FL. Tel. (800) 237-9447.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures

2.02 SIGN SYSTEM

A. Exterior signage: Wall mounted LC Series, Helvetica Medium style, size as shown on Drawings.

B. Vinyl Applied Letters: White. Text and art in locations and sizes as indicated. Font for text shall be Helvetica Medium.

C. Interior signage: Wall mounted WS Series with rounded corners at each interior door. Design so that paper insert can be installed from each end.

2.03 COMPONENTS – EXTERIOR SIGNAGE

A. Material: Cast aluminum. Mounting: Flush mount.

B. Finish: Baked enamel in manufacturer's standard color, to be selected by Architect.

2.04 COMPONENTS – INTERIOR SIGNAGE

A. Window Inserts: Laser printed paper insert with MDOT watermark. Text to be furnished by Owner.

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 1: 9 inches wide by 9 inches high. 1 inch top band. 2 ½ inch high paper insert window running the full sign width. Bottom band to have Braille and tactile copy of room number only.
2. Type 2: 9 inches wide by 9 inches high. International symbols in tactile copy. Room name and number text in Braille and tactile copy.

3. Type 3: 9 inches wide by 9 inches high. 1 inch top band. 5 inch high paper insert window running the full sign width. Bottom band to have Braille and tactile copy of room number only.

2.05 BRAILLE AND TACTILE COPY

A. Comply with requirements of the 2010 Americans with Disabilities Act. 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. Braille Tags shall be clear raster balls to be drilled and tapped using manufacturer's standard procedure complying with ADA.

2.06 FINISHES – INTERIOR SIGNAGE

A. Colors: Selected from manufacturer's standard.

B. Surface Texture: Matte.

2.07 FONT

A. Shall be Helvetica Medium, unless noted otherwise.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine the substrates and conditions under which the specialty signs are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION

A. 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.

B. 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.

C. Position sign on wall surface at locations and heights to comply with 2010 Americans with Disabilities Act.

3.03 SCHEDULES – All interior doors shall have signs. Type below:

A. Sign Type 1: Offices, Admin, single occupant,
Conference, Break, Storage,
Mechanical, Electrical
Janitor
Ice/Utility

B. Sign Type 2: Toilets
Shower

C. Sign Type 3: TMC

END OF SECTION

SECTION 10 14 16 PLAQUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall mounted cast bronze plaques and seals.

1.02 SUBMITTALS

A. Product Data: Indicate materials and lettering types and sizes. Include installation and maintenance procedures.

B. Shop Drawings: Indicate size, location, mounting height and anchorage. Include layout proof for Project Engineer / MDOT Architect's approval.

C. Color Selection: Provide samples of materials, texture, colors and finishes available for Project Engineer / MDOT Architect's selection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Matthews International Corp., 1315 W. Liberty Ave., Pittsburgh, PA 15226.

B. Equivalent products by the following manufacturers are acceptable:

1. A.R.K. Ramos Mfg. Co., Oklahoma City, OK. Tel. (800) 725-7266.
2. Gemini, Inc., Cannon Falls, MN. Tel. (800) 538-8377.
3. OMC Industries, Inc., Bryan, TX. Tel. (800) 488-4662.
4. Southwell Co., San Antonio, TX. Tel. (210) 223-1831.
5. Spencer Industries, Inc., Philadelphia, PA. Tel. (215) 634-2700.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 BUILDING PLAQUE

A. Material: Cast bronze, (alloy: minimum 85 percent copper: 5 percent zinc) 28 by 40 inches in size, with Dark Oxidized Background Finish, Matt Texture, Single Line, Bevel Edge Border, raised lettering and concealed mounting. Raised lettering and borders shall have Satin Finish. Exact wording and layout as determined by Project Engineer / MDOT Architect. Camera ready art will not be provided.

B. Plaque Wording shall include the following:

1. Name of Project.
2. Year the Construction was completed.
3. Name of the Governor.
4. Name of Commissioner.
5. Name of Project Professional.
6. Name of Contractor.

C. Plaque Lettering shall have the following characteristics:

1. Style: Helvetica and Helvetica Medium.
2. Heights: As determined by Project Engineer / MDOT Architect.
3. Finish: Satin polished.

D. Protective Coating: Two coats clear metal lacquer for entire plaque.

E. One interior unit required.

2.03 STATE SEAL

A. Mississippi State Seal, 30 inch diameter plaques as shown on Drawings. Project Engineer / MDOT Architect will provide camera-ready artwork.

B. Material: Cast Aluminum with Dark Oxidized Background Finish, Matt Texture, Single Line, Bevel Edge Border, raised lettering and concealed mounting. Raised lettering and borders shall have Satin Finish. Bronze anodized finish. Exact wording and layout as determined by Project Engineer / MDOT Architect.

C. One interior unit required.

D. Protective Coating: Two coats clear metal lacquer for entire plaque.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install unit plumb and level, in location as shown or described. Securely attach to supporting structure, in accordance with manufacturer's installation instructions.

3.02 CLEANING AND PROTECTION

A. At completion of installation, clean and polish in accordance with manufacturer's instructions. Protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 21 14 PLASTIC LAMINATE TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of toilet partition and urinal screen work required is shown on Drawings. Toilet partitions required are plastic laminate, floor-mounted, overhead braced.

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

1.02 SUBMITTALS

A. Product Data; Submit manufacturer's detailed technical data for materials, fabrication, and installation, including product data on anchors, hardware, fastenings, and accessories.

B. Shop Drawings: Submit shop drawings for fabrication and erection of toilet partition assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

1.03 QUALITY ASSURANCE

A. 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.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

1.04 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Ampco Products, Inc., Opa Locka, FL. Tel. (305) 821-5700.
2. General Partitions Mfg. Corp., Erie, PA. Tel. (814) 833-1154.
3. Knickerbocker Partition Corp, Freeport, NY. Tel. (516) 546-0550.
4. Metpar Corp., Westbury, NY. Tel. (516) 333-2600.
5. Rockville Partitions Inc., Pisgah, AL. Tel (256) 451-1300.

B. Substitutions shall fully comply with specified requirements and Section 01630 - Product Options and Substitution Procedures.

2.02 MATERIALS

A. Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are NOT acceptable.

B. Plastic Laminate: NEMA Std. LD-3, minimum 0.062 inch thick, color and pattern as indicated.

C. Core Material for Plastic Laminate: Manufacturer's standard particleboard for plywood, in thickness to provide finished dimension of 1 inch minimum for doors, panels, and screens, 1-1/4 inch for pilasters.

D. Wall Brackets: Wall brackets shall be full-length continuous stainless steel. Brackets shall be used for all pilasters to pilaster, pilasters to wall connections and urinal screens.

E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories, shall be stainless steel with satin finish.

F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

G. Overhead bracing shall occur between each partition pilaster and between each front pilaster and wall. Overhead bracing is also required between urinal screen and wall. Manufacturer's standard design with hardware and accessories.

2.02 PARTITION FABRICATION

A. Furnish standard doors, panels, screens, and pilasters fabricated for partition system, unless otherwise indicated. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Door Dimensions: Unless otherwise indicated, furnish 24 inches wide inswinging doors for ordinary toilet stalls and 32 inches wide (clear opening) outswinging doors at stalls equipped for use by handicapped.

C. Pressure-laminate one-piece face sheets to core material with no splices or joints, and with all edges straight and sealed. Seal exposed core material at cutouts to protect against moisture.

2.03 TOILET PARTITION HARDWARE

A. Hinges: Stainless steel continuous for door height and adjustable to hold door open at any angle up to 90 degrees.

B. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for easy emergency access, with combination rubber-faced door strike and keeper.

C. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper.

D. Door Pull: Manufacturer's standard unit.

PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine the areas and conditions under which toilet partitions and related items are to be installed, including supporting anchors and supports installed by others, and must notify 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 manner acceptable to the Installer.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedure and installation sequence. Install partitions rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels, and not more than 1 inch between panels and walls. Secure panels to walls with not less than two stirrup brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices. Comply with ADA for mounting heights, operation, clearances and placement.

3.03 ADJUST AND CLEAN

A. Adjust and lubricate hardware for proper operation. Set hinges on inswinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors (and entrance swing doors) to return to fully closed position.

B. 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 21 17 MOLDED ACRYLIC SHOWER UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Molded acrylic shower units as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit manufacturer's brochures, technical data, installation instructions, maintenance and operating instructions, including data substantiating that materials comply with requirements.

B. Samples: Submit two sets of samples of each color and finish of exposed materials and accessories required for review and selection from manufacturer's full line.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Aqua Bath Company, Inc., Tel. (800) 232-2284
2. Lasco Bathware, Anaheim, CA. Tel. (800) 94 LASCO
3. Aquarius Bathware, Savannah, TN Tel. (800) 443-7269.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SHOWER UNITS

A. Standard shower units shall be equal to Aqua Bath Company, Inc. model IS4136SH mod 4 inch, single piece shower units with smooth wall finish, center drain, molded toiletry shelf, grab bar, and ASTM F462 non-slip bottom.

1. The shower enclosure shall be molded from a single sheet of acrylic so as not to have any joints or seams and shall meet ANSI Z124.2.
2. The enclosure shall have inside dimensions of 36 inches wide x 36 inches deep x 78 inches high and outside dimensions of 41 inches wide x 37 inches deep x 84 inches high.
3. Units shall include a 1 inch diameter, 18 gauge stainless steel curtain rod with a weighted antibacterial shower curtain and hooks.
4. Provide hand held shower set.
5. 10 1/2 inch x 1 inch diameter, 18 gauge stainless steel towel bar with 1 1/2 inch safety statute clearance.
6. Units shall include a sealed dome ceiling light.
7. Finishes to be selected from manufacturer's full line of options.

B. ADA compliant transfer shower units shall be equal to Aqua Bath Company, Inc. model C 4136 BF-FUS 3/4 inch, single piece shower units with smooth wall finish, center drain, molded toiletry shelf, grab bar, ASTM F462 non-slip bottom, and fold down seat.

1. The shower enclosure shall be molded from a single sheet of acrylic so as not to have any joints or seams and shall meet ANSI Z124.2.
2. The enclosure shall have inside dimensions of 36 inches wide x 36 inches deep x 78 inches high and outside dimensions of 41 inches wide x 37 inches deep x 82 3/4 inches high.
3. Units shall include an 18 inch vertical grab bar and a 31 3/4 inch x 15 3/4 inch wrap grab bar. Grab bars shall be 1 1/2 inch outside diameter.
4. Units shall include a factory installed 34 inch "L" shaped phenolic fold-up seat with seat belt.
5. Units shall include a 1 inch diameter, 18 gauge stainless steel curtain rod with a weighted antibacterial shower curtain and hooks.
6. Provide hand held shower set.
7. Units shall include a sealed dome ceiling light.
8. Finishes to be selected from manufacturer's full line of options.

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 prior to rough-in. Coordinate with Electrical and Plumbing subcontractors.

3.02 INSTALLATION

A. Remove shipping packaging and install components in strict accordance with manufacturer's instructions.

B. Install units plumb and level, in locations and with mountings as shown. Securely attach to supporting structure in accordance with manufacturer's installation instructions.

3.03 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 10 26 13 CORNER GUARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vinyl / Acrylic surfaced mounted Corner Guards.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for corner guards.

B. Samples: Submit samples of material finishes, profiles and colors for corner guards.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. Arden Architectural Specialties, Inc., Saint Paul, MN. Tel. (651) 631-1607.
2. Construction Specialties, Inc., Muncy, PA. Tel. (570) 546-5941.
3. Koroseal Wall Protection Systems, Inc. Fairlawn, OH. Tel. (330) 668-7600.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures

2.02 CORNER GUARDS

A. Corner guards shall be installed full height from top of base to ceiling, unless height indicated otherwise on the Drawings, at all outside corners in corridors and rooms and elsewhere as shown on the Drawings. Not required at ceramic tile wall finishes.

1. Corner guards shall be equal to Construction Specialties Acrovyn Model SSM-20 series surface mounted corner guards with optional full height aluminum retainers, vinyl covers and matching top and bottom end caps.
2. Color to be selected by Project Engineer / MDOT Architect from full range of standard colors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units plumb and level, in locations as shown or described. Securely attach to supporting structure, in accordance with manufacturer's installation instructions.

3.02 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 10 28 13 TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The extent of each type of toilet accessory is shown on the Drawings and Schedules, unless otherwise indicated. The types of toilet accessories required include the following:

1. Toilet Paper Dispenser
2. Grab Bars
3. Paper Towel Dispenser
4. Paper Towel Dispenser with Waste Receptacle
5. Napkin Disposal
6. Clothes Hook
7. Mop Holder
8. Towel Bar
9. Under Lavatory Guards (required where hot water line is exposed).

1.02 SUBMITTALS

A. Submit 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.

1.03 QUALITY ASSURANCE

A. Provide products of the same manufacturer for each type of accessory unit. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.

1.04 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of toilet accessories 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Bradley Washroom Accessories Division, P.O. Box 309, Menomonee Falls, WI 53051. Tel. (414) 354-0100.

B. Equivalent products by the following manufacturers are acceptable:

1. A & J Washroom Accessories, 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 (800) 475-8629; (760) 343-7363.
4. TCI Products. Hillsboro, OR (866) 533-4273; (503) 533-9223.
5. Truebro, Inc. Ellington, CT (800) 340-5969; (860) 875-2868.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 ACCESSORIES

A. Toilet Paper Dispenser: Provide surface mounted stainless steel multi-roll toilet tissue dispenser equal to Bradley model 5402. Locate at each toilet.

B. Grab Bars: Provide 1-1/2 inches 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 requirements.

C. Paper Towel Dispenser: Provide surface mounted stainless steel paper towel dispensers equal to Bradley model 250-15. Locate at each Break room sink and as indicated on Drawings.

D. Paper Towel Dispenser / Waste Receptacle: Provide recessed stainless steel combination paper towel dispenser / waste receptacle equal to Bradley model 2017. Locate in all toilet rooms and as indicated on Drawings.

E. Napkin Disposal: Provide surface mounted napkin disposal unit equal to Bradley model 4781-15 in all stalls in women's toilet rooms.

F. Clothes Hook: Provide surface mounted satin finish stainless steel hook equal to Bradley model 9134 at each Toilet Room, unless coat hooks are provided with toilet partition doors. Provide one at each office door. Provide three at each shower unit at location coordinated with Architect.

G. Utility Shelf: Provide surfaced mounted stainless steel mop and broom holder equal to Bradley model 9934. 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 44 inches long, with 5 hooks and 4 holders. Shelf projects 8 inches. Locate at each service sink in each Janitor.

H. Towel Bar: Provide one heavy duty towel bar equal to Bradley model 908 outside of each shower unit at location coordinated with Architect.

I. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer shall examine the areas and conditions under which toilet accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION

A. Use concealed fastenings wherever possible. Provide anchors, bolts and other necessary anchorage, and attach accessories securely to walls and partitions in locations as shown or directed. Install concealed mounting devices and fasteners fabricated of the same material as the accessories, or of galvanized steel, as recommended by manufacturer.

B. Install exposed mounting devices and fasteners finished to match the accessories. Provide theft-resistant fasteners for all accessory mountings. Secure toilet room accessories in accordance with the manufacturer's instructions for each item and each type of substrate construction.

C. Installation shall meet all ADA requirements including proper mounting heights.

END OF SECTION

SECTION 10 43 15 DEFIBRILLATORS AND CABINETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Automated External Defibrillator, including cabinets, accessories and mounting brackets.

1.02 SUBMITTALS

A. Submit manufacturer's technical data and installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured / distributed by J.L. Industries, Inc., 4450 W. 78th Street Circle, Bloomington, MN 55435. Tel. (612) 835-6850.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

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(s) equal to J.L. Industries stainless steel recessed type cabinet complying with ADA requirements. Provide Fire-FX option where located in a fire rated wall. 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 INSTALLATION

A. Install items included in this section in locations indicated and at mounting heights to comply with applicable regulations of governing authorities.

B. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

C. Defibrillator unit(s) shall be mounted in exposed locations as indicated on the Drawings, or if not indicated, as directed by the Architect. A minimum of one unit is required.

D. Check all cabinets for scratched, nicked, and other surface defects. Cabinets with these conditions shall be repaired or replaced.

3.02 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 10 44 16 FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Portable, multi-purpose, dry-chemical and class K wet chemical fire extinguishers including cabinets, accessories and mounting brackets.

1.02 SUBMITTALS

A. Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required.

1.03 QUALITY ASSURANCE

A. Provide new portable fire extinguishers which are UL listed and bear UL "Listing Mark" for each type, rating, and classification of extinguisher indicated.

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. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

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 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 Rooms.

2.03 EXTINGUISHER CABINETS

A. Equal to J.L. Industries Cosmopolitan 1032F17 with ADAC option. Provide Fire-FX option where located in a fire rated wall. Cabinet shall accommodate the Cosmic 10E extinguisher. Provide black die-cut letters, vertical.

B. Equal to J.L. Industries Cosmopolitan stainless steel cabinet with return trim, rolled edge recessed model 2032F17 including ADAC option with flush pull handle. Provide Fire-FX option where located in a fire rated wall. 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 applicable regulations of governing authorities.

B. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

C. 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 in locations shown in Drawings. Units shall be required in all Break Rooms and within 20 feet of all Mechanical Rooms and exits. Type K units shall be required in all Break Rooms.

D. Check all cabinets for scratched, nicked, and other surface defects. Cabinets with these conditions shall be repaired or replaced.

END OF SECTION

SECTION 10 56 13 METAL STORAGE SHELVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal shelving as show on the Drawings.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Penco Products Inc., P.O. Box 378, Oaks, PA 19456. Tel. (610) 666-0500.

B. Equivalent products by the following manufacturers are acceptable:

1. Lyon Metal Products, Aurora, IL. Tel. (603) 892-8941.
2. Stanley Storage Systems, Allentown, PA. Tel. (800) 523-9462.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 STORAGE SHELVING

A. Shelving Unit: Heavy Duty capacity, Hi-Performance box beam shelves, closed type prefinished metal shelving complete with hardware, end kit, label holder and closed base. Equal to Penco Model Clipper, Closed Configuration, width and depth as indicated on Drawings, and 87 inches high with 7 shelves.

B. Color: Color to be selected from full color line by Project Engineer / MDOT Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units plumb and level, in locations and with mountings as shown or as directed by the Project Engineer.

B. Securely attach all components together in accordance with manufacturer's installation instructions.

C. Securely attach units to adjacent units and to wall or floor as required to not move or fall.

3.02 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 10 57 13 HAT AND COAT RACKS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall mounted tubular steel coat racks.

1.02 RELATED SECTIONS

A. Section 06 10 00 – Rough Carpentry.

1.03 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Datum / Raymond Engineering, Inc., 704 Vandalia Street, St. Paul, MN 55114. Tel. (800) 365-5770.

B. Equivalent products by the following manufacturers are acceptable:

1. A.J. Binns Ltd., South Burlington, VT. Tel: (802) 655-7502.
2. Magnuson Group Inc., Woodridge, IL. Tel: (800) 342-5725.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 COAT RACK

A. Equal to Rigid Rak Model 450.

2.03 MATERIALS

A. Brackets (3 req'd per rack) are 1-1/8 inch sq. tubing with mitered angle and hidden weld.

B. Shelf tubes (4 required per rack) are 3 /4 inch round steel tube.

C. Accessories: Model 967 hangers (20 required per rack) mounted on hanger pole. Model 913 P PVC coated double prong chrome butterfly hooks (12 per rack) mounted on alternating tubes.

D. Finish: All components shall be bright commercial nickel chrome.

E. Size: 5 feet long by 12 -1/4 inches deep.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install unit(s) plumb and level, at location(s) shown on Drawings. Securely attach to supporting structure, in accordance with manufacturer's installation instructions.

3.02 CLEANING AND PROTECTION

A. At completion of installation, clean surfaces in accordance with manufacturer's instructions. Protect units from damage.

END OF SECTION

SECTION 10 73 17 PRE-ENGINEERED CANOPIES

PART 1- GENERAL

1.01 SUMMARY

A. This Section includes requirements for self-supporting manufactured flat soffit entrance canopies.

1.02 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Submit manufacturer and Installer qualification data.

C. Submit shop drawings indicating field dimensions, structural components locations and positions, blocking, footings, attachment devices, flashing, material dimensions and details of construction and assembly.

D. Submit calculations stamped by an engineer registered in the state of Mississippi showing that canopies and foundation have been designed to meet wind load requirements for the geographic area in which they are located.

1.03 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years experience in the manufacture of canopies similar in design and scope to the work of this project.

B. Installer shall have a minimum of 5 years experience in the installation of canopies similar in size and scope of the work of this project.

C. Canopy shall conform to the requirements of the International Building Code and other local codes, including hurricane wind requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with manufacturer’s instructions.

PART 2- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide entrance canopy as indicated on drawings equal to Super Lumadeck as manufactured by Mapes Industries, Inc., Lincoln, Nebraska, Phone: 1-888-273-1132.

B. Products of the following manufacturers are acceptable upon compliance with the requirements of this section:

1. Ballew's Aluminum; Greer, SC 29650. Tel: 800-231-6666
2. E. L. Burns Co., Inc.; Shreveport, LA 71119. Tel: 318-636-2722

2.02 MATERIALS

A. Decking to be 3 inch extruded flat soffit minimum .078 inch decking to meet loading requirements.

B. Fascia shall be standard 8 inch tall extruded “J” style (minimum .125 aluminum).

C. Decking, beams, post, and fascia shall be extruded aluminum, alloy 6063-T6, in profile and manufacturer’s standard thickness.

D. Finish shall be custom two-coat Kynar to match Kynar Bone White.

E. Provide all hardware, anchors, and anchors for a complete installation.

F. Concrete for canopy footings: Footing block outs for post-supported units provided by manufacturer to installed as part of concrete work.

2.03 FABRICATION

A. Support columns and gutter beams shall be designed such that the columns will be notched to create a “saddle” that will receive and secure the gutter beams.

B. Post and beams shall be mechanically assembled utilizing minimum 3/16-inch fasteners with a minimum shear stress of 350 pound Pre-welded or factory-welded connections are not acceptable.

C. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.

D. Concealed drainage. Water shall drain from covered surfaces into integral gutter beam and be directed to ground level discharge via one or more designated support posts.

2.04 PERFORMANCE DATA

A. Canopies and their foundation system shall be designed to meet local hurricane wind loading requirements.

PART 3- EXECUTION

3.01 EXAMINATION

A. Verify conditions prior to installation and report any conditions detrimental to the proper placement and installation of canopy system. Do not proceed with installation until detrimental conditions have been corrected.

B. Installation shall be in strict accordance with manufacturer’s shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.02 INSTALLATION

A. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

B. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.03 CLEANING AND PROTECTING

A. Particular attention should be given to protecting the finish during handling and erection.

B. Clean all surfaces in strict accordance with the manufacturer's instructions. Protect finishes until final acceptance.

END OF SECTION

SECTION 10 82 14 IMPACT RESISTANT LOUVER GRILLES - Alternate

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes requirements for exterior grilles meeting impact resistance standards in accordance with FEMA 361.

B. The extent of louvers is indicated on the drawings including indications of sizes and locations.

1.02 QUALITY ASSURANCE

A. Where impact resistant grilles are indicated comply with specific performance requirements in accordance with Design and Construction Guidance for Community Safe Rooms, FEMA 361, Second Edition / August 2008. Products of this section shall be in accordance with the requirements of FEMA 361 for tornado debris impact for storm shelter and community safe room standards.

B. Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

C. Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Clearly mark units for reassembly and coordinated installation.

D. Installer shall be familiar with the installation of products meeting the requirements of this section and shall have completed similar work.

1.03 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Submit certified test data indicating conformance with the requirements of this Section.

C. Submit shop drawings for the fabrication, installation and erection of grilles and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

D. Submit 6 inch square samples of each required finish. Prepare samples on metal of same gage and alloy to be used in work. Where normal color and texture variations are to be expected, include two or more units in each sample showing limits of such variations.

PART 2 - PRODUCTS

2.01 LOUVER

A. Provide Model FSG-801 as manufactured by Greenheck or equal.

1. Frame: 8 inch by 0.25 inch thick hot rolled steel, frame flanges located at top and bottom. Frame depth as indicated on drawings.
2. Blades: Inverted V Style, 0.25 inch thick hot rolled steel.
3. Construction: fully welded.
4. Finish: Liquid urethane paint to match custom color to be selected.
5. Fastenings: Use same material as items fastened, unless otherwise indicated. Fasteners for exterior applications may be hot-dip galvanized, stainless steel or aluminum. Provide types, gages, and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
6. 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.
7. Bituminous Paint: Conform to SSPC-PS 9.01 cold-applied asphalt mastic painting system with extra-thick film.
8. Include supports, anchorages, and accessories required for complete assembly.
9. Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.
10. Join frame members to one another and to stationary louver blades by welding, except where indicated otherwise or where field bolted connections between frame members are made necessary by size of louvers. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
11. Screen: 1/2 inch by 18 gage expanded stainless steel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 INSTALLATION

A. Locate and place units plumb, level and in proper alignment with adjacent work. Use concealed anchorages wherever possible.

B. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

C. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units, at Contractor's option.

D. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with contract, masonry or dissimilar metals.

E. Install sealants as indicated on drawings in accordance with the requirements of Section 07 90 00 - Sealants.

END OF SECTION

SECTION 11 31 15 RESIDENTIAL APPLIANCES AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Appliances as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Equivalent products by the following manufacturers are acceptable:

1. GE Appliances, 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 Contract Sales, Hoffman Estates, IL. Tel. (847) 286-2994.

B. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 APPLIANCES

A. Electric Range: 30 inch slide-in clean design electric range equal to ADA Compliant GE Profile Model No. PS905TPBB (Black) with electronic touch controls, ceramic glass cooking surface, bridge element, fifth element warming zone, extra large oven capacity, auto shut off of burner when not in use, self clean oven. Provide accessory backguard.

B. Refrigerator: Provide 29.1 cu. ft. capacity equal to ADA Compliant GE Model PSHF9PGZBB (Black) side by side with dispenser and integrated ice system, frost free freezer, turbo cool setting, gallon door bins, door beverage rack, adjustable slide-out spill-proof glass shelves, and water filtration.

C. Washer: Provide 4.0 IEC Cu. Ft King-Sized capacity frontload washer with stainless steel basket equal to ADA compliant GE Model WCVH6800JWW (White) with Energy Star qualification, Hydro Heater option, Sanitize water temp option, 1100 RPM spin speed, 26 wash cycles, save custom cycles option, delay start, quiet operation, and ADA Compliant.

D. Dryer: Provide 7.0 Cu. Ft. super capacity frontload electric dryer equal to ADA compliant GE Model DCVH680EJWW (White on White) with sensor dry plus, interior dryer light, quiet operation, adjustable end-of-cycle signal, multiple dry cycles, anti-bacteria option, 5 heat selections, dura-drum, damp dry signal, and ADA compliant.

E. Ice Machine at Ice/Utility Room 128: Provide Ice Cube Machine and Bin equal to Manitowoc Indigo Series 322 Ice Cube Machine Model No. ID-0322A with bin B-400. Provide AuCS Guardian Slime Inhibitor, Luminice Growth Inhibitor, and Arctic Pure Water Filtration. Provide all fittings, adapters, and additional components required for a complete installation.

F. Ice Machine at Ice Room 149: Provide Ice Cube Machine and Bin equal to Manitowoc Indigo Series 850 Ice Cube Machine Model No. IR-0850A with bin B-970 with required adapter. Provide AuCS Guardian Slime Inhibitor, Luminice Growth Inhibitor, and Arctic Pure Water Filtration. Provide all fittings, adapters, and additional components required for a complete installation.

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

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 as per manufacturer’s instructions.

C. Modify (if required) swing of refrigerator door to open toward adjacent base cabinets. Coordinate with cabinets for proper fit.

3.03 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 11 52 13 PROJECTION SCREENS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes requirements for roll-up, electrically operated recessed ceiling mounted projection screens, operating devices, and accessories.

1.02 SUBMITTALS

A. Submit shop drawings showing dimensions, method of attachment, structural support, bracing, and electrical wiring. Indicate attachments to substrate provided showing all adjacent materials.

B. Submit samples of housing and screen finishes.

C. Submit manufacturer's installation and maintenance instructions.

D. Submit installer qualifications including list of similar completed projects.

1.03 QUALITY ASSURANCE

A. Obtain projection screens from single manufacturer as a complete unit including necessary mounting hardware, motor, controls, limit switches, and accessories.

B. Motorized projection screens shall be certified for use in the United States and Canada by Underwriters Laboratory (UL), Inc. and shall bear UL label.

C. Installer shall have a minimum of five (5) years experience in the installation of similar screens and related devices.

D. The screen manufacturer shall coordinate the actual size, location, drop, viewing area and other fabrication data with the provider of Audio Visual Equipment prior to submitting shop drawings and product data.

1.04 COORDINATION

A. Coordinate layout and installation of projection screens with ceiling construction and related components penetrating or above ceilings such as lighting fixtures, mechanical equipment, ductwork, and fire-suppression system.

B. Coordinate requirements for blocking, structural supports, and bracing to ensure adequate means for installation of screens.

C. Coordinate requirements for power supply conduit, and wiring required for projection screen motors and controls

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Store and handle screens in strict accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Draper, Inc., 411 South Pearl Street, Spiceland, Indiana 47385-0425; 765-987-7999.

B. Equivalent products by the following manufacturers are acceptable:

1. Da-Lite
2. Elite Screens

C. Manufacturers of equivalent products may be acceptable upon strict compliance with the specified product requirements and approval by the architect.

2.02 MOTORIZED PROJECTION SCREENS

A. Electrically operated projection screen for suspended installation consisting of case, screen motor, controls, electric brake, limit switches, mounting accessories/supports, and other components necessary for complete recessed ceiling installation.

B. Silhouette Series V- Ceiling Mounted Motorized Screen with Tab Tensioning HiDef Grey Viewing Surface. 60 inch high x 60 inch wide. Motor control shall be bottom accessible.

2.03 MATERIALS

A. Screen case: Fabricated in one piece from 22-gauge steel sheet with scratch resistant white polyester finish. End caps with integral roller brackets and universal mounting brackets for ceiling mounting, finished to match

B. Roller: 3 inches diameter steel tube mounted on rubber vibration insulators.

C. Viewing surface: securely attached to roller at top and at bottom to weighted dowel. Provide each side of viewing surface with black masking borders and tab-guide cable tensioning system to maintain even lateral tension and to hold surface flat. Top of screen masked by 12" minimum (30 cm) black drop. Stretchable, grey, washable, vinyl surface without backing providing high contrast and resolution; Equal to HiDef Grey as manufactured by Draper, Inc.

D. Joints: Viewing surface shall contain no seams.

E. Edge Treatment: Variable width black masking borders included as part of tab-guide cable tension system.

F. Drop Length: Provide custom drop length as required for ceiling height indicated so that bottom of screen in full down position is four feet (4'-0") above finish floor. Motor:

1. Silhouette Series V
   a. Type: 110-120 VAC, 60 HZ, 3 wire, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches.
   b. Mount inside screen roller.
   c. Roller to be mounted on vibration insulators.

G. Controls:

1. Provide one (1) control station to lower, raise, stop, and reverse projection screen at any point. Locate per architects instructions.
2. Provide one (1) Control Module.
3. Provide one (1) Low Voltage Control Housing.
4. Single station control: 3 position rocker switch with cover plate, accepting 110 V current, and operating by sustained contact. Cover plate to be stainless steel with black switch. Draper Model number SS-1R.
   a. Provide control switch with locking cover plate: 3 position 110V` control switch to lower, raise, stop, and reverse projection screen at any point with stainless steel locking cover. Provide with four (4) keys.
5. Low Voltage Control Module with RS232, Draper Model Number MC1. Low voltage control: Control station without switches for interface with infrared remote control receiver. Wiring from switches or receivers to low voltage control unit to be 24 V. Provide Stainless Steel Cover Plate.

H. Mounting Hardware: Provide additional Unistrut framing with all thread rods suspended from structure to provide a stable attachment point for factory hardware. Brace support framing as required to maintain manufacturer's operational tolerance requirements.

2.04 OPERATION

A. Projection screen shall operate within the manufacturers specified tolerances and shall provide a smooth, low noise presentation of the coiled screen into a flat, taught viewing surface when switched from the wall switch or when operated with the infrared remote control.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where screens are to be installed and report any conditions detrimental to the proper installation and control of screen. Do not proceed with installation until detrimental conditions are corrected. Coordinate the work of this Section with the work of other sections that are interfaced, attached or otherwise connected.

B. Install projection screens and controls at locations and heights indicated on Drawings. Coordinate with Architect prior to installation.

C. Comply with screen manufacturer's written instructions and shop drawings.

3.02 INSTALLATION

A. Install projection screens and controls at locations and heights as directed by the Architect.

B. Comply with screen manufacturer's written instructions and approved shop drawings.

C. Install screens securely to supporting substrate so that screens are level and back of case is plumb.

D. Provide required brackets, hanger rods, and fasteners. Paint all surfaces black.

E. Prior to installation, verify type and location of power supply.

3.03 TESTING AND DEMONSTRATING

A. Test motorized projection screens to verify that screen, controls, limit switches, closure, and other operating components are functional. Ensure that screen is level and viewing surface plumb when extended. Correct deficiencies.

B. Demonstrate operation of screen to Owner's designated representatives.

3.04 CLEANING AND PROTECTING

A. Clean housing and exposed devices in accordance with manufacturer’s instructions.

B. Protect projection screens after installation from damage from construction operations. If damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 11 52 16 PROJECTORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ceiling mounted LCD Projector with accessories as required for a complete system as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and Specifications are based on products manufactured by NEC, 1250 N. Arlington Heights Rd, Itasca, IL. 60143. Tel. (800) 632-4636.

B. Equivalent products by the following manufacturers are acceptable:

1. Panasonic.
2. Sony.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14 - Product Options and Substitution Procedures.

2.02 PROJECTOR

A. Equal to NEC model NP-P350X as follows:

1. 3500 Lumens.
2. 2000:1 Contrast Ratio.
3. 1024 x 768 Native Resolution.
4. Wireless Networking
5. Geometry Correction
6. AEC0305 Ceiling Mount with custom adapter plate for easy access to lamp and precision gear design for excess tilt and roll adjustments.
7. ECO Mode Technology
8. Active lens cover
9. HDMI Input

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units plumb and level, in locations and with mountings as required. Securely attach to supporting structure with concealed fasteners, in accordance with manufacturer's installation instructions.

B. Remove shipping packaging and install components as per manufacturer’s instructions.

C. Verify and provide all electrical hook-ups and electrical outlets required by the projector specified prior to rough-in.

3.02 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 15 HORIZONTAL LOUVER BLINDS-WOOD

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Two inch horizontal louver blinds, accessories, attaching hardware, labor and equipment necessary to complete satisfactory installation.

1.02 SUBMITTALS

A. Submit manufacturer's descriptive literature indication materials, finishes, construction and installation instructions, and data verifying that product meets requirements specified. Include manufacturer's recommendations for maintenance and cleaning.

B. Shop Drawings: Indicate field-measured dimensions of openings to receive blinds. Include illustrations of special accessory components not included in manufacturer's product data. Indicate details of head and sill conditions, corner conditions, and conditions between adjacent blind units.

C. Color Samples: Submit two 6 inch samples of material indicating full color range and color variation.

1.03 QUALITY ASSURANCE

A. Manufacturer and installer shall have at least five years experience in this type of product and installation.

1.04 WARRANTY

A. Provide manufacturer's standard five year written warranty against defects in materials and workmanship beginning at date of substantial completion.

1.05 PRODUCT DELIVERY

A. Blinds shall be carefully handled and stored to prevent damage to materials, finishes and operating mechanisms.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Skandia Window Fashions, 270 Crossway Road, Tallahassee, FL 32305; Tel. (800) 874–3168.

B. Equivalent products by the following manufacturers are acceptable:

1. Levolor Home Fashions Contract Division, High Point, NC. Tel. (336) 812-8181.
2. Hunter Douglas, Inc., Upper Saddle River, NJ. Tel. (800) 727–8953.
3. Springs Window Fashions Division, Inc., Montgomery, PA. Tel.(570) 547-6671.

A. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 MATERIALS

A. Provide faux wood blinds equal to Inspire® 2 inch Traditional Faux Wood Blinds by Skandia Window Fashions.

2.03 COMPONENTS

A. Valance: Provide standard valance, 2-5/8 inches high, molded. Finish shall match slats.

B. Head Channel Hardware: Metal hardware shall be electroplated with lift cords cloth tape guided by acetal low friction thermoplastic grommets in the head channel that prevent wear and discoloration. Operating hardware shall be mechanically locked into head channel by means of snap-in fittings with no mechanical cleats visible from underside of headrail.

C. Bottomrail: Rectangular molded, 5/8 inch high by 2 inches deep. Bottomrail finished shall match slat color and finish.

D. Slats: Slats shall be made from lead-free, UV-stabilized, integrally colored, opaque, extruded PVC and are resistant to warping, will not crack or yellow, antistatic, and dust-repellent treated. Slats shall be nominally 2 inches wide, by 1/8 inch thick. Spacing shall be manufacturer's standard.

E. Tilt Control: Enclosed worm-gear mechanism and linkage rod for the following operation:

1. Tilt Operation: Manual with cord.
2. Length of Tilt Control: Length required making operation convenient from floor level and reachable over adjacent built in shelves and desktops.
3. Tilt: Full tilt.

F. Ladder: Braided string evenly spaced to prevent long term slat sag.

G. Cord Lock: Metal cord lock shall be of a snap-in design and incorporate a floating shaft-type locking pin. The freely rotating locking pin shall offer minimum wear to cord. Cord lock shall incorporate a crash-proof safety feature that shall lock blind automatically upon release of cord. Locks pull cord to stop blind in any position in ascending or descending travel.

H. Lift Cord: Lift cord shall be braided with polyester jacket and center core or an approved equal construction. Size of cord shall be 1.8mm. Cords shall be detachable, if required, and shall be of sufficient length to properly control the raising or lowering of the blind. Lift cords shall be equipped with tassels to match slat finish. Cord ends shall be securely anchored to the bottomrail and it shall be possible to detach and attach cords.

I. Blinds shall be made with the following cord lock and tilter locations when viewed from within the room:

1. Tilter at left, cord lock at right (standard).
2. Where blinds are located at sidelights of doors, tilter and cord lock shall be located on the same side and on the far side away from the door.

J. End Support Brackets: Universal hinged cover and support brackets of phosphate treated steel with a prime coat of vinyl primer and a finish coat of baked on polyester enamel in color to match headrail. Brackets shall facilitate easy removal of head channel and will include an adjustable tab to eliminate lateral headrail movement.

K. Intermediate Support Brackets: Brackets shall be furnished for blinds over 36 inches wide. Maximum spacing for intermediate support brackets shall be 36 inches.

L. End Stiffeners: Thermoplastic end stiffener caps shall be inserted at each end of the headrail.

M. The blind shall be free of sharp edges, burrs or other defects which might be harmful. When other materials result in improved specifications, they shall be adopted.

N. Color: Color of headrail, bottomrail, ladder, wand, cord and accessories shall coordinate with slats. Plastic headrail components shall coordinate with selected slat color. Refer to Section 09 05 15 - Color Design for color selected for slats.

2.04 FABRICATION

A. Prior to fabrication, verify actual opening dimensions by on-site measurement. Calculate blind dimensions to fit with specified tolerances.

B. Fabricate blinds to fill openings from head to sill and jamb to jamb. One headrail per window - may have up to two blinds per headrail if window width exceeds blind maximum. Blind divisions shall be located at mullions.

C. Fabricate blinds to fill all exterior window openings, unless noted otherwise.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Blind installer shall be responsible for inspection of site, installation conditions, and field measurements prior to blind installation.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer’s procedures except as otherwise specified herein.

B. Install intermediate support brackets and extension brackets as needed to prevent deflection in headrail.

C. Install blinds with adequate clearance to permit smooth operation of blinds and any sash operators.

D. Set tilt and lift controls. Demonstrate blinds to be in smooth, uniform working order.

E. Blinds may be dusted. Gently clean soiled blind surfaces with a mild soap solution. Do not use steam, hot water, bleach or any abrasive or solvent based cleaners.

END OF SECTION

SECTION 12 21 16 ROLLING BLACKOUT SHADES

PART 1- GENERAL

1.01 SECTION INCLUDES

A. This Section includes requirements for motorized rolling window shades. Provide all window shades, accessories, attaching hardware, electrical connections, labor and equipment necessary for a complete installation as specified.

B. The objective of the window shading system shall be to provide room darkening to facilitate video and slide presentations. The motorized shade system shall consist of an electrically operated tubular asynchronous motor enclosed in the roller tube which will raise and lower the shade by means of one or more switches.

1.02 SUBMITTALS

A. Submit manufacturer's descriptive literature indicating materials finishes, construction, and installation instructions, and data verifying that product meets requirements specified. Include manufacturer's recommendations for maintenance and cleaning.

B. Shop Drawings: Indicate field-measured dimensions of openings to receive rolling shades. Include illustrations of special accessory components not included in manufacturer's product data. Indicate details of head and sill conditions, corner conditions, and conditions between adjacent rolling shade units.

C. Color Samples: Submit two 6 inch samples of material in color selected by Project Engineer / MDOT Architect.

1.03 QUALITY ASSURANCE

A. Manufacturer and installer shall have at least five years experience in this type of product and installation.

1.04 WARRANTY

A. Provide manufacturer's standard five year written warranty against defects in materials and workmanship beginning at date of substantial completion.

1.05 PRODUCT DELIVERY

A. Blinds shall be carefully handled and stored to prevent damage to materials, finishes and operating mechanisms.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Lutron Electronics Co., Inc.; 7200 Suter Rd Coopersburg, PA 18036-1299; Telephone: 610-282-3800; Website: www.lutron.com.

B. Equivalent products by the following manufacturers are acceptable:

1. Draper, Inc., Spiceland, IN. Tel. 800-238-7999.
2. MechoShade Systems, Inc., Long Island City, NY. Tel. 718-729-2020.

A. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 SHADE AND HOUSING MATERIALS

A. End roller shall be a two piece unit consisting of an outside sleeve and center bearing shaft made of high strength fiberglass reinforced polyester. The outside sleeve shall be free to rotate on the center shaft, providing the bearing surfaces on which the roller rides. This will provide a smooth, quiet, and long wearing system. Provide tracker at outer edge of shade as required due to size.

B. Mounting Brackets shall be 0.060 inch galvanized steel and universally applicable for mounting inside, outside, or to the ceiling, with the clutch on either the right or left hand side of the roller. The clutch mounts flush to the face of the bracket resulting in the smallest possible light gap between fabric and window frame.

C. Roller tube shall be either enameled roll-formed steel or extruded aluminum of sufficient diameter and wall thickness to prevent excessive deflection along its length, and will have a double-sided adhesive strip applied for exact and firm mounting of the fabric. A minimum of two turns of fabric will be placed on the roller before the working section of fabric starts. This will protect the fabric attachment and smooth out the starting seam.

D. Hem bar shall be either 1/8 inch by 1 inch or 1/8 inch by 1-1/2 inch extruded aluminum bar, depending on size of shade pockets, in lower end of fabric by thermal seal.

E. Shade fabric shall be:

1. Openness factor shall be 0 percent SuperWeave 100. Color shall be selected when submitted. Widths shall be calculated so that breaks between shades shall occur at window mullions with as few shades as possible. Shade widths shall be equally spaced.
2. Shading fabric shall be 64% Vinyl, 36% Fiberglass, meets or exceeds Fed. FR Spec NFPA 701. It shall be woven so that all yarn is interlocking and heat treated so that all material is totally bonded together.
3. Fire Retardance: The described woven fabric shall have been tested by an approved laboratory and met the minimum requirements established by the National Fire Protection Association Test 701, and shall be fade resistance to commercially accepted standards.

2.04 MOTORS

A. Motors shall be asynchronous capacitor start and run, single phase type operating on 120V-60HZ. They shall have planetary type gears, solenoid activated disc brakes and built-in limit switch units. Each motor shall be thermally protected, tubular in shape and totally enclosed within the roller tube. All motors shall operate at 30 RPM and shall be UL recognized and CSA certified for safe operation.

A. Mounting brackets for motor end, idler end and center supports shall be .125 inch galvanized steel and universally applicable for inside, outside or ceiling mount.

B. Controls for shades shall be operated in groups by means of one or more double pole, double throw switches. Group Control Systems shall allow for operating up to four motors from one or more switches ganged to control entire elevation. All shades in elevation shall operate smoothly and cohesively as a single unit.

2.05 ACCESSORIES

A. Provide rocker switches with switch plates to match other electrical devices as specified in Division 16.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Shade installer shall inspect areas in which shades are to be installed and report any conditions that are detrimental to the installation or proper operation of the rolling shades. Report any conditions unacceptable in writing to the contractor and do not proceed with installations until conditions are corrected.

3.02 INSTALLATION

A. Install shades in windows level and plumb and in accordance with manufacturer's product data and approved shop drawings.

B. Clean finished installation of all spots, smears, stains and other foreign matter and remove all resulting debris from the site.

END OF SECTION

SECTION 12 48 43 FLOOR MATS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal-rails, tapered vinyl-frame, surfaced mounted, removable, carpeted floor mats for Building Entrances.

1.02 RELATED SECTIONS

A. Section 09 05 15 – Color Design.

1.03 SUBMITTALS

A. Product Data: Submit manufacturers' product and technical data indicating compliance with these specifications and recommended maintenance practices.

B. Shop Drawings: Submit materials description, component dimensions and details. Show plan view that clearly indicates traffic direction and size of mat.

C. Colors: Submit samples of manufacturer's full range of available colors (minimum 20 for carpet) and finishes for materials exposed to view.

1.04 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on products manufactured by Construction Specialties, Inc. P.O. Box 380, Muncy, PA 17756. Tel. (888) 834-4455.

B. Other acceptable manufacturers offering equivalent products:

1. Arden Architectural Specialties, Inc., Saint Paul, MN. Tel. (651) 631-1607.
2. J.L. Industries, Inc., Bloomington, MN. Tel. (612) 835-6850.
3. R. C. Musson Rubber Co., Akron, OH. Tel. (330) 773-7651.

C. Substitutions shall fully comply with specified requirements and Section 01 62 14-Product Options and Substitution Procedures.

2.02 FLOOR MATS

A. Equal to C/S "Pedimat" Surface-Mounted Floor Mat, Model M1-D-HD-SM.

B. Install one floor mat at interior side of each exterior door. Do not install at room Ice 149.

C. Size: 6 feet wide by 4 feet deep (traffic direction) at double doors; 4 feet wide by 4 feet deep (traffic direction) at single doors.

D. Carpet Color: As selected by Project Engineer / MDOT Architect from full range of manufacturer's 25 standard colors.

E. Rails: Extruded aluminum 6063-T52 as selected by Project Engineer / MDOT Architect from full range of manufacturer's 7 optional anodized colors.

F. Carpet tread: Colorfast, solution dyed nylon tread, in color selected by Project Engineer / MDOT Architect, fusion bonded to rigid two-ply backing supplied in continuous splice-free lengths. Anti-static carpet fiber shall contain an antimicrobial additive and "Scotchgard" soil reducing treatment.

G. Frame: Tapered vinyl with mitered corners. Color as selected by Project Engineer / MDOT Architect from full range of manufacturer's six standard colors (match rail color).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install unit(s) level, in locations as described. Install mats after Final Cleaning of Project Floor.

3.02 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 22 05 10 PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete plumbing systems as specified herein and as shown on the drawings.

B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary and other conditions) and other divisions as appropriately apply to work specified in this division.

1.02 CODES, ORDINANCES, AND PERMITS

A. All plumbing materials and workmanship shall comply with the following codes and standards as applicable:

1. The National Electric Code (2005 Edition)
2. The International Building Code (2006 Edition)
3. The International Plumbing Code (2006 Edition)
4. The International Fuel Gas Code (2006 Edition)

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

1. Air Conditioning and Refrigeration Institute Standards (ARI)
2. American National Standards Institute, Inc. Standards (ANSI)
3. American Society for Testing and Materials Publications (ASTM)
4. American Gas Association Inc. Laboratories (AGA)
5. American Society of Mechanical Engineers Code (ASME)
6. Factory Mutual Underwriters (FM)
7. National Fire Protection Association Standard (2006)
8. Underwriters Laboratories Inc. (UL)

C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be used made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.

D. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.

E. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

1.03 APPLICABILITY

A. The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the plumbing systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

1.04 COORDINATION OF PLUMBING DOCUMENTS

A. The plumbing work listed in these documents shall be coordinated with the work indicated on all other drawings, schedules, schematics, and specifications that are part of these construction documents. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

1.05 WELDERS QUALITY ASSURANCE

A. All welders shall be certified by ANSI B31.1.0-1967 “Standard Qualification Welding Procedures, Welders and Welding Operators” or “Qualification Tests” in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder’s qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder’s identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

PART 2 - PRODUCTS

2.01 COORDINATION OF PRODUCTS

A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the plumbing systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

2.02 DESCRIPTION

A. All components of the plumbing systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter’s Laboratories, Inc. (UL) label.

PART 3 - EXECUTION

3.01 GENERAL

B. The Contractor shall provide and prepare all openings for plumbing work as required in walls, roof, ceilings, etc.; he shall also do all painting as may be required. He shall coordinate the installation of all plumbing equipment in the exterior wall and roof.

B. The plumbing plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.

C. If the Contractor proposes to install equipment and piping requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.

D. The Contractor is responsible for the proper location and size of all slots, holes or openings, in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.

E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interference shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. For example sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

F. Except where otherwise noted, all piping in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

G. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this contract. All control wiring shall be by the Controls Contractor.

H. Piping and equipment shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel-boards, power panels, motor control centers, or dry type transformers:

1. Within 42 inches in front (and rear if free standing) of equipment; or
2. Within 36 inches of sides of equipment,
3. Clearances apply vertically from floor to structure.
4. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors,

valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

3.02 ELECTRICAL WORK

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

3.03 PROTECTION OF EQUIPMENT

A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation and wind.

B. Plug ends of pipe when work is stopped and close ends of ducts with plastic taped in place until work resumes.

C. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

3.04 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All un-insulated black ferrous metal items exposed to sight inside the building, such as piping, equipment hangers and supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibitor primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. Black ferrous metal items exposed outside the building, such as equipment support beams, un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. In lieu of painting hanger rods, cadmium plated or galvanized rods may be furnished.

E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.

F. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.

3.05 PROTECTION OF EXISTING UTILITIES

A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.

B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

3.06 CUTTING AND PATCHING

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. All surfaces shall be patched to the condition of the adjacent surfaces.

C. The Contractor shall make suitable provisions for adequately water-proofing at his floor penetrations of water proof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, clean-outs, and sleeves for the various piping. This also applies to membrane roofing systems.

3.07 SLEEVES, FLOOR AND CEILING PLATES

A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under each section of the Specification.

B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.

C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.

D. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.

E. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.

F. All penetrations through rated walls and floors shall be packed, sealed and encapsulated per the applicable U.L. details(s).

G. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.

H. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to ¾" diameter, and permitting lateral adjustment.

3.08 ESCUTCHEONS

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls,

or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.09 CLEANING

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.

B. Before installing thermostatic members of the steam traps, and connecting return mains to the return pumps, pipe the return mains outside the building and blow down the new steam piping system until thoroughly clean. Open automatic steam valves while blowing down.

C. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

D. The exterior surfaces of all mechanical equipment, piping, etc., shall be cleaned of all grease, oil, paint, dust and other construction debris.

E. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

F. Equipment rooms shall be left broom clean.

G. End of open pipes shall be covered during construction except when working directly on such one prohibits covering.

H. Clean and polish identification plates.

3.10 EQUIPMENT, MATERIALS AND BID BASIS

A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products will be considered and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. Substitutions shall be submitted to the Architect for review after bid in accordance with specifications section 01 62 14.

B. The use of one named manufacturer in the schedules on the Drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

3.11 GUARANTEE

A. All systems and components shall be provided with a one year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.

3.12 FOUNDATIONS

A. All concrete foundations required by equipment furnished under the Plumbing Division shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed. Unless otherwise noted, foundations shall be four inches 4" - 6" high. All concrete work performed shall conform entirely to the requirements of the General Specifications that describe this class of work.

3.13 RECORDS AND INSTRUCTIONS FOR OWNER

A. The Contractor shall accumulate during the job's progress the following data in triplicate prepared in neat brochures or packet folders and turned over to the Architect/Engineer for check and subsequent delivery to the Owner:

1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.
2. Provide approved fixture brochures, wiring diagrams, and control diagrams.
3. Provide copies of approved shop drawings.
4. Three sets of operating instructions for plumbing equipment and systems. Operating instructions shall also include recommended periodic maintenance and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
5. Any and all other data and/or drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

B. All of the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor asks for his last estimate prior to his final estimate, but in no case, less than two weeks before final inspection.

C. The Contractor shall also give not less than 1 day of operating instructions, during the

adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in paragraph above shall be used as a basis for this on-the-job instruction.

3.14 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work the Contractor shall purchase from the Architect a set of mylar sepia prints to be used for the "Record Drawings".

B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS – “3/8" high letters to be used for recording field deviations, and "5/16" high letters to be used for dimensional data only.

3.15 INSTALLATION

A. All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

3.16 ACCESS DOORS

A. Furnish and install access doors at each point required to provide access to concealed valves, water hammer arrestors (PDI’s), cleanouts, and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.

C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor to be installed.

D. Access doors shall be MILCOR or approved equal in accordance with the following:

Style AT Door for Acoustical Tile Ceilings
Style AP Door for Acoustical Plaster Ceilings
Style K Door for Plastered Wall and Ceiling Surfaces
Style DW Door for Drywall

Style ATR for Suspended Drywall Ceilings
Style M Door for Masonry, Ceramic Tile, Etc.
Fire-Rated 1-1/2 hr. (B-label) Door where required.

E. Size and type shall be as required for proper service and/or as may be directed by the Architect.

F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

3.17 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

3.18 EQUIPMENT FURNISHED BY OWNER

A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the owner for installation by the contractor.

B. The contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

3.19 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in specification Division 22. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

END OF SECTION

SECTION 22 05 11 PLUMBING SUBMITTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, and Section 22 05 10 Plumbing General Requirements, apply to all work herein.

1.02 QUALITY ASSURANCE

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract.

1. The Contractor shall submit to the Architect a sufficient number of copies of all such Shop Drawings or catalog data to provide him with as many reviewed copies as he may need, plus five (5) copies for retention; one by the Architect, one by the Engineer, one by the commissioning agent, one by the MDOT Architect and one by the Project Engineer.

B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain.

1. The Contractor shall so note these Drawings before submitting them.
2. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect.
3. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

C. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect.

1. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings.
2. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.

E. Reproduction of design documents in any portion for use in a submittal is not acceptable.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

PART 3 - EXECUTION

3.01 SUBMITTAL DATA

A. General

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.
2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 22 and Division 23, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.
3. Plumbing and fire protection submittal data shall be bound into separate 3-ring binders. Each plumbing and fire protection volume shall contain one copy of all specified equipment/shop drawing submittals. Each binder shall be provided with an index of materials and an identification tab for each Specification Section that requires submittals. Each item in each tabbed section shall be identified with the paragraph number relating to the item submitted. FAILURE to provide **BOUND AND IDENTIFIED SUBMITTALS** will result in the **AUTOMATIC REJECTION** of the submittal data with **NO EXCEPTION.**

B. The bound submittals are to be submitted for review within 30 days after the Contract is awarded. No submittal will be checked until ALL required submittals have been received by the Engineer. Only sprinkler system shop drawings and pipe fabrication drawings may be submitted after the completed bound submittal is reviewed and accepted by the Engineer.

C. The Contractor shall submit with the bound and identified submittal data a letter signed by the Contractor's Project Manager (or higher level officer of the firm) stating that all electrical characteristics of the mechanical equipment to be supplied has been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

1. Backflow Preventers
2. Cleanouts
3. Disconnect Switches
4. Drains
5. Flexible Pipe Connectors
6. Flow Switches
7. Insulation
8. Hydrants
9. Meters
10. Motor Starters
11. Pipe Guides
12. Pipe Hangers and Supports
13. Plumbing Drains
14. Plumbing Fixtures, Carriers and Fittings
15. Shock Absorbers
16. Starters
17. Strainers
18. Thermometers, Gauges, etc.
19. Vacuum Breakers
20. Valves
21. Water Heaters
22. Water Supplies and Stops

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Description

1. Complete operating and maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instruction shall be included for each piece of equipment. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.
2. A system wiring and control diagram shall be included in the operating and maintenance instruction.
3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the Owner in the operation of all systems for a period of not less than three (3) days. This instruction shall include a complete walk-through of all equipment and systems. The Architect reserves the right to attend any such meeting and shall be duly notified. Training shall be in accordance with 22 05 10-7 and Section 01 79 00 “Demonstration and Training“.

3.03 OTHER SUBMITTALS – CLOSEOUT FORMS

A. Submit two copies of the following prior to occupancy of the project by the Owner. See Contract Closeout Forms – Section 01 77 00 “Closeout Procedures”.

1. Request for final payment.
2. Letter or “Release of Liens”.
3. Letter of “Guarantee”.
4. Submit two (2) copies of welder’s certificate.
5. Consent of Surety Company to final payment.
6. Certify disinfection of domestic water service.
7. Power of Attorney.
8. Manufacturer's representative shall certify that plumbing equipment and valves are installed in accordance with the manufacturer's recommendations.
9. Contractor’s Affidavit of Payment of Debts and Claims.

END OF SECTION

SECTION 22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions, and General Requirements Division 01 apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.

B. "C" CLAMPS may be used as point of attachment to building structure for pipe hangers and/or all-thread rods; however, piping shall not be supported directly by “C” clamps.

C. Do not pierce waterproofing with support bolts.

D. All ferrous metal hangers and supports, not otherwise coated, shall be provided with a field-applied coat of zinc chromate primer prior to any installation. In lieu of field painting, the contractor may furnish cadmium plated, or galvanized hangers and supports.

1.03 QUALITY ASSURANCE

A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.

B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories. Submit fastening methods to the Structural Engineer for approval and as approved copy to the engineer.

C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel straps are not acceptable.

D. For the purpose of this specification, Grinnell product figure numbers are given. Equal products by B-Line and Michigan Hanger Co. (M-Co) are acceptable.

1.04 DESIGN

A. Supporting steel not shown for the equipment will be designed, supplied and erected by the Contractor; the supporting steel is that steel which is connected to the structural steel shown on the drawings and carries the weight of the mechanical items. This supporting steel design must carry the dead weight and dynamic load imposed by the equipment, piping and other mechanical components.

B. The supporting steel shall be connected to the structural steel in such a manner as not to overload the structural steel. It is the responsibility of the General Contractor, Mechanical Contractor and the steel fabricator to verify that this purpose is accomplished. It is the responsibility of the General Contractor to call to the attention of the Architect-Engineer any deficiency prior to bidding.

C. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger in order to prevent excessive stress in either pipe or connected equipment.

PART 2 - PRODUCTS

2.01 UPPER ATTACHMENTS

A. New Concrete Construction:

1. Support piping in new concrete construction with adjustable type inserts, Grinnell Fig. 282. Where the pipe load exceeds the recommended load of the insert, use two inserts with a trapeze-type connecting member below the concrete.
2. Where hangers are required between structural members, (beams) provide side beam brackets, Grinnell Fig. 202, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hangers. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

B. Existing Concrete Construction:

1. Support piping in existing concrete construction with Cadmium plated, malleable iron, expansion case, Grinnell Fig. 117.
2. Where hangers are required between structural members (beams) side beam brackets Grinnell Fig. 20, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

C. Steel Construction:

1. Support piping in steel construction with adjust-able beam clamps and tie rods, Grinnell Fig. 218, or side beam brackets bolted or welded to the side of the beam.
2. Where hangers are required between structural members (beams or joist) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC steel Handbook and shall receive a field coat of zinc chromate primer.

D. Wood Construction: Support piping in wood construction with Side Beam Bracket, Grinnell Fig. 202 or Hanger Flange, Grinnell Fig 128R, using lag screws.

2.02 WALL SUPPORTS

A. Where piping is run adjacent to walls or steel columns welded steel brackets Grinnell Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

2.03 FLOOR SUPPORTS

A. Where pipe lines are located next to the floor and no provision for expansion are required support piping with Grinnell Fig. 258, pipe rest with nipple and floor flange.

B. Where provisions for expansion are required support piping with Grinnell adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.

C. Vertical piping shall be supported at every other floor using riser clamps Grinnell Fig. 261, for steel and cast iron pipe, and copper clad riser clamp Grinnell Fig. CT-121 for all copper piping.

2.04 SUPPORTS FOR PIPING OUTSIDE THE STRUCTURE

A. Support piping outside the structure on adjustable pipe supports Grinnell Fig. 264.

2.05 INTERMEDIATE ATTACHMENTS

A. Supports for horizontal piping shall be all-thread galvanized steel rods, ASTM A-107, Grinnell Fig. 146, of the following sizes:

Pipe Size	Hanger Rod Diameter
2 inches and smaller	3/8 inch
2-1/2 and 3 inches	1/2 inch
4 and 5 inches	5/8 inch
6 inches	3/4 inch
8 to 12 inches	7/8 inch
14 and 16 inches	1 inch

2.06 PIPE ATTACHMENTS

A. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.

B. Hangers for steel and cast-iron horizontal piping where provision for expansion are not required shall be Grinnell Fig. 260, clevis type with vertical adjustment.

C. Hangers for uninsulated copper pipe 4 inches and smaller shall be copper plated adjustable band hangers Grinnell Fig. CT. 99C, for pipe sizes over 4" provide Grinnell copper clad clevis type hanger with a copper clad saddle at each hanger location.

D. Hanger for PVC pipe shall be Grinnell Fig. CT. 99, adjustable band hanger.

E. Hangers for steel and copper piping where provisions for expansion are required shall be Grinnell Fig. 171 or Fig. 181, adjustable roller hanger with Grinnell Fig. 160, pipe covering protection saddles.

F. Support hot and cold water piping in spaces behind plumbing fixtures with plastic coated brackets and plastic coated U-bolts.

G. Pipe guide shall be Grinnell Fig. 256.

H. Hangers and supports for fire protection and sprinkler system shall conform to the

requirements of NFPA 13, and be UL listed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Support horizontal equipment such as in-line pumps, strainers, air separators, independently of the piping system.

B. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.

C. Support each horizontal length of NO-HUB cast iron pipe within 2-1/2 feet of each joint and a maximum of 5'-0" on centers.

D. Provide a hanger within one foot of each elbow.

E. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.

F. Unless specified otherwise, provide the following support spacing.

1.

Pipe Size	Support Spacing
1 inch and smaller	5’-0”
1-1/4 inch and larger	10’-0”

END OF SECTION

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABILITY

A. All work specified in this Section shall comply with the provision of General Requirements Division 01.

B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take-off, and 40'-0" maximum spacing on exposed straight pipe runs.

C. All underground plastic sewer and water piping outside the building shall have #14-copper (TW) tracer wire attached to pipe. Install directly above pipe a continuous 6-inch wide vinyl plastic tape with printing identifying buried service, 12 inches below finished grade, during backfilling operation.

PART 2 - PRODUCTS

2.01 PIPE MARKINGS

A. Pipe markings shall be manufactured preprinted markings in accordance with the following:

1. No tape or self-adhering markers will be allowed.
2. Snap on pipe markers, W. H. Brady Co. or approved equal are acceptable.
3. Markers shall be strapped on with nylon fasteners.
4. Markers will be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

2.02 BAND AND LETTER SIZE: Band and letter sizes shall conform to the following table:

O.D. of Pipe	Width of Color Band	Size of Letter/Numbers
1-1/4 inch and smaller	8 inches	1/2 inch
1-1/2 to 2 inches	8 inches	3/4 inch
2-1/2 to 6 inches	12 inches	1–1/4 inch
6 to 10 inches	24 inches	2–1/2 inches
Over 10 inches	32 inches	3-1/2 inches

2.03 IDENTIFICATION

A. Band legend and color and letter color shall conform to the following table:

Piping Band	Legend	Letters	Band Color
Cold Water (Domestic)	CW (Dom)	White	Green
Hot Water (Domestic)	HW (Dom)	Black	Yellow
Hot Water Circulation (Domestic)	HWC (Dom)	Black	Yellow
Drain	D	Black	Green

B. All equipment, such as water heaters, pumps, etc., furnished by this Contractor, shall be permanently labeled, in an approved manner, corresponding to the mark or name shown on the drawings and/or specifications, or Owners' sequences.

C. For applications where existing color schemes may already be in place, all new work requiring identification and color coding shall match the existing color schemes.

PART 3 - EXECUTION

3.01 EXECUTION

A. Locate pipe identification in the following areas:

1. Each riser and each valve,
2. One on each side where piping pass thru walls and floors,
3. Locate at or near each change in direction,
4. Every 40 feet along continuous runs,
5. Located within 4 feet of exit or entrance to a vessel or tank.

B. Indicate pipe content flow direction with arrows of matching style and placed so the arrow points away from the legend.

END OF SECTION

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION

A. All insulation products used outside of mechanical rooms shall meet NFPA requirements for Flame Spread Rating 25, Smoke Developed Rating 50, and Fuel Contributed 50.

B. Staples SHALL NOT be used for securing insulation. All insulation shall be installed in accordance with the insulation manufacturer's recommendations. Insulation shall be continuous through wall, ceiling, floor and roof openings and sleeves, except at fire/smoke dampers.

C. Supports for insulated piping shall be outside the insulation. Inserts shall be provided at hangers. Inserts shall be Foamglass Insulation, Calcium Silicate or Perlite and shall be 2 inches longer than the pipe shields. Pipe shoes welded to the pipe shall be used for roll type hangers.

D. All required tests of the relevant section of pipe or equipment shall be completed before insulation is applied.

E. Do not store materials in building until it is enclosed and dry. Wet insulation shall not be installed.

F. Insulation products with self-sealing type jacket shall not be applied at temperatures below 40 degrees F.

G. Items not to be insulated:

1. Chromium plated brass connections to plumbing fixtures.
2. Underground domestic cold water piping.
3. Vents from pressure relief valves.
4. Chrome plated piping at plumbing fixtures.
5. Exposed to sight piping at kitchen equipment.

H. Clean and dry all surfaces to be insulated from loose scale, dirt, oil, moisture and other foreign matter.

I. Insulate completely all metal surfaces of piping and equipment other than hangers.

J. Surface finishes shall present a tight smooth appearance.

K. Permit expansion and contraction without causing damage to insulation or surface finish.

L. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation.

M. Vapor barriers must be continuous and uninterrupted throughout the system where specified except where insulation is interrupted for fire dampers. See details for special conditions.

1.03 PIPING

A. Insulate all valves, strainers and fittings. For the purposes of this Specification, fittings include unions and flanges. Use premolded material where available. Insulate valves up to and including bonnets.

B. Pipe Hangers that are installed in direct contact with the surface of the pipe, such as a pipe clamp shall have the insulation applied over the hanger as well as the pipe. Provide a rain shield on piping supported on hangers outdoors to prevent bulk water from entry.

1.04 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.

C. Insulation shall be applied by experienced workers regularly employed for this type of work. Material shall be furnished to the job bearing the manufacturer's label.

D. Insulation products shall be as manufactured by Pittsburgh Corning Corporation, Owens-Corning, Certainteed, Armstrong or Manville.

PART 2 - PRODUCTS

2.01 PRE-MOLDED FIBERGLASS PIPE INSULATION

A. Insulation shall be heavy density, one- piece insulation made from inorganic glass fibers bonded with a thermosetting resin and accurately molded to conform to the outside diameter of the pipe. Insulation shall be one piece snap-on or self-sealing type with white all service jacket. Insulation shall be suitable for use on either hot or cold water pipes with temperature range of plus 20 degrees to 400 degrees F. Thermal conductivity shall not exceed 0.23 at 75 degrees F. mean temperature.

B. Safe burning characteristics shall be UL Classified and shall not exceed 25 flame spread, 50 smoke developed when tested in accordance with ASTM E84, NFPA 255 and UL723.

C. Insulation jacket shall have a water vapor transmission of 0.02 perms or less as tested by ASTM E96, Procedure A.

D. All pipe fittings and accessories insulated with fiberglass shall be fitted with heavy gauge PVC covers and jackets as manufactured by Johns Manville Zeston 300 Series. Fitting covers shall be two-piece PVC made for short and long radius elbows in shapes for 45 degrees and 90 degrees bends. Covers and jackets to have a white glossy finish and UV resistant. Material thickness to be minimum 30 mil and carry a flame spread of 25 or less with a smoke development of 50 or less.

E. Pre-molded fiberglass insulation shall be used on the following pipe systems. Pipe insulation shall be equal to Manville Fiberglass Micro-Lok AP-T Plus.

INSULATION THICKNESS IN INCHES FOR PIPE SIZES

	Temperature Up to	Up to 1"	1-¼" to 2"	2- ½" to 3- ½ "	4" & Over
Cold Water	50º-65ºF	1/2"	1"	1"	1"
Hot Water and Hot Water Circulating	200ºF	1/2"	1"	1"	1-1/2"
Indirect Refrigerator Waste	40º-55ºF	1/2"	1"	1"	1-1/2"
Drains Connecting A/C Equipment	40º-55ºF	1/2"	1"	1"	1-1/2"
Horizontal Portion of Primary Rain Leaders Including Each Elbow and Roof Drain Body	Any	1"	1"	1-1/2"	2"

2.02 FOAMED PLASTIC SHEET AND TUBING

A. Sheet Insulation shall be equal to Armstrong Armaflex. Minimum of 4.5 lbs. per cu. ft. Thermal conductivity shall not exceed 0.28 at 75 degrees F mean temperature.

B. Insulate the following piping system as indicated:

1. Water cooler waste and trap with 1/2 inch thick foamed plastic tubing
2. Domestic hot water piping below ground with 1/2 inch thick foamed plastic tubing.

C. Piping outside the building shall be insulated with 1 inch thick flexible foamed plastic insulation with weatherproof aluminum as hereinafter specified.

2.03 ADHESIVES, MASTIC, COATINGS

A. Benjamin Foster, Childers, Insul-Coustic, EPOLUX, Minnesota Mining and Manufacturing Co.

B. Treatment of pipe jackets to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Vapor barriers shall have a perm rating of not more than .05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than .25 perms.

2.04 TAPE

A. Wherever tape is used for sealing purposes, it shall be of the type and shall be applied as recommended by the non-conductive covering manufacturer. Where recommendation is lacking, the tape used shall be sealed with Minnesota Mining Adhesive EC-1329.

PART 3 - EXECUTION

3.01 GENERAL

A. Surfaces to be insulated shall be clean, dry, and free of foreign material, such as rust, scale and dirt when insulation is applied. Perform pressure tests required by other Sections before applying insulation.

B. Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.

3.02 INSULATION FOR ALL PIPING SYSTEMS

A. Insulate pipe, fittings, flanges, unions and valves.

B. Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal seams and end laps. Do not use scrap pieces of insulation where a full length section will fit.

C. Install insulation, jackets and coatings continuous through wall and floor openings and sleeves.

D. Fittings, valves and flanges shall be insulated with field fabricated multiple mitered segments of molded fiberglass insulation of the same thickness as adjoining pipe insulation. Secure fitting insulation segments with 20 gauge galvanized steel wire and apply a smoothing coat of insulating cement. White fabric and mastic shall be used on exposed fittings.

E. Application of all materials shall be in accordance with the manufacturer's instructions.

F. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint straps furnished with insulation.

G. Care shall be taken so as not to place insulation over vent and drain inlets and outlets.

H. Staples are not permitted on pipe insulation.

END OF SECTION

SECTION 22 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 13 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 13 General Commissioning and Division 22 for additional requirements.

END OF SECTION

SECTION 22 11 13 FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section of the Specifications and related drawings describe requirements pertaining to the plumbing piping and equipment.

B. Refer to the following sections for related work:

1.	22 05 11	Plumbing Submittals Data
2.	22 05 29	Hangers and Supports for Plumbing Piping and Equipment
3.	22 05 53	Identification for Plumbing Piping and Equipment
4.	22 33 00	Electric Domestic Water Heaters
5.	22 42 00	Commercial Plumbing Fixtures

1.02 RECORD DOCUMENTS

A. Provide corrected Record Documents in accordance with the Project Record Documents Sections and the Mechanical General Section.

1.03 GENERAL PROVISIONS AND BASIC MATERIALS

A. The requirements of Plumbing General Requirements Section 22 05 10 apply to this work.

1.04 CODE:

A. The work shall comply with the International Plumbing Code; acceptability under the codes shall not authorize any substitution, smaller size, lighter weight or less durable materials for the items specified.

B. The Contractor shall obtain and pay for all required permits and inspections and shall deliver one copy of each inspection certificate to the Architect before the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 WATER PIPING

A. Aboveground piping 3 inches and smaller: Type "L" copper tubing with tin-antimony soldered joints and wrought copper socket fittings.

B. Underground piping 3 inches and smaller: Type "K" hard drawn copper tubing, with 95-5 silver soldered joints and wrought copper socket fittings.

C. Underground piping 4 inches and larger: Class 50 ductile-iron pipe, with cement mortar lining, and push-on joints. Fittings shall be Class 250 ductile-iron, mechanical joints.

D. Underground piping 1 inch and smaller below building slab: Below slab Type "L" soft drawn copper tubing, with no joints.

2.02 BASIC PIPING SPECIALTIES

A. Unions:

1. Unions shall be the same material and working pressure as the fittings specified for the piping system. Unions on piping 2-1/2 inches in size and larger shall be bolted flanged joint and on smaller than 2-1/2 inches shall be screwed connection.
2. Unions and flanges provided between copper and ferrous pipe connections shall be insulating (dielectric) type to electrically separate dissimilar metal connections in piping system.

B. Dielectric Adapters:

1. Dielectric adapters shall be the union type for pipes 2 inches in size and larger. Adapters shall have working pressure of 250 psi for union type and 165 psi for flanged type. The insulating gaskets shall have an operating range of 40 degrees F to 240 degrees F and shall limit the galvanic corrosion to a maximum of 1 percent of the short circuit current. Dielectric adapters shall be Ebco, Crane or Capitol.
2. Provide a dielectric adapter between any ferrous and copper connection including piping and equipment.

C. Pressure Gauges:

1. Pressure gauges shall be connected to the piping system with threaded brass pipe and screwed brass fittings. Gauges shall be flangeless type and shall have 4-1/2 inch dials, cast aluminum cases, stainless steel rotary gear movements, phosphor bronze bourdon types, forged brass rod sockets and tips, 1/2 percent accuracy of scale range, plexiglass dial covers, safety blow-out disc and 1/4 inch lower connections. Gauges shall be Weksler Type AA1, Trerice No. 500X Series or Weiss Series PG.
2. Each gauge shall be provided with a needle valve type gauge cock suitable for the pressure and temperature of the system in which it is installed, and compatible with the gauge to which it attaches. Gauge cocks shall be Weksler Type A, Trerice No. 880 or Weiss Type LC.
3. Gauges in pump suction lines shall be the compound type. Gauges in all other locations shall be the plain pressure type. Select to operate at midpoint of scale during normal system operation.
4. Gauge cocks shall consist of a brass lever handle cock connected to the piping system with threaded brass pipe and screwed brass fittings. Gauge cocks shall be Weksler Type A, Trerice No. 880 or Weiss Type LC.

D. Thermometers:

1. Thermometers shall be the red-reading mercury filled adjustable angle type. Thermometers shall be adjustable to any angle through a 180 degree arc and shall be provided with a locking device. Thermometers shall have V-cast aluminum case with baked enamel finish and 9 inch scale. Thermometers shall be provided with separable sockets and, where installed on insulated pipes, sockets shall be extended neck type. Thermometer scale range shall be 0 to 160 degrees F. Thermometers shall be Weksler Adjust-Angle Series Type AA-5, Trerice Adjustable Angle Series Type BX, or Weiss Vari-Angle Series Type VS.

E. Pipe Sleeves:

1. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, equipment and devices furnished under each section of the Specification.
2. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
3. Where pipes pass through floor slabs, sleeve shall be standard weight black steel pipe with top of sleeve 3 inches above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
4. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.
5. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
6. All penetrations through rated floors shall be packed with mineral wool and capped off with a silicon caulk. As an alternate, an approved, fire rated sealant as manufactured by 3M or Hilti may be used.
7. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
8. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4 inch diameter, and permitting lateral adjustment.

F. Floor, Wall and Ceiling Plates:

1. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
2. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
3. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

2.03 BACKFLOW PREVENTERS

A. Reduced Pressure Principle - Provide reduced pressure principle backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks, air-gap drain funnel, and pressure-differential relief valve located between two (2) positive seating check valves. Assembly shall be constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research. Pipe drain to nearest floor drain.

B. Double Check Valve - Provide double check valve backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks, and shall be suitable for supply pressures up to 175 psi. Assembly shall be

constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research.

C. Provide backflow preventers as indicated on drawings. Backflow preventers shall be Watts or approved equal as follows:

Size	Double Check	Reduced Pressure Zone
1/2 to 3 inches	007QT-S	009QT-S
4 to 10 inches	709NRS-S	909NRS-S

2.04 WATER HAMMER ARRESTORS: Water hammer arrestors shall be piston operated, type "K" copper, pressure rated for 250 psi, tested and certified in accordance with PDI standard WH-201; Precision Plumbing Products, Inc., or approved equal.

2.05 VALVES

A. All shutoff valves shall be gate or ball valves unless otherwise noted. All drain valves shall be globe or angle valves unless otherwise noted.

B. Gate valves 2 inches and smaller shall be of Class 125, body and bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper-silicon alloy stem, brass packing gland, solder ends, Teflon-impregnated packaging, and malleable handwheel; NIBCO S-11 or approved equal.

C. Class 150 valves meeting the above specifications shall be used where pressure requires; NIBCO S-134 or approved equal.

D. Ball valves 2 inches and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome-plated brass ball, solder ends with extended solder cups; NIBCO S-580-BR-R-70 or approved equal.

E. Gate valves 2-1/2 inches and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-617-0 or approved equal.

F. Globe valves 2 inches and smaller shall be of Class 125, body and bonnet of ASTM B-62 cast bronze composition, solder ends, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwheel; NIBCO S-235-Y or approved equal.

G. Globe valves 2-1/2 inches and larger shall be of Class 125 iron body, bronze mounted with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged end, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-178-B or approved equal.

H. Check valves 2 inches and smaller shall be of Class 125, solder ends, with bodies and caps conforming to ASTM B-62 cast bronze composition, swing type disc; NIBCO S-413-BYW or approved equal.

I. Check valves 2-1/2 inches and larger shall be iron body, bronze mounted, with body and cap conforming to ASTM A-126 Class B cast iron, flanged ends, swing type disc; NIBCO F-918-B or approved equal.

J. Calibrated Balancing Valve 4 inches and smaller shall be of Class 125 at 150 Degree F bronze body, leak tight ball construction. Valves to have differential pressure read out parts with check valves across the valve seat area. Valves to have memory stop feature to allow valve to be closed for service and reopened to set point without disturbing balance position. Valve shall have an attached calibrated nameplate to indicate degree of closure; Taco CS or approved equal.

2.06 PLUMBING SYSTEM INSULATIONS

A. All water piping shall be insulated in accordance with specification section 22 07 00 “Plumbing Insulation”.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide pipe hangers and supports in accordance with Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment”.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install piping and make all joints in accordance with the pipe manufacturer's recommendations. Make provisions for thermal expansion and contraction.

B. Rough-in for fixtures in accordance with the fixture manufacturer's roughing-in drawings to provide the heights and locations indicated on the Architectural drawings or as specified.

C. Install piping and pipe supports as specified. Keep pipe ends closed except for vent and drain openings; protect vent and drains from the entrance of materials that could cause stoppage.

D. Install shut-off valves where indicated on the drawings and required by the code including valves at all fixture groups, and equipment.

E. Install drain valves at low points of all new water piping except buried piping.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation, trenching and backfilling for work under Division 22. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be re moved and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done.

B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface for pipe.

C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.

D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of 12 inches above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the modified Proctor test method of compaction.

3.04 TESTS OF PIPING

A. Install temporary connections and plugs or valves at all points necessary for venting air from the piping, filling, holding test pressure, draining and flushing the piping.

B. Test all new pressure piping roughing hydrostatically to show zero leakage in eight (8) hours at the following pressures measured at the low points: Domestic water (C.W., H.W. and H.W.R.), 125 psi.

3.05 FLUSHING AND STERILIZING

A. Flush all new water piping after pressure tests and repairs are completed by draining from the low points; refill with clean water.

B. Sterilize the above ground water piping after fixtures and equipment are installed with 50 ppm chlorine solution distributed throughout all C.W. and H.W. piping; let stand for 24 hours, then flush enough water at drinking fountains and lavatories to reduce the residual chlorine content to less than one (1) ppm. Domestic water heater shall have the heat source shut off while sterilization is in progress.

C. Furnish three copies of a Certificate of Performance of Complete Sterilization to the Architect before final inspection of the work, all certified by a registered chemical engineer.

3.06 WATER TESTS

A. The Contractor shall have representative water samples from the fixtures tested by the local Health Department or a laboratory approved by the Health Department. If the tests do not indicate potable water, the sterilizing procedure and the test shall be repeated. Submit test report to the Architect.

3.07 START-UP, ADJUSTMENT, INSTRUCTIONS

A. Start-up, lubricate, adjust and test equipment installed under this Section and furnish instructions to the Owner as specified in the General Requirements Section.

3.08 OPERATIONAL TESTS

A. When installation and adjustment of all fixtures and equipment is complete, perform operational tests of all plumbing system components at normal operating pressures as specified under the General Requirements Section and include the following tests:

1. Operate all manual and automatic valves at least one full open-closed cycle; examine for stem leakage, failure to close or other malfunction.

END OF SECTION

SECTION 22 13 00 FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section of the Specifications and related drawings describe requirements pertaining to the sanitary sewerage piping and drainage accessories.

B. Refer to the following sections for related work:

1. 22 05 29 Hangers and Supports for Plumbing Piping and Equipment
2. 22 05 53 Identification for Plumbing Piping and Equipment

1.02 RECORD DOCUMENTS

A. Provide corrected Record Documents in accordance with the Project Record Documents Sections and the Mechanical General Section.

1.03 GENERAL PROVISIONS AND BASIC MATERIALS

A. The requirements of the General Requirements Division 01 apply to this work.

1.04 QUALITY ASSURANCE

A. Manufacturing firms shall be regularly engaged in the manufacture of plumbing products of type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Subject to compliance with requirements, provide drains, cleanouts & drainage accessories of one of the following manufacturers:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Wade Div., Tyler Pipe
4. Zurn Industries, Hydromechanics Div.

1.05 CODE

A. The work shall comply with the International Plumbing Code; acceptability under the codes shall not authorize any substitution, smaller size, lighter weight or less durable materials for the items specified.

B. The Contractor shall obtain and pay for all required permits and inspections and shall deliver one copy of each inspection certificate to the Architect before the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS FOR DRAINAGE SYSTEMS

A. Aboveground piping all within building: Service weight (SV) No-hub cast iron soil pipe and fittings manufactured in compliance with CISPI 301 and certified by NSF. Heavy duty couplings shall be “husky” heavy duty couplings in compliance with ASTM C1543, with neoprene gaskets in compliance with ASTM C564. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

B. Underground building drain piping: Service weight (SV) cast iron hub and spigot soil pipe and fittings, ASTM A-74 with neoprene compression gasket, joints, ASTM C-564.

C. Condensate Drain Piping: Type DWV copper pipe with tin-antimony soldered joints and drainage fittings.

D. All traps shall have brass cleanout plug except where buried.

2.02 ROOF FLASHING

A. Vent pipes passing through roof shall be flashed with a one piece pipe flashing unit constructed of E.P.D.M. rubber with an aluminum reinforcing ring suitable for a temperature range of -25°F to 250°F as manufactured by Butler Manufacturing Company or approved equal. Flashing to be installed in accordance with metal building manufacturer recommendations. Vents shall offset in roof joist area or ceiling cavity if necessary so that no vent shall be closer than 4'-0" from outside wall line.

2.03 DRAINAGE ACCESSORIES

A. Provide factory fabricated drainage piping products of the size and type as indicated on drawings, including features as specified herein. Where not indicated, provide proper selection as determined by installer to comply with installation requirements and governing regulations.

B. Floor drains shall be provided with trap primer connections where indicated on drawings.

C. All floor drains without trap primers shall be provided with deep seal "P" traps.

D. All floor drains and floor sinks located on elevated floors shall be provided with seepage holes and flashing collar or clamping rings to provide for leak proof installation.

2.04 CLEANOUTS

A. Vertical and horizontal lines exposed - Test Tee – Smith 4510.

B. Vertical lines concealed – Smith 4472 with stainless steel access cover.

C. Horizontal lines under unfinished floors – Smith 4405.

D. Finished floors – Smith 4023 cast iron adjustable floor level cleanout assembly with round polished bronze top.

E. Finished Floors - Linoleum, Terrazzo or Tile – Smith 4143 cast iron adjustable floor level cleanout assembly with round polished bronze top. Top depression to be covered with surrounding floor pattern bonded with waterproof adhesive.

F. All lines outside of building - Smith 4400.

G. Finished floors - Carpet Smith 4023-Y cast iron adjustable floor level cleanout assembly with nickel bronze top and 1-1/2 inch diameter stainless steel carpet marker. Carpet shall cover top of cleanout with carpet marker exposed above carpet to serve as cleanout locator.

2.05 BASIC PIPING SPECIALTIES

A. Pipe Sleeves:

1. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, equipment and devices furnished under each section of the Specification.
2. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
3. Where pipes pass through floor slabs, sleeve shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
4. Each pipe passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.
5. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
6. All penetrations through rated floors shall be packed with mineral wool and capped off with a silicon caulk. As an alternate, an approved, fire rated sealant as manufactured by 3M or Hilti may be used.
7. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
8. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to ¾ inch diameter, and permitting lateral adjustment.

B. Floor, Wall and Ceiling Plates:

1. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
2. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
3. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide pipe hangers and supports in accordance with Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment".

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install soil and vent piping pitched to drain at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inches and smaller, and 1/8 inch per foot (1 percent) for piping 4 inches and larger.

B. Install piping and make all joints in accordance with the pipe manufacturer's recommendations. Make provisions for thermal expansion and contraction.

C. Install cleanouts on drainage piping where indicated on the drawings and as required by the code, and at every change in direction of more than 45 degrees in horizontal piping. Locate wall cleanouts as low as possible but high enough for the cover plate to clear the base. Locate test tees where necessary to separate sections of piping for testing.

D. Rough-in for fixtures in accordance with the fixture manufacturer's roughing-in drawings to provide the heights and locations indicated on the Architectural drawings or as specified.

E. Set floor cleanouts so that the top rims are level and flush with the finished floor surface and so that square and rectangular tops are parallel to the walls, unless otherwise noted.

F. Install piping and pipe supports as specified. Keep pipe ends closed except for vent and drain openings; protect vent and drains from the entrance of materials that could cause stoppage.

G. Vents shall terminate at 1'-0" above roof.

3.02 EXCAVATION, TRENCHING AND BACKFILLING

A. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be re moved and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done.

B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface for pipe.

C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.

D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of 12 inches above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the modified Proctor test method of compaction.

3.03 TESTS OF PIPING

A. Install temporary connections and plugs or valves at all points necessary for venting air from the piping, filling, holding test pressure, draining and flushing the piping.

B. Test all new soil, waste and vent piping under 10 feet head of water (except for the uppermost 10 feet) as required by the Plumbing Code, with zero leakage allowed. The test pressure shall be maintained for at least 30 minutes before inspection starts and maintained for the time necessary to inspect all joints but not less than 15 minutes.

3.04 OPERATIONAL TESTS

A. When installation and adjustment of all fixtures and equipment is complete, perform operational tests of all plumbing system components at normal operating pressures include the following tests:

1. Pour at least five (5) gallons of water into every floor drain to test for pipe stoppage.

B. All floor drain strainers shall be securely fastened to drain body.

C. During construction drains shall be kept covered so that traps, sediment buckets and dome type strainers are kept free from debris and trash.

END OF SECTION

SECTION 22 33 00 ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All work specified in this section is subject to the provisions of General Provisions Division 01.

B. Refer to the following sections for related work in connection with electric water heaters:

1.	22 05 29	Hangers and Supports for Plumbing Piping and Equipment
2.	22 05 53	Identification for Plumbing Piping and Equipment
3.	22 11 13	Facility Water Distribution Piping

1.02 DESCRIPTION OF WORK

A. The number and size of the electric water heaters are indicated on the drawings and schedules.

1.03 QUALITY ASSURANCE

A. Manufacturing firms shall be regularly engaged in the manufacture of electric water heaters of type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Provide water heaters which comply with ASHRAE 90.1b-1992 for energy efficiency.

C. U.L. and NEMA Compliances - Provide electrical components required as part of electric water heaters, which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.

D. NEC Compliance - Comply with the National Electric Code as applicable to installation and electrical connections of ancillary electrical components of electric water heaters.

1.04 SUBMITTALS

A. Product Data - Submit manufacturer's plumbing equipment specifications, installation and start-up instructions.

B. Shop Drawings - Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

C. Wiring Diagrams - Submit ladder type wiring/diagrams for all components, clearly indicating all required field electrical connections.

D. Maintenance Data - Submit maintenance data and parts lists for each item of accessory equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.01 GENERAL

A. Electric water heaters shall be of same manufacturer. Refer to schedule for heater sizes, capacities, electrical characteristics and element operation.

2.02 ELECTRICAL STORAGE TYPE WATER HEATERS

A. Tank Materials - Tank shall be welded steel construction, 150 psi working pressure.

B. Lining - All interior tank surfaces shall be glass lined.

C. Elements - Electric heating elements shall be low watt density with zinc plated copper sheath.

D. Enclosure - Heater shall be factory insulated and provided with steel enclosure with baked enamel finish.

E. Controls - Adjustable thermostat, high temperature cut off and low water cut off.

F. Accessories - Provide the following water heater accessories:

1. Magnesium anode
2. ASME combination temperature and pressure relief valve.
3. Brass tank blowdown drain valve.
4. Thermometer
5. Automatic air vent
6. Watts No. 530 adjustable bleeder pressure relief valve.

G. Warranty - Furnish three (3) year limited warranty for tank leakage.

H. Manufacturer - Provide water heaters meeting specification requirements of one of the following manufacturers:

1. A.O. Smith
2. Lochinvar
3. Rheem
4. Ruud
5. State Industries

2.03 ELECTRIC INSTANTANEOUS HEATER

A. Electric instantaneous point of use water heater shall have cast aluminum alloy housing, with heating coils to be flow switch operated.

B. Provide flow control fitting at inlet of heater. Provide ball valve at inlet and outlet of heater.

C. Instantaneous heater shall be equal to Stiebel Eltron, Eemax, or Chronomite.

PART 3 - EXECUTION

3.01 INSTALLATION OF WATER HEATERS

A. Install water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Connections - Make connections between water heaters and domestic water piping shutoff valves with unions or flanges as indicated. Provide dielectric isolation at all tank connections.

C. Pipe heater drain and relief valve drain, full size to floor drain.

D. Install bleeder pressure relief valve in tank drain line, set 25 psi below relief valve setting.

E. Where water heaters are indicated to be suspended above floor either above or below ceiling install heaters as detailed on drawings. Provide all necessary hanger rods, bolts, plates and miscellaneous steel as required.

F. Drain Pans - Provide drain pans constructed of 20 gauge galvanized sheet metal for all water heaters suspended above finished floor. Provide a minimum 1 inch drain from bottom of pan to nearest floor drain.

G. Identification - Provide sign securely attached to water heater identifying equipment number, service and capacity. Provide identification on all piping connections to water heaters.

H. Testing - Upon completion of installation, pressure test water heaters hydrostatically to assure structural integrity and freedom from leaks.

I. Disinfection and Flushing - Disinfect in accordance with potable water piping requirements and flush water heaters upon completion of installation in accordance with manufacturer's instructions, and comply with applicable health codes.

END OF SECTION

SECTION 22 42 00 COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of plumbing fixtures and trim work is indicated by drawings and schedules, and by requirements of this section.

B. Refer to Division-26 sections for electrical connections to water coolers and other plumbing fixtures; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturing: Firms shall be regularly engaged in the manufacturing of plumbing fixtures of the type, style and configuration required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Comply with applicable portions of the Plumbing Code, latest edition, pertaining to materials and installation of plumbing fixtures.

C. Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bathtub units.

D. Comply with ANSI A117.1 standard and the Americans with Disabilities Act (ADA) pertaining to plumbing fixtures for handicapped.

E. Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

F. Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.

G. Provide water coolers which are rated and certified in accordance with applicable Air Conditioning and Refrigeration Institute standards and are listed by Underwriter's Laboratories.

1.04 SUBMITTALS

A. Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers, and installation instructions.

B. Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in maintenance manual.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

C. Fixtures shall be protected after installation to prevent scratches, dents, surface mar or any other damage during the course of construction.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

A. Provide factory-fabricated fixtures of type, style and material scheduled on drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

B. Fixture color shall be white unless noted otherwise.

2.02 MATERIALS

A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

B. Include removable P-traps where drains are indicated for direct connection to drainage system.

C. Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

D. Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast-brass escutcheons with set screw.

E. Provide aerators on all faucet sets of types approved by Health Departments having jurisdiction.

F. Comply with additional fixture requirements contained in fixture schedule.

2.04 MANUFACTURERS

A. Subject to compliance with requirements, provide plumbing fixtures and trim of one of the following:

1. Plumbing Fixtures
   a. American Standard, U.S. Plumbing Products
   b. Eljer Plumbing-ware Division, Wallace-Murray Corporation
   c. Kohler Company
   d. Zurn Industries
2. Plumbing Trim
   a. American Standard, U.S. Plumbing Products
   b. Eljer Plumbing-ware Division, Wallace-Murray Corporation
   c. Kohler Company
   d. Zurn Industries
   e. T & S Brass and Bronze Works, Inc.
   f. Eastman Brasscraft
   g. McGuire Manufacturing Co.
3. Flush Valves
   a. Coyne & Delaney Company
   b. Sloan Valve Company
   c. Zurn Industries, Inc., Hydromechanics Div.
4. Fixture Seats
   a. Bemis Mfg. Co.
   b. Beneke Corp., Div. of Beatrice Foods
   c. Church
   d. Olsonite Corp., Olsonite Seats
5. Water Coolers
   a. Oasis
   b. Elkay Mfg. Co.
   c. Halsey Taylor Div.
   d. Haws Drinking Faucet Co.
6. Service Sinks/Mop Sinks
   a. American Standard, U.S. Plumbing Products
   b. Eljer Plumbing-ware Div., Wallace-Murray Corp.
   c. Fiat Products, Unit of Mark Control Corp.
   d. Kohler Co.
   e. Stern-Williams Co., Inc.
7. Stainless Steel Sinks
   a. American Standard, U.S. Plumbing Products
   b. Elkay Mfg. Co.
   c. Just Mfg. Co.
   4. Kohler Co.
8. Fixture Carriers
   a. Josam Mfg. Co.
   b. J.R. Smith
   c. Wade
   d. Zurn Industries, Inc., Hydromechanics Div.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Where fixtures are mounted against or abut walls, caulk along fixture.

3.02 CLEAN AND PROTECT

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match shall be judged by Architect. Remove cracked or dented units and replace with new units.

3.04 EXTRA STOCK

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one (1) device for every ten (10) units.

END OF SECTION

SECTION 23 05 10 HVAC GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete air conditioning, ventilating, and heating systems as specified herein and as shown on the drawings.

B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary and other conditions) and other divisions as appropriately apply to work specified in this division.

1.02 CODES, ORDINANCES, AND PERMITS

A. All heating, ventilating and air conditioning materials and workmanship shall comply with the following codes and standards as applicable:

1. The National Electric Code (2005 Edition)
2. The International Fuel Gas Code (2006 Edition)
3. The International Building Code (2006 Edition)
4. The International Mechanical Code (2006 Edition)
5. City of Lyman, MS Heating, Ventilation and Air Conditioning Code.

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

1. Air Conditioning and Refrigeration Institute Standards (ARI)
2. American National Standards Institute, Inc. Standards (ANSI)
3. American Society for Testing and Materials Publications (ASTM)
4. American Gas Association Inc. Laboratories (AGA)
5. American Society of Mechanical Engineers Code (ASME)
6. Factory Mutual Underwriters (FM)
7. National Fire Protection Association Standard (NFPA)
8. Sheet Metal and Air Conditioning Contractor's National Association Inc. (SMACNA)
9. Underwriters Laboratories Inc. (UL)

C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be used made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.

D. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.

E. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

1.03 APPLICABILITY: The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the mechanical systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

1.04 TEMPORARY HVAC

A. New HVAC equipment, i.e. air handling units, fans, roof top units, etc. shall not be placed into service until the facility has been turned over to the Owner. All HVAC equipment warranties shall start on the day of the Owner's acceptance of the facility.

NOTE: The temporary use of the building HVAC systems during the construction period SHALL NOT be permitted with the following exceptions:

1. HVAC systems may be placed in operation only when temperature and humidity control is critical for the installation of final finishes, i.e. interior painting, lay-in ceilings, hardwood floors, paneling, etc. All air systems must be equipped with heavy duty, high efficiency air filters. Each air system shall be checked on a daily basis to determine the filter status. Refer to Section 23 41 00 "Particulate Air Filtration" and air handling equipment schedules in these documents for filter types, sizes and capacities.
2. HVAC systems must be operational during the time required for the TAB Sub-contractor to do the final testing, adjusting and balancing.

The above exceptions shall be permitted only at a point in time when the building has been cleared of all debris and swept clean and all air systems are fitted with high quality, construction grade air filters. The Architect and/or Engineer shall also be notified of any and all temporary use of the HVAC systems and shall be documented by the General Contractor. NO EXCEPTIONS.

NOTE: HVAC systems SHALL NOT be in operation when sheet rock sanding is being performed.

B. If space conditioning is required before the above conditions are satisfied, such space conditioning shall be the responsibility of the Contractor. If the Contractor elects to utilize the permanently installed building HVAC systems to provide the space conditioning, it shall be the responsibility of the General Contractor to ensure that the required warranty periods for all equipment provided are effective from the date of acceptance of the project.

1.05 COORDINATION OF HVAC DOCUMENTS: The HVAC work listed in these documents shall be coordinated with the work indicated on all other drawings, schedules, schematics, and specifications that are part of these construction documents. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

1.06 WELDERS QUALITY ASSURANCE: All welders shall be certified by ANSI B31.1.0-1967 “Standard Qualification Welding Procedures, Welders and Welding Operators” or Qualification Tests” in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder’s qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder’s identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

PART 2 - PRODUCTS

2.01 COORDINATION OF PRODUCTS

A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

2.02 DESCRIPTION

A. All components of the mechanical systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter’s Laboratories, Inc. (UL) label.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall provide and prepare all openings for ducts and other HVAC work as required in walls, roof, ceilings, etc.; he shall also do all painting as may be required. He shall coordinate the installation of all mechanical equipment in the exterior wall and roof.

B. The HVAC plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.

C. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.

D. The Contractor is responsible for the proper location and size of all slots, holes or openings, in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.

E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interference shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. For example sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

F. Except where otherwise noted, all piping and ductwork in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes and ducts shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

G. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this contract. All control wiring shall be by the Controls Contractor.

H. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panel-boards, power panels, motor control centers, or dry type transformers:

1. Within 42 inches in front (and rear if free standing) of equipment; or
2. Within 36 inches of sides of equipment,
3. Clearances apply vertically from floor to structure.
4. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

3.02 ELECTRICAL WORK:

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

3.03 PROTECTION OF EQUIPMENT

A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation and wind.

B. Protect air handling units coil by use of protective sheet metal panels or plywood.

C. Plug ends of pipe when work is stopped and close ends of ducts with plastic taped in place until work resumes.

D. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

3.04 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All un-insulated black ferrous metal items exposed to sight inside the building, such as piping, equipment hangers and supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibitor primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. Black ferrous metal items exposed outside the building, such as un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. In lieu of painting hanger rods, cadmium plated or galvanized rods may be furnished.

E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.

F. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.

G. All ductwork, piping, insulation, conduit or other appurtenances visible from finished spaces through grilles, diffusers or other such required openings shall be painted flat black.

3.05 PROTECTION OF EXISTING UTILITIES

A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.

B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

3.06 CUTTING AND PATCHING

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. All surfaces shall be patched to the condition of the adjacent surfaces.

C. The Contractor shall make suitable provisions for adequately water-proofing at his floor penetrations of water proof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, clean-outs, and sleeves for the various piping. This

also applies to membrane roofing systems.

3.07 SLEEVES, FLOOR AND CEILING PLATES

A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all pipe, duct, equipment and devices furnished under each section of the Specification.

B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.

C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.

D. Each pipe or duct passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes or ducts.

E. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.

F. All penetrations through rated walls and floors shall be packed, sealed and encapsulated per the applicable U.L. details(s).

G. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.

H. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4 inch diameter, and permitting lateral adjustment.

3.08 ESCUTCHEONS

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.09 CLEANING

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging

with water.

B. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

C. The exterior surfaces of all mechanical equipment, piping, ducts, etc., shall be cleaned of all grease, oil, paint, dust and other construction debris.

D. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

E. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

F. Equipment rooms shall be left broom clean.

G. Any fans operated during construction shall have temporary filters. Temporary filters shall be changed regularly to prevent contamination of the equipment and duct systems. Permanent filter shall be installed prior to final inspection.

H. End of open ducts and pipes shall be covered during construction except when working directly on such one prohibits covering. Cover with minimum four (4) mil thick polyethylene taped, tied or wired in place.

I. Clean and polish identification plates.

3.10 EQUIPMENT, MATERIALS AND BID BASIS

A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products will be considered and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect, he shall furnish descriptive catalog material, text data, samples, etc., as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect. Refer to Section 01 62 14.

B. The use of one named manufacturer in the schedules on the Drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

3.11 GUARANTEE

A. All systems and components shall be provided with a minimum of one year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement

without incurring additions to the Contract.

B. All air conditioning compressors shall be guaranteed for an additional four years. This additional guarantee shall be non-prorated on all parts, refrigerant, and labor.

3.12 FOUNDATIONS

A. All concrete foundations required by equipment furnished under the HVAC Division shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed. Unless otherwise noted, foundations shall be six inches (6") high. All concrete work performed shall conform entirely to the requirements of the General Specifications that describe this class of work.

3.13 RECORDS AND INSTRUCTIONS FOR OWNER

A. The Contractor shall accumulate during the job's progress the following data in triplicate prepared in neat brochures or packet folders and turned over to the Architect/Engineer for check and subsequent delivery to the Owner:

1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.
2. Provide approved fixture brochures, wiring diagrams, and control diagrams.
3. Provide copies of approved shop drawings.
4. Three sets of operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended periodic maintenance and seasonal changeover procedures, and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
5. Any and all other data and/or drawings required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. Valve tag charts and diagrams specified elsewhere herein.

B. All of the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor asks for his last estimate prior to his final estimate, but in no case, less than two weeks before final inspection.

C. The Contractor shall also give operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in paragraph above shall be used as a basis for this on-the-job instruction. Refer to Section 01 79 00 “Demonstration & Training”.

D. A competent technician employed by the Temperature Control Subcontractor shall be required to instruct the Owner in proper operating procedures and shall explain the

significance of the temperature control literature filed in the maintenance manual while the system is in continuous operation as specified above. Refer to Section 01 79 00 “Demonstration & Training”.

3.14 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work the Contractor shall purchase from the Architect a set of mylar sepia prints to be used for the "Record Drawings".

B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS – “3/8" high letters to be used for recording field deviations, and "5/16" high letters to be used for dimensional data only.

3.15 INSTALLATION: All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

3.16 VALVE CHART AND LABELS: Contractors shall prepare and install in suitable glazed frame typewritten valve charts giving the number, location and function of each line valve installed under this contract. They shall also install on each valve stem a stamped one and one-half inch (1-1/2") diameter brass tag plainly numbered corresponding to the number indicated on the above chart. Tags shall be secured to valves by heavy figure eight hooks.

3.17 ACCESS DOORS

A. Furnish and install access doors at each point required to provide access to concealed valves, clean-outs, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.

C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor to be installed.

D. Access doors shall be MILCOR or approved equal in accordance with the following:

1. Style AT Door for Acoustical Tile Ceilings
2. Style AP Door for Acoustical Plaster Ceilings
3. Style K Door for Plastered Wall and Ceiling Surfaces
4. Style DW Door for Drywall
5. Style ATR for Suspended Drywall Ceilings

6. Style M Door for Masonry, Ceramic Tile, Etc.
7. Fire-Rated 1-1/2 hr. (B-label) Door where required.

E. Size and type shall be as required for proper service and/or as may be directed by the Architect.

F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

3.18 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)

B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

3.19 EQUIPMENT FURNISHED BY OWNER

A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the owner for installation by the contractor.

B. The contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

3.20 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in specification Division 23. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

END OF SECTION

SECTION 23 05 11 HVAC SUBMITTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 01 Sections and Section 23 05 10 HVAC General Requirements, apply to all work herein.

1.02 QUALITY ASSURANCE

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit to the Architect a sufficient number of copies of all such Shop Drawings or catalog data to provide him with as many reviewed copies as he may need, plus five (5) copies for retention; one by the Architect, one by the Engineer, one by the commissioning agent, one by the MDOT Architect and one by the Project Engineer.

B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

C. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.

E. Reproduction of design documents in any portion for use in a submittal is not acceptable.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

PART 3 - EXECUTION

3.01 SUBMITTAL DATA

A. General

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.
2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 23, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.
3. HVAC submittal data shall be bound into separate 3-ring binders, Each HVAC volume shall contain one copy of all specified equipment/shop drawing submittals. Each binder shall be provided with an index of materials and an identification tab for each Specification Section that requires submittals. Each item in each tabbed section shall be identified with the paragraph number relating to the item submitted. FAILURE to provide BOUND AND IDENTIFIED SUBMITTALS will result in the AUTOMATIC REJECTION of the submittal data with NO EXCEPTION.

B. The bound submittals are to be submitted for review within 30 days after the Contract is awarded. No submittal will be checked until ALL required submittals have been received by the Engineer. Only Automatic Temperature Controls, ductwork and piping fabrication drawings may be submitted after the completed bound submittal is reviewed and accepted by the Engineer.

C. The Contractor shall submit with the bound and identified submittal data a letter signed by the Contractor's Project Manager (or higher level officer of the firm) stating that all

electrical characteristics of the mechanical equipment to be supplied has been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

1. Air Conditioning Units with fan, filter and coil data
2. Air Handling Units (AHU)
3. Automatic Temperature Controls
4. Cleanouts
5. Coils
6. Condensers/ Condensing Units
7. Disconnect Switches
8. Ductwork Accessories and Details
9. Energy Management System
10. Evaporators
11. Fans
12. Grilles, Registers and Diffusers
13. Heaters
14. Heating and Ventilating Units
15. Insulation
16. Motor Starters
17. Plumbing Fixtures, Carriers and Fittings
18. Piping Specialties
19. Refrigerant Piping Diagrams and Layouts
20. Starters
21. Test, Adjusting and Balancing Reports and Forms
22. Valves
23. Variable Air Volume Units (VAV)
24. Variable Speed Drive Controllers
25. Vibration Isolators (to be submitted with equipment being isolated)
26. Valve Tag Schedule

D. The Contractor shall submit three copies of a letter, signed by an officer of the company, which states that the items listed below meet or exceed the criterion of the plans and specifications. This letter is to include a listing of each item to be used on the project along with the manufacturer name and model numbers.

1. Flexible Duct
2. Flexible Connectors
3. Ductwork Access Doors and Panels
4. Filters
5. Dampers
6. Cleanouts
7. Drains
8. Pipe Hangers and Supports

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Description

1. Complete operating and maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall

be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instruction shall be included for each piece of equipment. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.

2. A system wiring and control diagram shall be included in the operating and maintenance instruction.
3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the Owner in the operation of all systems. This instruction shall include a complete walk-through of all equipment and systems. The Architect reserves the right to attend any such meeting and shall be duly notified. Coordinate with commissioning requirements.

3.03 OTHER SUBMITTALS – CLOSEOUT

A. Submit two copies of the following prior to occupancy of the project by the Owner. See Section 01 77 00 “Closeout Procedures”

1. As built drawings for ductwork, HVAC piping, plumbing and fire protection systems.
2. Request for final payment.
3. Letter or “Release of Liens”.
4. Letter of “Guarantee”.
5. Submit two (2) copies of welder’s certificate.
6. Consent of Surety Company to final payment.
7. Certify disinfection of domestic water service.
8. Power of Attorney.
9. Manufacturer's representative shall certify that HVAC equipment and valves are installed in accordance with the manufacturer's recommendations.
10. Contractor’s Affidavit of Payment of Debts and Claims.

END OF SECTION

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. All electrical work specified in this section shall comply with the provisions of Division 26. All mechanical work specified shall be in accordance with Division 23.

B. All motors shall be provided as noted herein.

C. A motor starter shall be provided under this section for each motor including package units which shall be furnished with integral starters. Motor starters shall be installed either in a motor control center or separately mounted adjacent to the motor served as shown, indicated and/or required. Motor starters not provided in the motor control center under Electrical Specifications Division 26, shall be provided.

D. Motor power wiring is defined as those conductors between the energy source and the motor. This power wiring shall be terminated at motor terminals and will be provided under Division 26 work.

E. All control wiring required for automatic starting and stopping of motors shall be provided under this Division unless specifically shown on the electrical drawings.

F. Power wiring will be connected through all line voltage control devices such as firestats and thermostats by Division 26 work.

G. Smoke detectors by Division 26.

H. System power wiring to be under Division 26.

PART 2 - PRODUCTS

2.01 STARTERS

A. The Mechanical Contractor shall provide for each and every motor that is a part of his equipment, a properly sized motor starter. This includes, but is not limited to the following: Air handling unit motors, system controls, variable speed control devices, pilot lights, push button controls, etc., and shall be furnished complete as a part of the motor apparatus which it operates. All components shall be in conformance with the requirements of the National Electrical Codes (NEC) and Division 26 of this specification. Starters for fractional horsepower motors shall be furnished and installed under Division 26 and as noted herein.

B. All motor starters shall be turned over to the Electrical Contractor for installation with the following exceptions:

1. Starters for all motors that are 1/2 horsepower and smaller and are 120 volts, single phase shall be provided and installed by the Electrical Contractor.
2. Motor starters and motor control devices will be furnished and installed in Division 26 where motor control centers are provided by the Electrical Contractor.

C. Manual operated motor with magnetic controllers shall be pushbutton type. All automatic controlled motors shall have automatic (H.O.A.) switches. All magnetic starters shall have red and green pilot lights on cover. Power wiring and control circuits shall be run in rigid conduit and shall conform to the NEC standards.

D. All poly-phase motors and all motors that are automatically controlled shall be furnished with magnetic starters, full voltage, non-reversing type, complete with necessary auxiliary contacts for controls unless otherwise noted. Heaters shall be of the melting alloy type, sized to the exact nameplate running current of the motor. Overloads shall have visual trip indicators and shall be trip-free with reset button held in. All magnetic motor starters or controllers shall be equipped with one overload element in each phase. All starters for 3-phase motors, 3hp/3kw and larger, shall include protection against loss of any one phase or phase reversal and voltage fluctuations.

E. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single speed, unless otherwise indicated.

F. Each starter for a three-phase motor shall be combination magnetic type with circuit breaker and shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external “RESET” button or “HAND-OFF-AUTO” selector switch as scheduled with red “RUNNING” light. Provide a green pilot light to indicate motor “STOPPED”. Each pilot light shall have a legend plate indicating reason for signal.

G. Each overload relay shall have normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a “TRIPPED” legend plate.

H. Provide two sets each of normally open and normally closed auxiliary contacts for all magnetic starters. See equipment schedules on plans for voltage requirements.

I. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. Each starter shall have a laminated nameplate to indicate Division 23 unit number, function and circuit number. Outdoor starters shall be rain-tight weatherproof.

J. All motor starters, push buttons and pilot lights shall be of the same manufacture as the switchboard.

K. Combination Starters: Combination starters shall consist of a circuit breaker and a motor starter mounted in a common NEMA Type 1 general purpose enclosure. The circuit breaker component shall be a minimum 22,000 RMS interrupting capacity and shall be as required in the Electrical Division.

2.03 MOTORS

A. Unless specifically noted otherwise in other sections of this Specification, all motors and motor controllers shall meet the requirements specified in this Section. All motors shall be built in accordance with the current applicable IEEE and NEMA standards, and shall have voltage, phase, frequency and service as scheduled.

B. Each motor shall be suitable for the brake horsepower of the driven unit, rated with 1.15 minimum service factor and shall be NEMA design B. The motor temperature rise shall not exceed 104 degrees F. for drip proof motors, 122 degrees F. for splash proof motors and 131 degrees F for totally enclosed or explosion proof motors. The motor shall be capable of operating continuously at such temperature rises, and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating.

C. Each item of motor driven equipment shall be furnished complete with the motors and drives as required to perform the specific function for which it is intended, scheduled, and specified.

D. Motors shall be ball bearing type selected for quiet operation and shall be manufactured for general purpose duty unless otherwise indicated. Each bearing shall be accessible for lubrication and designed for the load imposed by the V-belt drive or the driven apparatus. Direct drive motors shall be designed for the specific application with all necessary thrust bearings, shaft capacities, etc.

E. Motors larger than 1/2 horsepower shall have bearings with pressure grease lubrications fittings.

F. Motors connected to drive equipment by belt shall be furnished with adjustable slide rail bases except for fractional horsepower motors, which shall have slotted bases. Motor leads shall be permanently identified and supplied with connectors.

G. Each motor to be installed outdoors shall be of the totally enclosed fan-cooled type, or housed in a weatherproof housing.

H. Unless otherwise indicated, motors smaller than 1/2 horsepower shall be capacitor start or split phase type designed for 120 volt, single phase, 60 cycle alternating current. Shaded pole motors are not acceptable except 35 watts and smaller. Motors 1/2 horsepower and larger shall be squirrel cage induction type, 3 phase, 60 cycle alternating current.

I. Multi-speed motors shall, except as noted, be consequent pole, variable torque, single winding. When the speed ratios or the load characteristic dictates, the multi-speed motors shall be separate winding types. Variable speed motors operating over an adjustable range of speeds shall be motors specifically designed and rated for this duty.

J. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Architect of the change and shall then coordinate the change and shall pay all additional charges in connection with the change.

2.04 IONIZATION SMOKE DETECTORS

A. Provide and install ionization smoke detectors in all air handling units. Detectors are to be installed in both the supply and return air duct connections at each unit. Detectors are to

be installed by the Mechanical Contractor and furnished and wired by the Electrical Contractor in Division 26.

B. Detectors shall de-energize air systems when and if particles of combustion are detected in the air stream. Detectors shall be fitted with sampling tubes that are sized to fit duct widths. Provide a manual reset switch and interlock with the building fire alarm system if such exists.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide control wiring and install all motor starters, unless integrally factory mounted on a piece of equipment.

B. Provide control wiring to all motors except packaged units that are prewired between the starter and motor.

C. Where line voltage control devices are mounted at or inside a unit, such as aquastats, firestats for single phase devices, etc., the power wiring to the unit shall be connected through such a control device by the work of Division 26.

D. On final inspection, it shall be demonstrated to the Engineer or his representative that each overload relay control circuit is properly wired and functioning correctly by manually tripping each overload relay individually, one at a time. This inspection procedure shall not involve removal of any wiring or disconnecting any current carrying parts.

E. Standard minimum one-year warranty on all electrical equipment provided herein shall apply.

3.02 ELECTRICAL WORK

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

B. All power wiring and final power connections to the system shall be provided under Division 26.

C. Control wiring (120V. and less) shall be provided under Division 23 and extended from the 120V power circuits indicated on the Electrical Drawings. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

D. All electrical characteristics shall be taken from the Electrical Drawings and Specifications and coordinated before equipment is ordered or submitted.

END OF SECTION

SECTION 23 05 15 DESIGN CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The requirements of the General Conditions, Supplementary conditions, and Section 22 05 10, “Plumbing General Requirements” and Section 23 05 10 ”HVAC General Requirements” apply to all work herein.

PART 2 - DESIGN CONDITIONS

2.01 DESIGN CONDITIONS

A. Outside conditions are as follows:

	Dry Bulb Deg. F.	Wet Bulb Deg. F.
Summer Outside Air Temperature	91	80
Winter Outside Air Temperature	30	

B. The indoor design condition for cooling is 72 deg. F. dry bulb/50% relative humidity.
C. The indoor design condition for heating is 72 deg. F. dry bulb.

D. Range of indoor design goals for HVAC sound control:

1. All occupied space shall have a Noise Criterion (NC) curve range not to exceed NC 30.

E. Building envelope design criteria - these values are repeated here to alert the General Contractor to the properties of materials used in the calculation of heating and cooling loads for this project. It shall be the responsibility of the General contractor to notify the Architect and Engineer if materials with properties other than those stated below are used in the construction of this project:

1. Typical vision glass shading coefficient - .030
2. Typical vision glass "U" values – 0.26
3. Insulated exterior walls transmission U Value .039 (F deg.)(sq.ft.)
4. Roof heat transmission U Value 0.047 (F. deg.)(sq. ft.)

2.02 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

B. Temperature/pressure rating of all components shall meet or exceed design conditions for the system in which they are installed. All components shall be designed for operating conditions of not less than:

	System	Working Pressure PSIG	Temperature Range
1.	Sanitary, Waste & Vent	Atmosphere	Ambient
2.	Domestic Cold Water	150	120ºF
3.	Domestic Hot Water	150	140ºF
4.	Domestic Hot Water	150	140ºF
5.	All Remaining Service	125	200ºF

PART 3 – EXECUTION

3.01 PRESSURE TESTING / RECORDING

A. All pressure tests shall be observed by the Engineer. He may delegate others, i.e. Architect, General Contractor, Clerk of Works, etc., to observe tests in his absence. Said tests and time duration shall be recorded and posted onto the pipe segments as indicated on the project set of construction documents.

END OF SECTION

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.

B. "C" CLAMPS may be used as point of attachment to building structure for pipe hangers and/or all-thread rods; however, piping shall not be supported directly by “C” clamps.

C. Do not pierce waterproofing with support bolts.

D. All ferrous metal hangers and supports, not otherwise coated, shall be provided with a field-applied coat of zinc chromate primer prior to any installation. In lieu of field painting, the contractor may furnish cadmium plated, or galvanized hangers and supports.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions, and - Section 23 05 10, ”HVAC General Requirements” apply to work of this section.

B. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

1.03 QUALITY ASSURANCE

A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.

B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories. Submit fastening methods to the Structural Engineer for approval and as approved copy to the engineer.

C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel straps are not acceptable.

D. For the purpose of this specification, Anvil product figure numbers are given. Equal products by B-Line and Michigan Hanger Co. (M-Co) are acceptable.

1.04 DESIGN

A. Supporting steel not shown for the equipment will be designed, supplied and erected by the Contractor; the supporting steel is that steel which is connected to the structural steel shown on the drawings and carries the weight of the mechanical items. This supporting steel design must carry the dead weight and dynamic load imposed by the equipment, piping and other mechanical components.

B. The supporting steel shall be connected to the structural steel in such a manner as not to overload the structural steel. It is the responsibility of the General Contractor, Mechanical Contractor and the steel fabricator to verify that this purpose is accomplished. It is the responsibility of the General Contractor to call to the attention of the Architect-Engineer any deficiency prior to bidding.

C. Where thermal movement in the pipe line will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger in order to prevent excessive stress in either pipe or connected equipment.

PART 2 - PRODUCTS

2.01 UPPER ATTACHMENTS

A. New Concrete Construction:

1. Support piping in new concrete construction with adjustable type inserts, Anvil Fig. 282. Where the pipe load exceeds the recommended load of the insert, use two inserts with a trapeze-type connecting member below the concrete.
2. Where hangers are required between structural members, (beams) provide side beam brackets, Anvil Fig. 202, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hangers. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.

B. Steel Construction:

1. Support piping in steel construction with adjust-able beam clamps and tie rods, Anvil Fig. 218, or side beam brackets bolted or welded to the side of the beam.
2. Where hangers are required between structural members (beams or joist) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC steel Handbook and shall receive a field coat of zinc chromate primer.

2.02 WALL SUPPORTS

A. Where piping is run adjacent to walls or steel columns welded steel brackets Anvil Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

2.03 FLOOR SUPPORTS

A. Where pipe lines are located next to the floor and no provision for expansion are required support piping with Anvil Fig. 258, pipe rest with nipple and floor flange.

B. Where provisions for expansion are required support piping with Anvil adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.

C. Vertical piping shall be supported at every other floor using riser clamps Anvil Fig. 261, for steel and cast iron pipe, and copper clad riser clamp Anvil Fig. CT-121 for all copper piping.

2.04 SUPPORTS FOR PIPING OUTSIDE THE STRUCTURE

A. Support piping outside the structure on adjustable pipe supports Anvil Fig. 264.

2.05 INTERMEDIATE ATTACHMENTS

A. Supports for horizontal piping shall be all-thread galvanized steel rods, ASTM A-107, Anvil Fig. 146, of the following sizes:

Pipe Size	Hanger Rod Diameter
2 inches and smaller	3/8 inch
2-1/2 and 3 inches	1/2 inch
4 and 5 inches	5/8 inch
6 inches	3/4 inch
8 to 12 inches	7/8 inch
14 and 16 inches	1 inch

2.06 PIPE ATTACHMENTS

A. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.

B. Hangers for steel and cast-iron horizontal piping where provision for expansion are not required shall be Anvil Fig. 260, clevis type with vertical adjustment.

C. Hangers for uninsulated copper pipe 4 inches and smaller shall be copper plated adjustable band hangers Anvil Fig. CT. 99C, for pipe sizes over 4 inches provide Anvil copper clad clevis type hanger with a copper clad saddle at each hanger location.

D. Hanger for PVC pipe shall be Anvil Fig. CT. 99, adjustable band hanger.

E. Hangers for steel and copper piping where provisions for expansion are required shall be Anvil Fig. 171 or Fig. 181, adjustable roller hanger with Anvil Fig. 160, pipe covering protection saddles.

F. Pipe guide shall be Anvil Fig. 256.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.

B. Provide a hanger within one foot of each elbow.

C. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.

D. Unless specified otherwise, provide the following support spacing:

1. Pipe Size	Support Spacing
1 inch and smaller	5'-0"
1-1/4 inch and larger	10'-0"

END OF SECTION

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 APPLICABILITY

A. All work specified in this Section shall comply with the provision of Section 23 05 10, “HVAC General Requirements”.

B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take-off, and 40'-0" maximum spacing on exposed straight pipe runs.

PART 2 - PRODUCTS

2.01 PIPE MARKINGS

A. Pipe markings shall be applied by using stencils and spray-on stencil ink as indicated in EXECUTION 3. Band and letter sizes and identification shall be as indicated herein. Direction of flow arrows shall be placed next to color bands. A white background of stencil ink shall be provided where black letters are used on pipe or pipe covering material that is already black.

B. Manufactured preprinted markings shall be used in accordance with the following:

1. No tape or self-adhering markers will be allowed.
2. Snap on pipe markers, W. H. Brady Co., Seton, or Brimar Industries, Inc.
3. Markers shall be strapped on with nylon fasteners.
4. Markers will be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

2.02 BAND AND LETTER SIZE: Band and letter sizes shall conform to American Society of Heating, Air Conditioning Engineers (ASHRAE) standards of the following table:

O.D. of Pipe	Width of Color Band	Size of Letter/Numbers
1-1/4 inch and smaller	8 inches	1/2 inch
1-1/2 to 2 inches	8 inches	3/4 inch
2-1/2 to 6 inches	12 inches	1-1/4 inch
6 to 10 inches	24 inches	2-1/2 inch
Over 10 inches	32 inches	3-1/2 inch

2.03 IDENTIFICATION

A. Band legend and color and letter color shall conform to the following table:

Piping Band	Legend	Letters	Band Color
Refrigerant Liquid	RL	Black	Yellow
Refrigerant Suction	RS	Black	Yellow
Refrigerant Discharge	RD	Black	Yellow
Drain	D	Black	Green

B. All equipment, such as air units, condensing units, pumps, fans, etc., furnished by this Contractor, shall be permanently labeled, in an approved manner, corresponding to the mark or name shown on the drawings and/or specifications, or Owners' sequences.

C. For applications where existing color schemes may already be in place, all new work requiring identification and color coding shall match the existing color schemes.

PART 3 - EXECUTION

3.01 EXECUTION

A. Locate pipe identification in the following areas:

1. Each riser and each valve,
2. One on each side where piping pass thru walls and floors,
3. Locate at or near each change in direction,
4. Every 40 feet along continuous runs,

B. Indicate pipe content flow direction with arrows of matching style and placed so the arrow points away from the legend.

C. A copy of the pipe identification legend will be framed and accompany the valve tag schedule. See Section 23 05 10, "HVAC General Requirements".

D. If manufactured preprinted marking are used they shall be attached to the piping with self-locking nylon fasteners.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems:

1. Airside systems: Supply air, return air, relief air, exhaust air, and outside air systems, all pressure ranges; Verify temperature control systems operations.

C. This Section does not include:

1. Specifications for materials for patching mechanical systems; specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Requirements and Division 01 Specification Sections apply to work in this section.

1.03 SCOPE OF WORK

A. A Test and Balance Agency that is independent of any contractor or manufacturer shall perform the testing, adjusting and balancing and prepare reports, and deliver them to the Architect. The independent Test and Balance Agency shall be a certified member of the Associated Air Balance Council (AABC). The Test and Balance Agency contract shall not be assigned to any Subcontractor; the Agency shall work directly under the General Contractor.

B. Total System Balance shall be performed in accordance with the 6th edition of the AABC National Standards for Total System Balance, and in accordance with the scope of work defined by the Contract Documents.

C. Testing and Balance Agency as part of its contract shall act as an authorized inspection agency, responsible to the Owner's Representative, and shall, during the test and balance, list systems that are installed incorrectly, require correction, or have not been installed in accordance with Contract Drawings and Specifications.

D. Upon the completion of the test and balance work, the Agency shall compile the test data and submit the specified number of copies of the complete report to the Owner's Representative for his evaluation and approval.

E. Test, adjust and balance the air systems. After testing, adjusting, and balancing is complete, the Contractor shall visit the job during the heating cycle and during the cooling cycle to make adjustments to provide uniform temperatures throughout the building. Schedule the trips during the months of December through February for the heating cycle, and June through August for the cooling cycle. Obtain signed statements from the Using Agency acknowledging these two trips and subsequent adjustments. Submit statements to the Architect.

F. All costs associated with Test and Balancing for this project shall be the responsibility of the General Contractor.

1.04 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air distribution systems;
2. Adjustment of total system to provide design quantities;
3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls;

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified air patterns as applicable at the terminal equipment (e.g., reduce fan speed, throttling).

D. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

E. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

F. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets and return outlets on air terminals and exhaust or return inlets on air terminals such as fans, rooftop units, registers, grilles, diffusers and louvers.

G. Main: Duct containing the system's major or entire air flow.

H. Sub-main: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

I. Branch Main: Duct serving two or more terminals.

J. Branch: Duct serving a single terminal.

1.05 SUBMITTALS

A. Agency Data:

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Certified Representative and Technicians Data:

1. Submit proof that the Test and Balance certified representative assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Certified Reports: Submit testing, adjusting, and balancing reports bearing the certified seal and signature of the Test and Balance representative. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 3 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 4 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
   a. General Information and Summary
   b. Air Systems
   c. Temperature Control Systems
   d. Special Systems
4. Report Contents: Provide the following minimum information, forms and data:
   a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Owner, Owner's Representative, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance registered representative. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
   b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

D. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.06 QUALITY ASSURANCE

A. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems specified to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The independent testing, adjusting, and balancing agency certified by Associates Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one registered in the State in which the services are to be performed, certified by AABC as a Test and Balance representative.

C. Codes and Standards:

1. AABC: "National Standards For Total System Balance".
2. ASHRAE: ASHRAE Handbook, HVAC Applications - Testing, Adjusting, and Balancing.

1.07 FINAL INSPECTION

A. All systems, when completed, shall be operated by the organization to test the performance as directed by and to the satisfaction of the Using Agency.

B. Systems shall be balanced within the stated tolerances at the design conditions. The Owner's Representative may request or perform a check reading on up to 10 per cent of the outlets and duct traverses. If any reading varies beyond the stated tolerances, the system will be considered out of balance and the entire system be readjusted and a new report prepared at no additional cost to the Owner.

C. Heating, ventilation and air conditioning systems shall maintain uniform temperatures without drafts through the normal change of seasons. The Owner's Representative may request new design settings on up 20 per cent of the air outlets and coil connections for final adjustment of the system during the first year of operation at no additional cost to the Owner.

D. Air ducts shall circulate without excessive noise.

E. All defects demonstrated by inspections and tests shall be remedied immediately to the Architect' satisfaction.

1.08 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Contractor for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

PART 3 - EXECUTION

3.01 REQUIRED DOCUMENTS

A. The Contractor shall provide the following, in a timely fashion, to the Test and Balance Agency:

B. Contract drawings (complete set)

C. Applicable specifications (Div. 23 & 26, as a minimum)

D. Related addenda

E. Related change orders

F. Related reviewed shop drawings

G. Related reviewed equipment manufacturer's submittal data

H. Reviewed equipment control drawings

3.02 COOPERATION

A. The Contractor and his subcontractors shall cooperate fully with the Test and Balance Agency and provide:

1. Completely operable systems
2. The right to adjust the systems
3. Access to systems components

3.03 BELT DRIVES

A. Adjustable speed drives are to be adjusted by the Test and Balance Agency. In cases where the specified capacities cannot be obtained with the original adjustable sheave or original fixed drive sheave, the Agency is to report to the Contractor the sheave size required to obtain the specified capacity.

B. Where larger or smaller sheave sizes are required, the Contractor shall provide new sheaves and, if required, new belts at no additional cost to the Owner.

3.04 CONTROL PERFORMANCE CHECK

A. The results produced by the operation of rooftop and fan systems controls shall be checked by the testing agency; controls requiring adjustment shall be listed and reported to the Contractor. This does not reduce the responsibility of the Contractor for the checking and adjustment required for a fully operational control system. The Test and Balance Agency is responsible only for final settings; the Contractor is responsible for completeness and correctness of all the control systems.

3.05 SETTINGS

A. The Test and Balance Agency shall permanently mark the settings of all dampers, valves and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.

3.06 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

E. Take all reading with the eye at the level of the indicated value to prevent parallax.

F. Take measurements in the system where best suited to the task.

3.07 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Cut insulation and ductwork, for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

B. Patch insulation, ductwork, and housings, using materials identical to those removed. Seal ducts, and test for and repair leaks. Seal insulation to re-establish integrity of the vapor barrier.

C. Mark equipment settings, including damper control positions, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

D. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.08 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.09 REPORT

A. The following items shall be tested, recorded, and incorporated in the test and balance report. The report shall not be limited to these items, but shall include these tests as minimum requirements.

1. Record each equipment manufacturer, model numbers and serial numbers.
2. Test, adjust and record required and measured total CFM for each air system and component. Test and record quantity of exhaust or relief air in CFM.
3. Test, adjust and record all required and measured outside air quantities and return air CFM.
4. Test and record required and measured system static pressures; filter differential, air and water coil differential, and fan total static pressure.
5. Record all installed fan drive assemblies; fan sheaves, motor sheaves, and belts.
6. Record each installed motor manufacturer.
7. Record each installed motor horsepower.
8. Test and record each motor name plate and measured voltage and full load amperage.
9. Test, adjust, and record each blower RPM.
10. Test and adjust the CFM delivery of each diffuser, grille, and register.
11. Identify the location of each diffuser, grille, and register.
12. Record the size, type, and manufacturer of each grille, register and diffuser.
13. Data obtained for each diffuser, grille and register shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
14. All diffusers, grilles, and registers shall be adjusted to minimize drafts.
15. All tests shall be made with supply, return, relief and exhaust systems operating, and all doors, windows, etc. closed or in their normal operating condition.
16. All damper positions shall be permanently marked after air balancing is complete.
17. The final balanced condition of each area shall include the testing and adjusting of pressure conditions. Front doors, exits, etc., should be checked for air flow so that exterior conditions do not cause excessive abnormal pressure conditions.
18. Indicate on floor plans the locations and results of the sound measurements taken.

3.10 SYSTEM BALANCING REQUIREMENTS

A. Testing, adjusting and balancing shall be provided for all airside systems and equipment specified and indicated in the Contract Documents.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION

A. All insulation products used outside of mechanical rooms shall meet NFPA requirements for Flame Spread Rating 25, Smoke Developed Rating 50, and Fuel Contributed 50.

B. Staples SHALL NOT be used for securing insulation. All insulation shall be installed in accordance with the insulation manufacturer's recommendations. Insulation shall be continuous through wall, ceiling, floor and roof openings and sleeves, except at fire/smoke dampers.

C. Supports for insulated piping shall be outside the insulation. Inserts shall be provided at hangers. Inserts shall be Foamglass Insulation, Calcium Silicate or Perlite and shall be 2 inches longer than the pipe shields. Pipe shoes welded to the pipe shall be used for roll type hangers.

D. All required tests of the relevant section of pipe, ductwork, or equipment shall be completed before insulation is applied.

E. Do not store materials in building until it is enclosed and dry. Wet insulation shall not be installed.

F. Insulation products with self-sealing type jacket shall not be applied at temperatures below 40 degrees F.

G. Items not to be insulated: Ducts with internal lining or factory insulated ducts.

H. Clean and dry all surfaces to be insulated from loose scale, dirt, oil, moisture and other foreign matter.

I. Insulate completely all metal surfaces of piping, ductwork and equipment other than hangers.

J. Surface finishes shall present a tight smooth appearance.

K. Permit expansion and contraction without causing damage to insulation or surface finish.

L. Surface finish shall be extended to protect all surfaces, ends, and raw edges of insulation.

M. Vapor barriers must be continuous and uninterrupted throughout the system where specified except where insulation is interrupted for fire dampers. See details for special conditions.

1.03 PIPING

A. Insulate all valves, strainers and fittings. For the purposes of this Specification, fittings include unions and flanges. Use premolded material where available. Insulate valves up to and including bonnets.

B. Pipe Hangers that are installed in direct contact with the surface of the pipe, such as a pipe clamp shall have the insulation applied over the hanger as well as the pipe. Provide a rain shield on piping supported on hangers outdoors to prevent bulk water from entry.

1.04 DUCTWORK

A. Insulation shall cover all standing seams and metal surfaces. Materials shall be applied subject to their temperature limits.

1.05 QUALITY ASSURANCE

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Any methods of application of insulation materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations. Insulation shall be applied by experienced workers regularly employed for this type of work. Material shall be furnished to the job bearing the manufacturer's label.

C. Insulation products shall be as manufactured by Pittsburgh Corning Corporation, Knauf, Resolco, Owens-Corning, Certainteed or Armstrong.

1.06 FITTING COVERS AND JACKETS

A. Where applicable, provide and install PVC covers and jacketing on fittings with fiberglass insulation as manufactured by Johns Manville Zeston 300 Series, Knauf Proto, or Speedline Corporation.

PART 2 - PRODUCTS

2.01 EXTERIOR WRAP FOR ROUND DUCTWORK

A. Insulation shall be equal to Knauf Duct Wrap. Insulate externally, all round ductwork with 2 inches thick blanket fiberglass duct insulation. All seams to be taped with pressure sensitive tape and banded with nylon ties on 3’-0” centers.

B. The board type shall have a minimum 3 lbs. density, 1-1/2 inch thick with ASJ jacket. Insulation board shall have an average conductivity not to exceed 0.27 BTU/inch/ square foot/degree F / hour at a mean temperature of 75 degrees F.

2.02 ACOUSTICAL DUCT LINER

A. Duct liner shall be equal to Knauf Textile Duct Liner. Acoustical duct liner shall be a flexible type with a minimum 1 inch thickness using long fiberglass with a smooth firmly bonded fire-resistant surface to prevent erosion of the insulation. Surface not to exceed 25 flame spread and 50 smoke development. Thermal conductivity shall not exceed 0.26 at 75 degrees F. mean temperature.

B. Noise reduction coefficient (NRC) shall not be less than .60 based on acoustical materials test, Mounting No. 6. Completely coat all duct surfaces with Benjamin Foster 85-15 adhesive. Neoprene coated side on liner shall face air stream. Sections shall be jointed by coating the edges with Foster 30-36. Secure liner to duct system with self-adhering pins adhered to clean surface and secure with self locking washers, space pins not more than 4 inches from the edges and not more than 16 inches on centers. Lining shall meet National Board of Fire Underwriters' Standards for Internal Duct Application and shall have a minimum density of 3 lbs. per cu. ft. All duct liner shall be marked with the density located so as to be visible on the exposed surface of the liner. Air friction correction factor shall not exceed 1.40 at 2000 FPM and 1.5 at 4000 FPM.

C. Insulate all rectangular supply, return, and outside air ductwork internally as described in Paragraphs A and B.

2.03 FOAMED PLASTIC TUBING

A. Sheet Insulation shall be equal to Armstrong Armaflex. Minimum of 4.5 lbs. per cu. ft. Thermal conductivity shall not exceed 0.28 at 75 degrees F mean temperature.

B. Insulate with 3/4 inch Armstrong Tubing on all refrigerant piping and all coil condensate drain piping.

C. Piping outside the building may be insulated with 1 inch thick Armaflex flexible foamed plastic insulation with weather proof aluminum as hereinafter specified.

2.04 ADHESIVES, MASTIC, COATINGS

A. Manufacturers: Benjamin Foster, Childers, Insul-Coustic, EPOLUX, Minnesota Mining and Manufacturing Co.

B. Treatment of pipe jackets and duct facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Vapor barriers shall have a perm rating of not more than .05 perms. Adhesives, coatings and mastics shall have a perm rating of not more than .25 perms.

2.05 TAPE

A. Wherever tape is used for sealing purposes, it shall be of the type and shall be applied as recommended by the non-conductive covering manufacturer. Where recommendation is lacking, the tape used shall be sealed with Minnesota Mining Adhesive EC-1329.

2.06 WEATHERPROOFING

A. Protect piping insulation exposed to weather outside the building with corrugated aluminum sheets of .016 inch thickness and aluminum formed elbows with leak proof beads and epoxy coated interior as marketed by Pabco, Childers Metals, or Ideal Products.

PART 3 - EXECUTION

3.01 GENERAL

A. Surfaces to be insulated shall be clean, dry, and free of foreign material, such as rust, scale and dirt when insulation is applied. Perform pressure tests required by other Sections before applying insulation.

B. Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.

3.02 INSULATION FOR ALL PIPING SYSTEM

A. Insulate pipe, fittings, flanges, unions and valves.

B. Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal seams and end laps. Do not use scrap pieces of insulation where a full length section will fit.

C. Install insulation, jackets and coatings continuous through wall and floor openings and sleeves.

D. Fittings, valves and flanges shall be insulated with field fabricated multiple mitered segments of molded fiberglass insulation of the same thickness as adjoining pipe insulation. Secure fitting insulation segments with 20 gauge galvanized steel wire and apply a smoothing coat of insulating cement. White fabric and mastic shall be used on exposed fittings.

E. Application of all materials shall be in accordance with the manufacturer's instructions.

F. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint straps furnished with insulation.

G. Care shall be taken so as not to place insulation over vent and drain inlets and outlets.

H. Staples are not permitted on pipe insulation.

I. Insulate all refrigerant piping appurtenances subject to sweating, such as thermometer wells, gauge cocks, and valve stems with preformed and mitered Armaflex pipe insulation. All joints shall be glued and banded for air tight finish.

3.03 INSULATION EXPOSED TO WEATHER OUTSIDE THE BUILDING

A. Finish with standard weight glass cloth set in a 1/16 coat of vapor barrier. After drying, apply a 1/16 coat of weatherproof vapor barrier similar to SEAL KOTE. Protect insulation including elbows with .016 inch thick corrugated aluminum, overlap two inches, locate seams to shed water, and secure with a minimum of three aluminum bands per section. Oversize insulation to allow for heat tape. Apply insulation after piping has been painted and heat tape has been installed.

3.04 INSULATION FOR DUCT SYSTEM

A. Secure insulation to duct with Benjamin Foster 85-15 adhesive applied in 4 inch strips around the duct on 8 inch centers. Nylon cord shall be used to secure the insulation. Where ductwork is 36 inches wide or more secure insulation to the bottom of the duct using self adhering pins and self locking washers placed not more than 18 inches on center. Insulation shall overlap lining and factory applied insulation a minimum of 2 inches. Vapor barrier at all butted joints or breaks shall be sealed with 4 inches wide foil reinforced tape adhered with Benjamin Foster 82-07.

B. Insulate ductwork exposed to the weather that is not lined with glass fiber semi-rigid board insulation 1-1/2 inch thick, 3 lbs. per cubic feet density. Secure to metal with self-adhering pins with self locking washers. Finish with standard weight glass cloth set in 1/16 inch weatherproof mastic similar to Seal-Kote. After drying, apply a 1/16 inch finish coat of waterproof mastic. Butt insulation joints and seal with mastic.

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 13 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 11 VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10, “HVAC General Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11, titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. Furnish and install all required equipment, appurtenances, and accessories for a complete heating and cooling system.

D. See other sections of these specifications that may specify accessories or features.

E. Refer to the schedules on the drawings where equipment capacities are not included in this section.

F. Review other sections of the specifications and the plans for services required to each piece of mechanical equipment. Any required accessories, appurtenances, or service omitted from the plans or specifications that are not called to the attention of the Architect at least 72 hours before bidding and corrected by addendum shall be provided as though shown.

1.02 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers of adjustable frequency controllers are Magnetek, Parametric, Eaton or ABB provided the equipment meets or exceeds the requirements of the Contract Documents. The manufacturer shall have a local distributor with repair parts in stock.

1.03 COORDINATION

A. Motors required in connection with equipment shall be of sufficient size and speed for duty to be performed, not exceeding their full-rated load when driven equipment is operated at specified capacity under most severe conditions likely to be encountered.

B. Submit all equipment for approval.

PART 2 - PRODUCTS

2.01 COORDINATION

A. The units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

2.02 VARIABLE FREQUENCY DRIVES

A. Provide and install for air handling units and indicated on drawings variable frequency drives as follows. Install electrical service between motors and drive.

1. Variable Frequency Drives: Each VFD shall have an automatic and a manual bypass switch and contactor mounted within a common, NEMA 1 enclosure.
2. VFD Input Power: Shall be 480/3/60and 4160/3/60. The VFD shall tolerate plus or minus 10 percent voltage and plus or minus 5 percent Hz.
3. VFD Output Power: Shall vary frequency to the motor from 0 to 400 Hz to vary the motor speed in proportion to the motor nameplate rated speed, with output voltage variation from zero to motor rated voltage for optimum voltage per hertz ratio for air handling unit motor loads. Output current shall be rated at 150 percent of the VFD'S constant torque rating. The output must be voltage source type generating a sine coded pulse width modulated waveform utilizing an asynchronous carrier frequency. The carrier frequency shall be adjustable to minimize harmonically induced noise or vibration. These criteria shall be accomplished by using microprocessor based techniques.
4. VFD Power Structure: The power structure converting AC power to variable frequency output power shall consist of three functional stages:
   a. Input Stage: Shall convert three phase AC line power to a fixed DC bus voltage with a solid state, three phase full wave diode rectifier with metal oxide varistor three phase protection. Displacement power factor shall be .98 throughout the speed range.
   b. Intermediate Stage: Shall be interfaced with the VFD diagnostics to provide continuous monitoring for power component protection. The DC bus shall be fused for short circuit protection and shall have capacitive filtering to provide smooth DC power to the output stage.
   c. Output stage: Shall utilize switching transistors to convert DC bus power to sine coded pulse width modulated output current of all three phases to the motor. Current transformers shall be provided to detect current utilization by the microprocessor to provide information generation for overload protection, three phase current limit, ground fault and short circuit protection.
5. Operation and Protective Functions:
   a. Provide adjustable DC injection braking, selectable for deceleration braking or braking before start (anti-windmill).
   b. Provide with three (3) adjustable prohibited frequency ranges to avoid mechanical resonant vibration.
   c. Provide with auto speed reference loss detection which shall automatically drop the VFD to a present speed until auto speed command is restored.
   d. Provide with programmable automatic restart for up to ten attempts of automatic restart.
   e. The VFD shall "ride through" a power loss of up to two (2) seconds.
   f. Provide with reverse run inhibit which shall prevent reverse rotation even if started into a reverse wind-milling load.
   g. Provide with input electrical power protection, including phase reversal, phase loss, under and over voltage protection, etc.
6. Bypass Control shall be provided within a common NEMA enclosure which shall allow the motor to run at full speed with line power while the VFD is being serviced or is out of service. The bypass and the VFD shall be electrically interlocked to prevent line power and the VFD output being connected to the motor at the same time. The unit shall be so constructed that the VFD can be removed and the bypass remain in service. The maximum frequency (Hz) setting in bypass shall be set by the test and balance contractor to prevent damage to

ductwork, ductwork accessories and equipment.
NOTE: VFD shall default in the full run mode meaning motor shall be fully powered to maximum power setpoint**.**

7. Quality Assurance
   a. All printed circuit boards shall utilize surface mounted devices to provide higher reliability and strengthened printed circuit assembly. Printed circuit boards shall be “burned in” for at least 96 hours. Circuit boards shall be tested to accepted quality level (AQL) of .5%.
   b. The fully assembled VFD shall be factory tested with fully loaded induction motor.
   c. The VFD shall be UL listed, and constructed per NEMA and IEEE standards.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.

C. Coordinate all work with other trades as necessary for proper interfacing.

D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 AIRFLOW CONTROL SYSTEM INSTALLATION

A. The electrical contractor shall wire a dedicated 120 VAC single phase power circuit to each wall-mounted power supply. ATC contractor shall install all wall-mounted power supplies.

3.03 START-UP

A. The initial start-up shall be made by an authorized representative of the equipment manufacturer. System start-up shall be provided by a factory authorized representative of the airflow controls manufacturer. Said start-up shall include verification of proper installation and wiring and verification of proper operation of the airflow control systems. The balancing contractor shall be responsible for final verification and reporting of all airflows and pressurization.

B. The airflow control system manufacturer shall furnish a minimum of four hours of owner training to provide an overview of the job specific airflow control components, general troubleshooting procedures, and operation of the isolation room monitor.

3.04 ADJUSTMENT

A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 DESCRIPTION

A. General: The control system shall be as indicated on the drawings and described in the specifications.

B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project.

C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

D. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.

1.02 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:

1. Graphic Display: The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 20 seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within 30 seconds.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be 10 seconds. Analog objects shall start to adjust within 10 seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior 60 seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciation: All workstations on the network shall receive alarms within 5 seconds of each other.

1.03 WARRANTY

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.

1.04 SCOPE OF WORK

A. The Energy Management & Control System (EMCS) manufacturer shall furnish and install a complete and functioning direct digital control system equal to the Trane Tracer Summit System. This new system shall be a fully integrated building automation system, incorporating direct digital controls (DDC) for energy management, equipment monitoring and control, and sub-systems with open communications capabilities as herein specified.

B. The system shall be complete with dynamic color graphics using symbols, icons, abbreviations, and layouts identical to existing graphics, and developed on the Trane Tracer Summit Software. Graphics will display all applicable inputs, outputs, setpoints, statuses, etc. updating changes as they occur.

C. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

D. EMCS manufacturer shall be responsible for all EMCS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Trane Company. With prior approval, other manufacturers may be substituted provided that all products fully integrate within the existing systems. The contractor must provide any gateway/integrator hardware throughout all facilities. It shall be the responsibility of this contractor to make the campus-wide system fully functional as one system. The contractor must provide, adjacent to his main communication panels for each building, a gateway/integrator panel. The gateway/integrator panel shall translate the language of the new systems installed under this contract to that of Trane Process Control Language (TPCL). The contractor shall provide all labor and software to accomplish programming his database into the TPCL language in the gateway/integrator panel, such that all points, programs, and commands are operable from the existing front-end software as well as existing panels in all buildings.

2.02 OPERATOR INTERFACE

A. Operator Interface: A touch screen display is factory mounted on the front of the controller. The operator display has graphical images that show the type of equipment controlled by the head end controller. The screen will be used for viewing equipment and system status information, making changes to time of day schedules, changing system setpoints, viewing the alarm and event log, performing timed overrides.

B. System Software:

1. Operating System: Furnish a commercially available, concurrent multi-tasking operating system. The operating system shall also support the use of other common software applications that operate under DOS or Microsoft Windows. Acceptable operating systems are Windows NT, and Windows 95/98.
2. System Graphic: The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Graphics shall be capable of launching other PC applications.
    a. Custom Graphics: Custom graphic files shall be created with the use of commonly available graphics packages such as PC Paint. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as PCX, BMP, GIF and JPEG. The graphics generation package shall also provide the capability of capturing or converting graphics from other programs such as Designer, or AutoCAD.

b. Graphics Library: Furnish a complete library of standard HVAC equipment such as roof top units, air handlers, and terminal units (i.e., VAV). This library shall also include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

c. Engineering Units: Allow for selection of the desired engineering units i.e. Inch pound in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be: Standard Inch Pound.

C. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation.

1. Automatic System Database Save and Restore: Each workstation shall store on the hard disk a copy of the current database of each building controller. This database shall be updated whenever a change is made in any panel in the system. The storage of this data shall be automatic and not require operator intervention. In the event of a database loss in a building management panel, the first workstation to detect the loss shall automatically restore the database for that panel.
2. Manual Database Save and Restore: A system operator with the proper password clearance shall be able to archive the database from any system panel and store on magnetic media. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. System Configuration: The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.
4. On-Line Help and Training: Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. Provide an interactive tutorial CD, which will act as on-line training/help for the systems operator.
5. Security: Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto logoff time shall be set per operator password. All system security data shall be stored in an encrypted format.
6. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.
   a. Alarm Reactions. The operator shall be able to determine what actions, if any, are to be taken, by object (or point), during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, forwarding to an e-mail address, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by workstation and time of day. An object in alarm that has not been acknowledged within an operator specified time period shall be re-routed to an alternate operator specified alarm receipt device.
   b. Binary Alarms. Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to disable alarming when the associated equipment is turned off or is being serviced.
   c. Analog Alarms. Each analog object shall have both high and low alarm limits and warning limits. Alarming must be able to be automatically and manually disabled.
8. Trend Logs. The operator shall be able to define a custom trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals of 1, 5, 15, 30, and 60 minutes as well as once a shift (8 hours), once a day, once a week, and once a month shall be selectable. All trends shall start based on the hour. Each trend shall accommodate up to 64 system objects. The system operator with proper password shall be able to determine how many samples are stored in each trend. Trend data shall be sampled and stored on the Building Controller panel and be archived on the hard disk. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. They shall also be storable in a tab delimited ASCII format for use by other industry standard word processing and spreadsheet packages.
9. Dynamic Graphical Charting. The operator shall be able to select system values to be charted in real time. Up to three values at one time can be selected for each chart. The type of chart (bar, line, 3-D, etc.) shall be selectable.
10. Alarm and Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be archived to the hard disk on the workstation.
11. Object and Property Status and Control. Provide a method for the operator with proper password protection to view, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics, or through custom programs.
12. Clock Synchronization. The real time clocks in all building control panels and workstations shall be synchronized on command of an operator. The system shall also be able to automatically synchronize all system clocks; daily from any operator designated device in the system. The system shall automatically adjust for daylight savings and standard time if applicable.

13. Reports and Logs. Provide a reporting package that allows the operator to select, modify, or create reports. Each report shall be definable as to data content, format, interval, and date. Report data shall be archived on the hard disk for historical reporting. Provide the ability for the operator to obtain real time logs of designated lists of objects. Reports and logs shall be stored on the PC hard disk in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals.
    a. Custom Reports: Provide the capability for the operator to easily define any system data into a daily, weekly, monthly, or annual report. These reports shall be time and date stamped and shall contain a report title and the name of the facility.

2.02 SYSTEM SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.

B. System Security:

1. User access shall be secured using individual security passwords and user names.
2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system manager.
3. User logon/logoff attempts shall be recorded.
4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

C. Scheduling: Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

1. Weekly Schedule: Provide separate schedules for each day of the week.
2. Exception Schedules: Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
3. Holiday Schedule: Provide the capability for the operator to define up to [99] special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

4. Optimal Start/Stop: The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
5. Timed Override: Building will be divided into seven zones for timed override activation using the touchscreen. Timed override period will be user defined.

D. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, be logged in the event log, printed, generate custom messages graphics.

E. Remote Communications: The system shall have the ability to dial out in the event of an alarm. Receivers shall include PC Workstations, and alphanumeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system offsite through the use of a web-based controls access interface.

F. Maintenance Management: The system shall monitor equipment status and generate maintenance messages based upon user designated run time, starts, and/or calendar date limits.

G. PID Control: A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, set-point, and PID gains shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.

H. Staggered Start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts shall be user-selectable.

I. System Calculation:. Provide software to allow instantaneous power (e.g. KW), flow rates (e.g. GPM] to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window KW demand value. Provide an algorithm that calculates energy usage and weather data (heating and cooling degree days). These items shall all be available for daily, previous day, monthly and the previous month.

J. Anti-Short Cycling: All binary output points shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

K. Building Controller Operator Display: The building controller shall include an operator display allowing the user to perform basic daily operations tasks on the building automation system. At a minimum this operator display shall:

1. Be installed on the building controller and require no additional power source.
2. Consist of a one-quarter VGA touch screen with 320 by 240-pixel resolution. The brightness and the contrast of the backlit touch screen shall be adjustable to allow for easy reading of information on the screen.
3. Be capable of having unique user identification and passwords that can be programmed to limit access to the system and operator functions.
4. Display the current state of an input/output point and equipment controller connected to the system.
5. Give the operator the ability to override the current state of an output point or HVAC equipment controller connected to the building controller.
6. Allow the operator to modify the start and stop times of any time-of-day schedule within the system.
7. Provide a visual indication that a system alarm exists and allow for an optional audible alarm annunciation.
8. Provide the ability to view and acknowledge alarms that are annunciated at that building controller.
9. Allow the operator to view custom graphical displays with dynamic status information.
10. Automatically update displayed system information every 10 seconds.

2.03 INPUT/OUTPUT INTERFACE

A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers. The points list will be included and demonstrated to the owner and professional.

B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

2.04 LOCAL CONTROL PANELS

A. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with [hinged door], key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.

1. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
2. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

PART 3 - EXECUTION

3.01 WIRING

A. All control and interlock wiring shall comply with the national and local electrical codes and Division 16 of these specifications. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence. EMT Conduit where exposed and plenum cable elsewhere.

3.02 CONTROLLERS

A. Provide a separate Controller for each major piece of HVAC equipment. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15 percent spare I/O point capacity for each point type found at each location. If input points are not universal, 15 percent of each type is required. If outputs are not universal, 15 percent of each type is required. A minimum of one spare is required for each type of point used.

C. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

D. Controllers shall be furnished with uninterruptable power supply (UPS) devices as required to maintain building operation when a loss of power to the controller occurs. The controller shall be powered by emergency power when available from the emergency generator when regular power to the building is not available.

3.03 PROGRAMMING

A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming:

1. Provide programming for the system as per specifications and adhere to the strategy algorithms provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. Operators' Interface:

1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Roof Top Unit, Air Handler, VAV Terminal.

These standard graphics shall show all points dynamically as specified in the points list.

2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.
3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of 8 hours on-site. Tests shall be made in the presence of the Owner or Owner's representative.

E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.04 TRAINING

A. Provide a minimum of one (1) classroom training sessions, 8 hours each.

3.05 DUCT SMOKE DETECTION

A. Provide complete submittal data to controls system contractor for coordination of duct smoke detector interface to HVAC systems. Smoke Detectors furnished by Div 26, mounted by Div 23, powered by Div 26, control wiring by ATC (Div 23).

B. Div 26 contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

PART 4 - CONTROL SEQUENCE

4.01 BUILDING EXHAUST FAN CONTROL

A. Provide time of day control to start building exhaust fans. Fans shall operate only during occupied cycle.

4.02 FIRE SAFETY INTERFACE CONTROL

A. Duct mounted smoke detectors (furnished by Division 26), located as shown on plans, shall signal the fire alarm system upon detection of products of combustion. On indication of alarm, temperature controls shall be overridden on alarm floor.

4.03 SYSTEM OVERRIDE CONTROL

A. Override cycle for any air handling system shall be initiated by telephone dial-up. During the override cycle, the self-contained VAV unit supplying the floor on which the suite is located shall be enabled. All VAV terminals served by the system in the suite will revert to "occupied" status. The building exhaust fan and outside air supply fan will remain de-energized. The length of time for override cycle shall be pre-programmed and may be changed at any time. At

the conclusion of override cycle, the system will return to its programmed normal status.

4.04 VARIABLE AIR VOLUME (VAV) TERMINAL UNITS

A. The VAV terminal units shall be individually controlled by a DDC VAV controller per VAV terminal unit. The DDC VAV controller, damper motor, transducer and transformer shall be supplied by the BAS contractor and furnished to the terminal unit supplier. The cost to factory mount, calibrate and test the controller, transducer, transformer and actuator shall be coordinated prior to bid day and included in the BAS price.

1. To assure proper operation and control, the BAS contractor as part of this bid shall recalibrate the transducers six (6) months after acceptance of the BAS system to correct any deviations as a result of transducer drift.
   a. Submit a copy of the recalibration report to the Engineer, Mechanical Contractor, Test, Adjust and Balance Contractor and Owner.
2. Refer to Section 23 36 16 Variable Air Volume Units for requirements.

B. The BAS shall perform the following VAV Terminal unit control strategies and provide the points as listed on the DDC/VAV point list and the specified monitoring and diagnostics.

1. Grouping - The BAS shall be able to group VAV boxes via keyboard commands. These groups shall make it possible for the operator to send a common command to all boxes in a group to operate in the same mode. A sample of this group report must be provided in the submittal package for approval by engineer and owner. BAS shall also compile on a group basis, the following:
   a. Minimum group temperature
   b. Maximum group temperature
   c. Average group temperature
   d. Current airflow through boxes in group (total)
2. Setpoint Control - The BAS shall edit the zone space temperature setpoint of each VAV box. The zone temperature setpoint shall be operator adjustable. Individual zone setpoint and control logic shall reside at the zone level, and not be dependent upon the BAS for control. In the event of communication loss, or an alarm shall be reported to the BAS. The box will continue to control using the last state set points until communication is re-established. The box will then resume control to current set-points.
3. Cooling Valve Control - The BAS shall control the cooling air valve to a fully open, fully closed, maximum CFM, or minimum CFM position based on operator commands. The operator shall also have the capability to adjust the maximum and minimum airflow limits o the air valve through the BAS.
4. Operating Mode - The BAS shall place the box in either the occupied or unoccupied mode based on an operator adjustable time schedule. Separate heating and cooling

set-points shall be enterable for each mode through the BAS. Other modes available for special applications shall include full open, full closed, maximum flow, and minimum flow.

5. Control Offset - the BAS shall be capable of offsetting the cooling or heating set-points of one or more groups of boxes by an operator adjustable amount. This capability will allow for automatic zone setpoint changes based on system requirements, such as demand limiting.
6. Automatic Recalibration - The system shall automatically recalibrate its air flow sensing and air valve position measurement system at system startup and on a scheduled basis.
7. Remote Setpoint Adjustment - The BAS zone temperature setpoint programmed in software shall be c capable of being manually overridden by a remote adjustment at the temperature sensor. This manual readjustment feature may be disabled through the BAS, if desired.
8. Override Button - The VAV box shall be capable of being placed in the "occupied" mode by pressing an override button mounted on the zone temperature sensor. Associated fan systems and condensing units must also automatically index to the correct operating mode at this request.
9. Portable interface terminal - The VAV box shall have a communications port on the space sensor for use with a hand held portable operator's terminal. This portable terminal shall give the operator the capability to interrogate and edit DDC/VAV box parameters.
10. Terminal unit status reports - For each terminal unit, the BAS shall provide an operating status summary of all unit sensed valued (zone temperature, CFM, etc.), set-points, and modes.
11. Terminal unit group report - For each group of VAV terminal units, the BAS shall report the group mode, heating and cooling airflow, average zone temperature, minimum zone temperature, and maximum zone temperature. The report shall also display for each terminal unit in the group the present temperature control set-points and the current zone temperature.

C. Terminal Box Diagnostics:

1. If zone temperature sensor input fails above its high range, unit shall control at its maximum CFM setpoint. If sensor input fails below its low range, unit shall control to its minimum CFM setpoint. In both cases, all heat outputs shall be disabled. A diagnostic message shall be displayed upon operator inquiry.
2. If flow measuring system fails, unit shall automatically convert to a pressure dependent, damper position based algorithm. Diagnostic message shall be displayed upon operator inquiry.
3. If zone temperature setpoint potentiometer on zone sensor fails, unit shall automatically control to 74 degrees F. Diagnostic message shall be displayed upon operator inquiry.
4. If communications are lost, controller shall continue to operate in the current mode of operation. All set-points shall be retained in nonvolatile memory. If communications are not restored within 15 minutes, unit shall automatically initiate a reset-recalibrate.

D. Shutoff VAV Terminals:

1. On a rise in space temperature, the unit will modulate to provide maximum CFM. As space temperature decreases, the box will modulate down to its minimum CFM.

4.05 VAV AIR HANDLING UNIT WITH VENTILATION RESET AND STATIC PRESSURE OPTIMIZATION

A. Occupied Cooling Mode/Pre-Occupancy Ventilation Mode: When the AHU is in the Occupied Cooling Mode, the Supply Fan shall operate continuously, the fan motor variable frequency drive (VFD) shall modulate to maintain the Duct Static Pressure, and the Cooling Stages shall modulate in sequence to maintain the cooling Discharge Air Temperature. The outdoor airflow, as measured at the air handling unit outdoor air intake, shall be maintained at a value equal to or higher than the minimum required outdoor airflow setpoint by modulating the outside air damper. Determination of the Minimum Required Outdoor Airflow Setpoint shall be per the Minimum Required Outdoor Airflow Setpoint section of the AHU System Level Operation section of this specification. Building CO2 shall be monitored and the Outside Air Damper shall be modulated to maintain CO2 levels (1000 ppm). Outside Air shall be reset below minium at a rate of 200 CFM/hr as long as CO2 levels are maintained. Outside Air quantities shall not be allowed to go below building exhaust air volume.

B. Unoccupied Mode: When the AHU is in the Unoccupied Mode, the Supply Fan shall be OFF, fan motor VFD shall be off with a setpoint of 0Hz,Outdoor Air Damper, and Cooling Valve shall be closed, and the Heating Valve shall be fully open.

C. Night Setback (NSB) / Morning Warm-Up Heating Mode (MWU): When the AHU is in the Night Setback / Morning Warm-up Heating Mode, the Supply Fan shall operate continuously, the fan motor VFD shall modulate to maintain the Duct Static Pressure, the Outdoor Air Damper shall be closed and Cooling stages shall be off, the Return Air Damper shall be fully open. All VAV Terminal Units shall disable local heat and operate in their VAV heating mode until the NSB/MWU criteria is satisfied and the AHU returns to the occupied or unoccupied mode.

D. Supply Fan Control: The Supply Fan shall operate continuously whenever the AHU is in either the Occupied Cooling Mode or the Night Setback / Morning Warm-up Heating Mode. The Supply Fan shall be OFF whenever the AHU is in the Unoccupied Mode, the Stop / Auto interlock is open, the Mixed Air Low Limit is tripped, or the Supply Fan Status indicates a failure (after a two minute delay). The Low Limit and the Fan Failure require a manual reset.

E. Frequency Inverter Control (VFD): When the Supply Fan is ON, Frequency Inverter shall slowly ramp (adjustable) up and modulate to maintain the proper Discharge Duct Static

Pressure Setpoint. Determination of the Discharge Duct Static Pressure Setpoint shall be per the Discharge Duct Static Pressure Setpoint section of the AHU System Level Operation section of this specification. The Frequency Inverter shall be off if the Supply Fan is OFF or the Duct Static Pressure Sensor fails.

F. D/X Cooling Control: The Condensing Unit(s) and/or their respective compressors and staging shall cycled on and off to maintain the Discharge Air Temperature at the Discharge Cooling Setpoint without the use of hot gas bypass. A minimum of four (4) stages of control at each AHU is required. Condensing units shall stage on and off as required to maintain associated AHU discharge air temperature. Condensing units shall alternate lead lag configurations based upon manufacturer's requirements to maintain equal run time of condensing units. The Condensing Unit(s) shall be off and the cooling disabled if the AHU is in the Heating mode, the Supply Fan is OFF, or the Discharge Air Sensor has failed.

G. Operator Display: The custom application controller shall include an operator display allowing the user to perform basic daily operations tasks. At a minimum this operator display shall:

1. Be installed on the custom application controller and require no additional power source.
2. Consist of a one-quarter VGA touch screen with 320 by 240-pixel resolution. The touch screen shall be backlit. The brightness and contrast shall be adjustable to allow for easy reading of information on the screen.
3. Provide on-screen graphical icons to identify common user functions including viewing point data, alarms, scheduling, output overrides, and controller setup.
4. Be capable of having unique user identification and passwords that can be programmed to limit access to the system and operator functions.
5. Display the current state of all input/output points connected to the controller.
6. Allow for up to 24 individual custom display screens that allow 24-character English descriptions of controller data.
7. Give the operator the ability to override the current state of all binary and analog output points connected to the controller. The controller shall have this capability prior to any on-site programming.
8. Include a time clock that shall maintain correct time for at least 7 days during a power loss to the controller.
9. Allow the operator to modify the start and stop times of the time-of-day schedule within the controller. Scheduling function shall provide for 7-day control, with 2 start and stop events per day.
10. Provide a unique visual alarm indicator such as a flashing LED, separate from the display screen.
11. Automatically update displayed system information every 10 seconds.

H. Building Automation System Interface: The Building Automation System (BAS) shall send the AHU a Discharge Air Temperature Setpoint, a Discharge Duct Static Pressure Setpoint and a Minimum Required Outdoor Airflow Setpoint. The BAS shall also send Start-up, Occupied, Pre-Occupancy Ventilation, Unoccupied, Morning Warm-up, Heating / Cooling, Timed Override, Startup, Coastdown, Demand Limit, Duty Cycle, Night Setback, Purge, and Priority Shutdown commands. If communication with the BAS is lost, the AHU uses its default setpoints and operates in the Occupied Cooling mode. The Economizer function is enabled based on the AHU Outdoor Air Temperature Sensor. The last known Minimum Required Outdoor Airflow Setpoint shall be maintained.

I. AHU System Level Operation

1. Minimum Required Outdoor Airflow Setpoint:
   a. The air handler Outdoor Air Damper shall be controlled to deliver required outdoor airflow to each individual VAV zone at all load conditions. The minimum outdoor airflow setpoint shall be determined using ASHRAE Standard 62-99, Equation 6.1. The actual outdoor airflow shall be sensed at the outdoor air intake.

   b. The ventilation fraction (design ventilation airflow for the zone divided by primary airflow) shall be continuously calculated for each VAV terminal zone. Continuously determine the maximum zone ventilation fraction (Z), the sum of the outdoor air requirements for all VAV terminal zones (Von) and the total supply airflow (Vst). This information shall be used in Equation 6.1 of ASHRAE Standard 62-99 to calculate the minimum required outdoor airflow (Vot). The minimum required outdoor airflow (Vot) setpoint shall be regularly recalculated based on the prevailing VAV zone conditions.
   c. The contractor shall submit a written sequence of operation and sample programming required to determine the minimum required outdoor airflow (Vot) setpoint.
   d. Prior to final system acceptance, a trend log of actual air system operation over a typical forty-eight hour period shall be required by the engineer and owner. System operating conditions to be logged include: critical space ventilation fraction, system supply air flow, calculated outdoor airflow setpoint, and actual measured outdoor airflow at 30-minute intervals.
2. Discharge Duct Static Pressure Setpoint:
   a. The building automation system shall continuously monitor the damper position of all VAV terminal units. The discharge duct static pressure shall be sensed directly at the discharge of each air handler. The sensor must be mounted in a non-turbulent location.
   b. When any damper is more than 95% (adj.) open, the supply fan discharge duct static pressure setpoint shall be reset upward by 5% (adj.) of the maximum system static pressure setpoint at a frequency of 10 minutes (adj.) until no damper is more than 95% open or the static pressure setpoint has reset upward to the system maximum setting or the inlet vanes (or frequency inverter) are at their maximum setting.
   c. When all dampers are less than 85% (adj.) open, the supply fan discharge duct static pressure setpoint shall be reset downward by 5% (adj.) of the maximum system static pressure setpoint at a frequency of 10 minutes (adj.) until any damper is more than 85% open or the static pressure setpoint has reset downward to the system minimum setting or the inlet vanes (or frequency inverter) are at their minimum setting.
   d. The control bands, setpoint increment values, setpoint decrement values and adjustment frequencies shall be adjusted to maintain maximum static pressure optimization with stable system control and maximum comfort control.

J. Fire Shutdown - The unit will shut down in response to a signal from the area smoke detector indicating the presence of a fire or other emergency condition. The unit will shut down in response to a signal from the general fire alarm system. Shutdown shall be via a hard wire connection independent of the BAS. An alarm shall be sent to the BAS indicating a fire alarm and shall shutdown HVAC air handling equipment.

K. Smoke Shutdown – The unit will shutdown upon detection of smoke from the duct mounted smoke detector.

L. Supply Temperature Reset – Reset AHU discharge air temperature to 60 degrees F when outside temperatures are at or below 50 degrees F.

PART 5 - CONTROL POINTS

5.01 CONTROL POINTS

A. Furnish as a minimum the points as shown on the drawings.

END OF SECTION

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK:

A. Extent of the piping systems work is indicated on the Drawings and schedules, and by the requirements of this section.

B. The construction requirements herein shall include appurtenant structures and buildings to which the piping system is to be connected.

1.02 RELATED DOCUMENTS:

A. The requirements of the General Conditions and Supplementary Conditions.

B. Refer to Specification Section 23 05 29 “Hangers and Supports for HVAC Piping and Equipment” for specification and installation requirements of the pipe support system.

C. Refer to Specification Section 23 07 00 “HVAC Insulation” for specification and installation of thermal insulation for the various types of pipe, fittings, and accessories specified in this section.

1.03 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications shall govern.

B. Firms regularly engaged in manufacture of piping products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years are approved.

C. Certify brazing procedures, brazes and operators in accordance with Section IX ASME Boiler and Pressure Vessel Code (ANSI B31.5). Two copies of the qualification test report and certification shall be submitted to the Architect.

1.04 DEFINITIONS

A. Pipe sizes listed are for outside diameter of the pipe (O.D.).

1.05 SUBMITTALS

A. Submittals shall include but shall not be limited to a diagram approved by the compressor manufacturer, to include the size and length of the refrigerant piping, all offsets and elbows required for the installation location of all valves, filter dryers, moisture and liquid indicators and flexible connectors where required.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPE:

A. All Pipe Sizes:

1. Type: Copper tubing of the pipe sizes listed.
2. Class: ACR Type L hard drawn tubing, ASTM B-88
3. Fitting: Sweat type wrought copper.
4. Joints: Socket brazed with 95-5 tin-antimony

B. Accessories: The refrigeration system shall include all accessories for complete and operable system. Accessories shall include, but not limited to: oil traps, filter dryers, expansion valves, sight glasses, solenoid valves, liquid charging, valves and strainers.

PART 3 - EXECUTION

3.01 GENERAL PIPE SYSTEM:

A. Nonferrous Metallic Pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses ferrous piping material, a separation must be maintained between pipes.

B. Cut pipe accurately to measurements, and ream free of burrs and cutting splatter. Carefully align and grade pipe, and work accurately into place. Fittings shall be used for any change in direction. Provide for expansion at every building expansion joint. Protect open pipe ends to prevent trash being placed in the lines during installation. Clean all dirt and cutting debris from pipes before making the next joint.

C. Install piping so as to preserve access to all valves, air vents, and other equipment and to provide the maximum headroom possible.

D. Joints shall be made with nitrogen gas in the pipes to prevent oxidation. All piping shall be installed parallel to or at right angles with building walls, columns, and partitions.

E. Clean inside of refrigerant lines with methyl alcohol before assembly and take care thereafter to prevent foreign matter from entering and being sealed in. Cut pipe ends square and de-burr. Clean pipe and fitting with #00 steel wool before joining.

3.02 TESTS:

A. Test refrigerant piping, equipment, valves and fittings at a pressure of 245 psi on the low side and 300 psi on the high side by introducing refrigerant and dry carbon dioxide ($C0_2$) or nitrogen throughout the refrigerant circuit. Bubble test joints with soap lather, clean joints of soap and leak-test with a halide torch. The system shall be pumped out and the entire circuit placed under 27 inches of vacuum and allowed to stand sealed off for a period of 8 hours, without any loss of vacuum.

B. Submit an affidavit signed by the Architect's representative and the Contractor's representative stating they have witnessed and approved the dehydration test.

END OF SECTION

SECTION 23 30 00 HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. All work specified in this Section is subject to the provisions of Division 23.

B. Ductwork shall be provided to meet the minimum capacities indicated, shall meet all constraints of construction, and shall comply with all Specification Sections.

C. See Section 23 07 00, “HVAC Insulation” for ductwork insulation.

D. No ductwork shall be fabricated until fabrication shop drawings have been prepared, submitted and reviewed.

PART 2 - PRODUCTS

2.01 DUCTWORK - GENERAL:

A. SMACNA Standards indicated shall mean standard published by the Sheet Metal and Air Conditioning Contractor's National Association, Inc. Ductwork shall be constructed in complete conformance with the latest edition of the SMACNA Manual. Duct classification shall be as follows:

1. From air handling unit to all terminal units: High Pressure – 6 inches static pressure, to 10 inches static pressure, Class A seals.
2. From air handling unit to all terminal units: Medium Pressure – 6 inches static pressure, Class A seals.
3. Round/oval outside air ductwork to supply fans: Medium Pressure – 6 inches static pressure, Class A seals.
4. From terminal units to diffusers, toilet exhaust ductwork: Low Pressure – 1 inch static pressure, Class B seals.
5. All other supply, return, and outside air ductwork: Low pressure – 2 inches static pressure, Class A seals.

B. Ductwork – High and Medium Pressure: Provide all ductwork as indicated in these documents for each and every air conditioning system. This includes all mains, all branches, related fittings and accessories. All duct and fittings shall be manufactured by the same company. Ductwork shall be round, oval or rectangular as indicated on drawings. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. All round and oval high and medium pressure supply air ductwork from each air handling unit for the first twenty feet shall be perforated acoustical (K-27 or equal). All return and outside air ductwork shall be lined with duct liner. Additionally, each branch duct which connects to the main supply air duct within the first twenty (20) feet from the unit shall be perforated acoustical for the first five (5) feet. All supply ductwork from each VAV and fan-powered box shall be lined through the first branch or take-off for a minimum of five feet. High and medium pressure ductwork may be 1 inch thick, double-wall, acoustical duct (K-27 or equal), at the Contractor's option. All branch takeoffs in high and medium pressure ductwork shall be made with conical, bell mouth, or lateral fittings.

1. Sizes given shall be considered to be the minimum, and any conversion from the given shape shall be made without increasing air velocity of friction losses. Double wall duct shall be insulated between liners for the first 20'-0". Liner material shall be 1 inch thick, 3 lb. per cubic foot density fiberglass as noted above. All other internally insulated ductwork shall be1 inch thick, 1-1/2 lb. cubic foot density fiberglass duct liner. Secure liner with spray-on adhesive and stick pins and clips. Liner shall have black neoprene face in contact with the air stream. Liner shall meet all requirements for Flame Spread and Smoke Developed ratings; i.e., NFPA 25/50. Thermal conductivity for duct liner insulation shall be K = 0.24 Btu-in. per sq. ft. per degrees F per hour at 75 degrees F mean temperature. All duct dimensions indicated are net clear inside dimensions.
2. Rectangular duct liner for first 20'-0" shall be 1 inch thick, 3 lb. per cubic foot density fiberglass noted above. All other internally insulated ductwork shall be 1 inch thick, 1-1/2 lb. cubic foot density fiberglass duct liner. Secure liner with spray-on adhesive and stick pins and clips. Liner shall have black neoprene face in contact with the air stream. Liner shall meet all requirements for Flame Spread and Smoke Developed ratings; i.e., NFPA 25/50. Thermal conductivity for duct liner insulation shall be K = 0.24 Btu-in. per sq. ft. per degrees F per hour at 75 degrees F mean temperature.

D. Ductwork – Rectangular Low Pressure: Provide all ductwork as indicated in these documents for each and every air conditioning system. This includes all mains, all branches, related fittings and accessories. All duct and fittings shall be manufactured by the same company. Ductwork shall be round, oval or rectangular as indicated on drawings. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Low pressure duct including fittings shall be constructed of steel sheet metal. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.

E. Elbows: The construction of radius type elbows in rectangular ductwork shall maintain a centerline radius of 1-1/2 times the cross sectional dimension of the duct in the horizontal plane of the duct turn. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Where radius turns are prohibited, hard 90 degree elbows with turning vanes may be installed. All duct fittings (tees, elbows, etc.) metal gauges for the various fittings shall be as listed in the latest edition of SMACNA. Ductwork fabrication shop drawings shall including drawings of fittings as a part of the shop drawing submittal.

F. Turning Vanes: Turning vanes shall be installed in all 90 degree square and rectangular elbows and at other locations as shown. Vanes shall also be installed on all turns greater than 40 degrees in all rectangular supply, return, outside air and exhaust ductwork. All turning vanes shall be constructed of galvanized steel, two metal gauges heaver than that of the adjacent ductwork. All vanes shall have minimum 4" radius of the curvature, a maximum 4" spacing and no less than 3 vanes in each installation. The turning vanes shall be double thickness type, with vanes secured to the runners and runners secured to the duct. Elbows in round ductwork and other radius elbows shall have an inside radius equal to the diameter of the duct. All duct specialties, i.e. turning vanes, shall be as listed in the latest edition of SMACNA.

G. Ductwork – Round/Oval Low Pressure; Low pressure round ducts up to and including 12 inches diameter shall be longitudinal lock seam construction. Low pressure round ducts larger than 12 inches and all medium pressure round ducts shall be spiral lock seam construction. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.

1. Girth joints in ducts up to and including 12 inches shall be beaded crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 8 inches on centers and with a minimum of 3 screws in each joint. The beaded-crimp joint shall provide at least a 1 inch lap to accommodate the sheet metal screws.
2. Girth joints in ducts larger than 12 inches shall be the beaded sleeve type. The beaded sleeve joints shall be fabricated of the same gauge galvanized sheet steel and the duct shall be a minimum of 3 screws in each section.

H. Support for Rectangular Ductwork: For ductwork with static pressures greater than 2 inches, provide and install sufficient angle iron steel supports to maintain the rectangular configuration. The angle iron sizes and the dimensions of spacing of the supports shall be as listed by the latest edition of SMACNA.

I. Hangers and Supports: Duct hangers and supports shall be in accordance with Section IV (pages 4-1 through 4-13) of the referenced SMACNA Standard, except:

1. Hangers shall be spaced not over 8'-0" on centers.
2. For rectangular ducts with longest dimensions up through 60 inches, hangers shall be the galvanized steel strap type; with the longest dimension 61 inches and larger, hangers shall be trapeze type constructed of galvanized steel angles with round hanger rods. Sizes for strap hangers and trapeze angles and rods shall be based on duct size as scheduled in the SMACNA Standard, Table 4-1 (page 4-8) for strap hangers and Table 4-3 (page 4-10) for trapeze hangers.
3. For round ducts, hangers shall be galvanized steel strap hangers. Sizes and number of strap hangers shall be based on duct size as scheduled in the SMACNA Standard, Table 4-2 (page 4-9). For duct sizes requiring 2 hangers, the hanger supports shall be minimum 3/8 inch round steel hanger rods.
4. Exposed ductwork on the roof shall be welded, watertight construction and shall be painted with an asphaltic based paint to inhibit rust. Ductwork passing through roof curbs shall be flashed watertight.

2.02 DOUBLE WALLED, INSULATED, SPIRAL DUCTWORK:

A. All exposed round ductwork throughout this project shall be doubled walled type with full thick insulation between walls. Ductwork shall be as manufactured by Hamlin Sheet Metal, Inc., or as approved by the Engineer**.**

B. Duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which will seal the duct joint airtight without use of a duct sealer when installed as per manufacturer's recommendations.

C. All ductwork and fittings shall be constructed as per SMACNA's Duct Construction Standards to 10 inches W.C. pressure. Duct and fittings shall be constructed of a minimum of G-60 galvanized steel in accordance with ASTM-A-653 and A-924. All fittings shall come factory equipped with a double lipped U-profile, EPDM rubber gasket. Gaskets shall be manufactured by gauge and flexibility to meet all published performance criteria.

D. Gaskets shall be classified by U.L. to conform to ASTM-E84-91a and NFPA-90A flame spread and smoke developed ratings of 25/50.

E. All fitting ends from 3 inches to 12 inches diameter shall have rolled over edges. Elbows from 3 inches to 12 inches diameter shall be constructed of two piece die stamped and continuously stitch welded. Elbows 14 inches diameter and larger shall be standing seam gorelock construction. All radiuses of 90 degrees and 45 degrees shall be 1.5 times the elbow diameter unless noted otherwise. The radius of all 15 degree, 30 degree and 60 degree elbows shall be 1.0 times the elbow diameter.

F. Volume dampers shall be fitting sized to fit into the spiral ductwork. Dampers to be complete with the following:

1. Locking quadrant with blade position indicator,
2. 2 inches sheet metal insulated stand-off,
3. Integral shaft/blade assembly,
4. Shaft mounted, load bearing bushings,
5. Gasketed shaft penetrations to minimize leakage.

G. Spiral Ductwork: Spiral ductwork shall be calibrated to the manufacturer's published dimensional standards. All spiral ductwork 14 inches diameter and larger shall be corrugated for strength and rigidity. Seam slippage shall be reduced by means of a flat seam and a mechanically formed indentation spaced along the spiral seam.

H. Leakage: Spiral duct system performance shall meet SMACNA's Leakage Class 3 requirements at the system design static pressure as indicated on the Contract Documents. Duct pressures shall not exceed minus 20 inches W.G. or plus 12 inches W.G.

2.03 MANUAL DAMPERS AND DAMPER HARDWARE:

A. Splitter dampers shall be constructed of not less than 20-gage galvanized steel sheet. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12 inches.

B. Volume Control Dampers:

1. Dampers shall be single blade butterfly type in ducts up to and including 12 inches by 12 inches size; for ducts larger than 12 inches by 12 inches, in either or both dimensions, the dampers shall be the multi-blade type. All dampers in O.A. ductwork shall shut tightly and have vinyl edge seals.
2. Single blade butterfly dampers shall be constructed of not less than 16-gage galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator.
3. Dampers larger than 12 inches in either direction shall be multi-blade dampers and shall be the opposed blade type, constructed of not less than 16-gage galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6 inches and the top and bottom edges of the blade shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator.

4. When dampers occur above other than lay-in ceilings, provide Young Model No. 270-275 controller mounted on top of diffuser with the 5020CC damper. Damper assembly complete with supports, bearings and Young No. 1 regulators with an additional end bearing and chromium plated ceiling escutcheon.

C. Hardware for Manual Dampers:

1. Splitter damper hardware - When neither dimension of a damper exceeds 18 inches, the damper shall be provided with a ball joint bracket attached to the outside of the duct. The bracket shall have a setscrew for securing damper rod in position. The damper operating rod shall be not less than 1/4 inch diameter steel rod and shall be secured to the damper blade with a clip. When either dimension of a damper exceeds 18 inches, the damper shall be provided with 2 ball joint brackets and rods. The rods shall be located at quarter points on the damper.
2. Duct mounted regulators with operating handle and locking quadrant shall be provided on manual volume control dampers.
3. Damper hardware shall be Ventfabrics, Young Regulator of Duro-Dyne provided the equipment meets or exceeds the Contract Documents.

D. Dampers shall be Ruskin or approved equal by Air Balance, Price, or American Warming and Ventilating.

2.04 FLEXIBLE DUCTWORK:

A. Flexible ductwork shall be Class 1, UL 181-air duct with an aluminized mylar or polyester inner liner laminated to a corrosion resistant steel wire helix. Aluminum helix is not acceptable.

B. A 1 inch thick, one (1) pound density fiberglass insulation and vinyl outer jacket shall cover the wire helix.

C. The maximum allowable length of low pressure flexible ductwork shall be 4'-0" and shall be limited to short run-outs and end runs connected to round neck ceiling supply diffusers. Provide a spin-in fitting with integral volume damper at all flexible run-out connections in low-pressure ductwork.

D. The maximum allowable length of medium pressure flexible ductwork shall be 1'-0" and shall be limited to short run-outs connecting FPB and VAV units to medium pressure sheet metal ductwork.

E. Flexible ductwork shall be designed for pressures up to 4 inches W.G. for low-pressure ductwork and 10 inches W.G. for medium pressure ductwork.

F. Low pressure flexible ductwork shall be Clecon Model Flex 28 VF Series or Genflex Type SLS-181 or Wiremold Type WGC and medium pressure flexible ductwork shall be Clecon Model FLEX 28 VF Series, Genflex 1HPL-181 or Wiremold Type WGC.

2.05 FLEXIBLE DUCT CONNECTIONS:

A. Flexible duct connections shall be non-combustible, installed at all belt-driven equipment and where shown. Material shall be glass fabric double coated with neoprene (30 0z. per square yard minimum) and shall be Vent Fabrics, Duro-Dyne or Young Regulator, provided the equipment meets or exceeds the Contract Documents. Provide duct supports on each side of flexible connections.

2.06 FIRE DAMPERS/COMBINATION FIRE/SMOKE DAMPERS:

A. Fire dampers (FD) shall be provided at all penetrations through fire rated walls and partitions. Fire dampers shall be UL labeled and shall be Type B (blades out of the air stream) or Type C (round or oval duct). Damper shall be Ruskin Model 1BD2 or approved equal.

1. Hat channel frame shall be 16 gauge minimum galvanized steel with tabbed corners for reinforcement. Bearings shall be stainless steel sleeve. Blades shall be airfoil shaped double skin construction with 14-gage equivalent thickness. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in blade edge (adhesive or clip fastened seals not acceptable) and shall withstand 450 F. Jamb seals shall be flexible metal compression type.
2. Each damper shall be 1-1/2 hour rated under UL555, and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems. Leakage rating under UL555S shall be Class 1 (4-cfm/sq. ft. at 1 inch W.G. and 8 cfm/sq. ft. at 4 inches W.G.)
3. Dampers shall operate (open and close) under HVAC system operating conditions with pressures of at least 8 inches W.G. in the closed position and 4000 fpm air velocity in the open position.
4. In addition to the leakage ratings, the dampers and their actuators shall be qualified as a single entity under UL555S to 350 degrees F elevated temperature. Actuators shall be installed at time of damper fabrication. Dampers shall be equipped with factory supplied caulked sleeve. All wiring or piping material required to interconnect the actuator with detection and/or alarm or other systems shall be furnished by others. Damper shall be Model FSD60 or approved equal.
5. FireStat: Each combination fire/smoke damper in smoke exhaust system or smoke wall shall be equipped with a UL Classified FireStat equal to Ruskin Model TS150. The FireStat shall electrically and mechanically lock damper in a closed position when duct temperatures exceed 212 degrees F and still allow appropriate authority to override the FireStat and operate the damper as required for smoke control functions. Damper must be operable while temperature is above 250 degrees F. FireStat package shall include two position indicator switches linked directly to the damper blade to remotely indicate damper blade position. FireStat and position indicator switches shall permit electrical interface with smoke detectors, building fire alarm systems, and remote indicating/control stations. FireStat shall be equipped with High Limit Temperature Sensor that meets all NFPA 92A requirements by returning damper to fire protection mode when temperatures reach 350 degrees F which is the operational limit of the damper and actuator assembly.
6. Electric actuator shall be 120 volts ac, 70 watts running and 25 watts while in the holding mode. The actuator shall be designed to spring the damper closed upon loss of power in less than 20 seconds. Stall type actuators are unacceptable. Damper actuators shall be factory-installed on the damper and tested to verify cycle timing.

B. Combination fire/smoke dampers shall be provided at penetrations through walls, partitions, and floors with fire/smoke rating. Combination fire/smoke dampers shall be UL labeled.

C. Acceptable manufacturers of fire dampers are: Ruskin, or Greenheck provided the equipment meets or exceeds the Contract Documents.

2.07 ACCESS DOORS:

A. Provide a duct access door at each fire and/or smoke damper where required for access. Access doors 18 inches by 18 inches and larger shall have a continuous hinge on one side with latch on the other side. Access door shall be designed for five (5) times the pressure of the duct in which it is mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting or replacing thermal links. Access doors shall be double metal faced, internally insulated same as duct, and provided for gasket seal. Access doors downstream of fire dampers in medium pressure ductwork shall be the implosion type.

B. Coordinate the location of access doors above inaccessible ceilings with the Architect.

C. Access doors shall be equal to Ruskin Model"ADR16" for round duct and Model "ADC22" for square ductwork.

2.08 COMPUTER CHECK:

A. Allow the cost of making an acceptable computer check of the air terminal units and duct design as shown on the sheet metal shop drawings.

B. Do not fabricate ductwork for computer designed medium pressure systems without written approval of computer check from engineer.

2.09 AIR EXTRACTORS:

A. Provide in duct mounted supply outlets and takeoff or extension collars to supply outlets. Air extractors shall be factory-fabricated and factory or field assembled units consisting of curved turning vanes or louver blades for uniform air distribution and change of direction with minimum turbulence and pressure loss. Where adjustable devices such as air deflectors or extractors are inaccessible they shall be provided with means for adjustment and position lock external to the duct in which they are located. Similar to Young Regulator Model No. 1.

2.10 DUCT INSTRUMENT TEST HOLES:

A. Provide for each system four (4) test holes two (2) in supply duct and two (2) in return air plenum at opposite ends near air handling units with screwed caps. Also, at duct mounted coils and electric duct heaters provide one (1) on either side of the coil or duct heater.

2.11 REGISTER AND GRILLE CONNECTION:

A. Where take-offs are on the side of a duct, clinch lock short tee sections onto trunk. Install collars with slip joints and 3/4 inch flange at outlet end. At plastered surfaces set collars exactly flush with plaster surface (mechanic must be on job to make adjustments during plaster application). Set flange face so as to receive register gasket, and be concealed by register flange. Collars may be deleted where mounting frames are furnished with registers.

B. Install boots above lay-in ceilings simultaneously with ceiling work; mechanic must be on job during this phase of construction work.

C. At return relief and exhaust grilles 48 inches or more in either dimension, collars shall be 1 by 2 by 1/8 inch steel angle frames with corners mitered, welded and ground smooth. Frames in ceilings shall be independently suspended from the ceiling structure.

D. Interior of ductwork visible through grilles and diffusers shall be painted flat black.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install all ductwork and accessories as shown and in accordance with applicable SMACNA Standards.

B. All joints in ductwork shall be sealed with a fire retardant duct sealant. Tape is not acceptable.

C. Duct liner shall be cut to provide overlapped and compressed longitudinal corner joints. Liner shall be installed with coated surface facing the air stream. Duct liner shall be adhered to the ductwork with a 100 percent coverage of the sheet metal surfaces using a fire retardant adhesive applied by spraying. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. All leading and trailing edges shall be secured with sheet metal airfoils.

D. Sound Proof Construction for Duct Penetrations is required for openings between ductwork and interior spaces. The method for soundproofing shall be as follows:

1. Fill openings with fibrous glass blanket or board for full depth of penetration.
2. Caulk each side of opening with non-hardening, non-aging caulking compound equal to Johns-Manville "Duxeal".
3. Penetrations through fire-rated partitions and shafts shall be sealed with Dow-Corning RTV fire-retardant foam.
4. Duct system sound levels shall be maintained at such as level as to not exceed a maximum of NC 35 for all spaces. Duct fabrication and installation shall be altered if noise levels are exceeded at no cost to the Contract.
5. All exterior kitchen exhaust ductwork shall be painted with rust inhibiting primer.
6. Unavoidable obstruction: Where structural elements or pipes must pass through a duct, provide two-piece streamliners, and enlarge duct to compensate for net loss of area. Round pipes and rods smaller than three (3) inches need not have special treatment. Note: This provision will not be used to justify obstructions, which can be avoided.

E. Splitter Dampers:

1. Provide where shown on drawings. Fabricate blades of same thickness galvanized steel as the duct where used; minimum 20 gauge thickness
2. Anchor splitters at the air entering edge by 3/16 inch adjustable galvanized steel rods that pass through set screw clamps on the outside of duct. Use one (1) rod and clamp on splitters with leading edge up to 15 inches, (2) rods up to 30 inches, and on 15-inch centers above 30 inches.
3. When splitter dampers occur above other than lay-in ceilings, provide Young Model No. 270-275 Controller Mounted on Top of Diffuser with the 5020CC Damper. Damper assembly complete with supports, bearings and Young No. 1 regulators with an additional end bearing and chromium plated ceiling escutcheon.

3.02 PRESSURE TESTING OF DUCTWORK:

A. Testing Procedures: All pressure testing of ductwork shall be preformed prior to the installation of external insulation. Duct sealant shall be applied within the factory recommended temperature range and fully cured prior to any tests.

B. The contractor shall determine pressure range and capacity of the test apparatus to insure the pressure is suitable for the ductwork being tested.

C. Allowable leakage chart:

System Types	Minimum Test Press	Max Allowable Leakage
1) Fan coil systems, small exhaust/supply fans. Fractional HP fan systems.	0.5 inch W.C.	2 percent
2) Small split D.X systems	1.00 inch W.C.	2 percent
3) VAV and constant terminal units including LP downstream ductwork.	1.00 inch W.C.	2 percent
4) Single zone systems/ L.P. VAV and CAV systems, RA duct systems.	2.00 inches W.C.	2 percent
5) Constant volume ductwork in chases, concealed spaces, main R.A. ducts on VAV and CAV systems & main ducts on exhaust and/or supply systems.	3.00 inches W.C.	1 percent
6) Supply air ductwork to VAV and CAV terminal units	4.00 inches W.C	1 percent
7) High pressure induction system	6.00 inches W.C.	0.5 percent

D. Report of Test Data:

1. Once the testing of all duct systems has been completed, this contractor shall provide a report of leakage results that will include the following:
   a) The project name and location
   b) Date of test
   c) Name of person making test including the name of Architect, Engineers, Contractor, or witness to said test.
   d) Description of test including the sealing clarification and duct classification
   e) The design and actual test static pressure
   f) The design and actual leakage rate
   g) Duct test to conclude if test passed or failed

E. All pressure testing of ductwork shall be in accordance with the Associated Air Balance Council (AABC) standards for Total System Balance, 2002 Edition.

END OF SECTION

SECTION 23 34 00 HVAC FANS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Section 23 05 11, “HVAC General Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11 titled "HVAC Submittal Data" for the submittal and approval requirements regarding fan systems.

C. See other sections of these specifications that may specify accessories or features.

D. Refer to the schedules on the drawings where equipment capacities are not included in this section.

E. Review other sections of the specifications and the plans for services required to each piece of mechanical equipment. Any required accessories, appurtenances, or service omitted from the plans or specifications that are not called to the attention of the Architect at least 72 hours before bidding and corrected by addendum shall be provided as though shown.

F. V-belt drives shall be designed for not less than 150% of connected driving capacity and motor sheaves shall be adjustable to provide not less than 20% speed variation. Sheaves shall be selected to drive the fan at a speed to produce the scheduled capacity indicated on the drawings when set at the approximate midpoint of the sheave adjustment. Motors with V-belt drives shall be provided with adjustable bases.

G. Fan motor enclosure shall be the drip-proof type unless specifically indicated otherwise.

H. Roof-mounted fans shall be waterproof design so that water cannot enter the building through the fan housing, whether or not the fan is operating.

I. Belt driven power assemblies shall be mounted on vibration isolators.

J. Centrifugal fan wheel shall be statically and dynamically balanced.

1.02 COORDINATION

A. Motors required in connection with equipment shall be of sufficient size and speed for duty to be performed, not exceeding their full-rated load when driven equipment is operated at specified capacity under most severe conditions likely to be encountered.

B. Belt drives shall be adjustable "V" belt type. Selection shall be based on 150% of the motor horsepower. Selection shall be factory-set so that specified capacity is at midpoint setting, allowing 20% overall speed adjustment. Motors shall be selected on 110% of the brake horsepower required with a service factor of 1. Motors and/or drives shall be changed if required to delivery specified CFM should static pressure differ from that specified.

C. All exposed rotating machinery shall be equipped with guards.

D. Submit all equipment for approval.

1.03 SUBMITTALS

A. In accordance with Section 23 05 11, submittals shall be furnished for the following:

1. All fan sections, including motors and drives. All centrifugal fans, including motors and drives.
2. Ceiling and inline cabinet fans

B. Complete maintenance and operating manuals.

C. Sound power levels for all fans (Db and/or sone levels).

D. Provide fan curves for each fan showing CFM versus static pressure, horsepower and fan efficiency at the specified design point.

1.04 APPLICABLE STANDARDS:

A. All fans and power exhausters shall be listed in the current edition of AMCA and shall bear the AMCA seal.

B. Fan performance criteria:

1. Fans shall be scheduled on plans indicating manufacturer's name and model number, CFM, static pressure, sones, drive, horsepower and voltage. Fan motors 1/2 horsepower and larger shall be sized based on full design CFM at 115 percent design static pressure.

PART 2 – PRODUCTS

2.01 COORDINATION

A. Units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment form the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

2.02 FANS

A. Furnish and install all supply and exhaust fans as scheduled on drawings. Fans shall be of the type size and capacity as scheduled and shall be furnished as hereinafter specified and scheduled.

B. All fans shall have been statically and dynamically balanced prior to leaving the factory. Fans found vibrating noticeable in the field, due to damage in shipment, improper handling, etc., shall be removed and replaced at no additional cost to the Owner.

2.03 DESCRIPTION

A. Cabinet Fans:

1. Ceiling and inline cabinet fans as indicated on drawings shall have acoustically insulated housings and shall not exceed sound level ratings shown. Fans shall bear the AMCA Certified Ratings Seal and UL Label. Integral backdraft damper shall be chatter-proof. Fans shall have true centrifugal wheels. Face grille shall be of aerodynamic white egg crate design and provide 85% free area. Manufacturers shall submit vibration amplitudes and magnetic motor hum in decibels. Fans shall be provided with cord, plug, and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable without disturbing the housing. Fan motors shall be suitably grounded and mounted on vibration isolators. Fans shall be Greenheck or approved equal by Cook, Acme or Penn.

B. Ceiling and Inline Cabinet Fans:

1. Fans as indicated on drawings shall have acoustically insulated housings and shall not exceed sound level ratings shown.
2. Fans shall bear the AMCA Certified Ratings Seal and UL Label.
3. Integral back-draft damper shall be chatter-proof. Fans shall have true centrifugal wheels.
4. Face grille shall be aerodynamic white egg crate design and provide 85% free area.
5. Manufacturers shall submit vibration amplitudes and magnetic motor hum in decibels.
6. Fans shall be provided with cord, plug, and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable without disturbing the housing. Fan motors shall be suitably grounded and mounted on vibration isolators.
7. Fans shall be Greenheck, Cook or approved equal by Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.

C. Coordinate all work with other trades as necessary for proper interfacing.

D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 START-UP

A. An authorized representative of the equipment manufacturer shall make the initial start-up. The balancing contractor shall be responsible for final verification and reporting of all airflows.

3.03 ADJUSTMENT

A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 36 16 VARIABLE-AIR-VOLUME UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all required equipment, appurtenances, and accessories for a complete heating and cooling system.

1.02 RELATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10, “HVAC General Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11 titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. See other sections of these specifications that may specify accessories or features. Refer to the schedules on the drawings where equipment capacities are not included in this section.

1.03 COORDINATION

A. Equipment shall be of sufficient size and perform their operation at specified capacity under most severe conditions likely to be encountered.

B. All exposed rotating machinery shall be equipped with guards.

C. Submit all Variable Air Volume (VAV) equipment to Engineer of Record for approval.

D. Provide connections from ceiling mounted VAV terminal units to VAV controllers and unit mounted electric heating coils.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Units shall be as manufactured by one of the following:

1. Trane
2. Titus
3. Price
4. or as approved equal by engineer.

2.02 VARIABLE AIR VOLUME UNITS (VAV)

A. General: Furnish and install an operational variable air volume system as herein specified. The system shall be installed in accordance with this specification and the variable volume unit manufacturer’s printed recommendations.

B. Casing: Unit casings shall be completely factory assembled, manufactured of corrosion protected welded steel and fabricated with a minimum 26 gauge metal constructed to withstand the pressures encountered. All interior surfaces shall be acoustically and thermal insulated with one and one half PCF glass fiber, mat coated for erosion protection. The insulation shall meet NFPA 90A requirements per standard NFPA #225-ASTME84-50T. All units shall be provided with provision for hanger rod support at each corner. Static regain computer duct design program must be run and provided by unit manufacturer. Program output must include thorough sound analysis and static pressures at all points in the system.

C. Ratings: All pressure drops capacities and sound data will be certified as complying with ARI Standard 880 and bear the ARI seal.

D. Operation: Air volume control shall be accomplished at the unit inlet. The unit shall modulate from design air-flow to scheduled minimum air-flow as indicated. The device shall be capable of a tight shut-off and a three inch pressure differential. Air volume modulation shall be accomplished by an air valve or damper. The device shall be formed of aluminum, either die cast or extruded. It shall be permanently fixed to the control shaft with shall operate with bushings or bearings requiring no lubrication. The air modulation device shall be designed for linear control over the full modulation range. Unit shall be capable of maintaining air-flow to within plus or minus 5 percent of rated unit airflow set-point with 1.5 duct diameters straight duct upstream from the unit. A calibrated air-flow measuring device shall be provided with each control unit. It shall include sensing taps and calibration chart unit mounted. Units shall have pressure volume regulators.

E. Heating Section: Each VAV unit shall be equipped with an electric heating element of the helical configuration. The heater section shall be attached to the discharge end of the air valve. The space temperature shall be controlled by a wall mounted thermostat that cycles the heating element to maintain space conditions through the unit control module. Provide electrical power/circuitry as required for the heating elements at each unit and the low voltage circuitry required for the controls of the VAV system. See Electrical Division 26 for power circuitry.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices. Coordinate all work with other trades as necessary for proper interfacing.

C. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 START-UP

A. An authorized representative of the equipment manufacturer shall make the initial start-up. The balancing subcontractor shall be responsible for final verification and reporting of all air and water flow rates.

3.03 ADJUSTMENT

A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is subject to the provisions of HVAC General Requirements Section 23 05 10.

B. Grilles, registers and diffusers shall be provided to meet the minimum capacities indicated on the drawings and shall meet all constraints of construction.

1.02 COORDINATION

A. The grilles, registers and diffusers of one manufacturer have been used as the basis of design. Any modifications to ductwork, controls, building structure, etc., that result from the use of any other units shall be coordinated with all trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional costs to the Contract.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Approved equal products which are ADC tested, rated and certified may be provided. Manufacturers listed below are acceptable:

1. Price,
2. Metalaire
3. Titus.

B. All devices selected must meet or exceed all the requirements of these Contract Documents.

2.02 DESCRIPTION

A. Color of all grilles, registers and diffusers are to be selected by Architect. Also, ceiling mounted items shall be selected to fit the ceiling in which they are applied.

B. Air distribution devices shall be as follows:

1. Exhaust air register shall have a fixed core of 1/2 by 1/2 by 1/2 inch aluminum squares. Register shall have opposed blade dampers. Registers shall be as scheduled on plans or equal.
2. Return air grilles (ceiling mounted) shall have a fixed core of 1/2 by 1/2 by 1/2 inch aluminum squares. Grilles shall be as scheduled on plans or equal. Finish shall be white baked enamel.
3. Supply air diffusers (square) shall be extruded aluminum rectangular to round neck diffusers with T-Bar flange frames. Diffusers shall be as per scheduled on plans or approved equal.

4. Sidewall air registers shall have 1inch framed border and aluminum face bars on 1/2

inch centers. Unit shall be extruded aluminum with natural anodized finish. Sidewall registers shall be as scheduled on plans or approved equal.

5. Linear slot diffusers shall be extruded aluminum with adjustable pattern controller. Linear diffusers shall be as per scheduled on plans or approved equal.

C. The Contractor shall verify that all air distribution devices are suitable for the ceiling and wall types in which they are installed.

D. All air distribution devices shall be shown in grille, register and diffuser schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grilles, registers and diffusers shall be installed as indicated in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

B. All grilles, registers and diffusers shall be selected and submitted at a NC level of 35 or less.

C. The grilles, registers and diffusers shall be tested and adjusted to provide the scheduled capacities.

END OF SECTION

SECTION 23 41 00 PARTICULATE AIR FILTRATION

PART 1 – GENERAL

1.01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Contract Drawings.

B. Descriptions:

1. Air filters for Heating, Ventilating and Air Conditioning.
2. Definitions: Refer to ASHRAE 52.2 (MERV) for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), atmospheric dust spot efficiency, dust-holding capacity, etc.

1.02 COORDINATION

A. The Filters of one manufacturer (Farr) have been used as the basis of design. Any modifications to ductwork, building structure, ect., that result from the use of any other units shall be coordinated with all trades; this coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the Owner.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed below are acceptable: Farr, American Filter, or Cambridge.

B. All devices selected must meet or exceed all the requirements of the Contract Documents.

C. Manufacturer's Literature:

1. Holding frames
2. Side access housing
3. Throwaway filters (T.A.)

2.02 TEMPORARY FILTERS

A. Temporary Filters: For temporary use of HVAC systems during the construction period, all systems shall be equipped with replacement filters as described herein:

1. For HVAC systems with pre-filter and final filter banks, contractor to provide to the owner two complete sets of pre and final sets of replacement filters.
2. HVAC systems with only one filter bank; provide the owner with two complete sets of replacement filters.
3. Refer to Section 23 05 10 "HVAC General Requirements"; paragraph 1.04-Temporary HVAC for the operation of HVAC systems during the construction period.

B. Side Servicing Housing: Minimum 16-gage galvanized steel, or aluminum, completely factory assembled with upstream and downstream flanges for connection into the duct system. Furnish housing with sufficient length to provide for a fully extended filter.

C. Access Doors: Double skin insulated, on each side of the housing with continuous gasketing on the perimeter a positive air lock.

D. Filter Slide Channels: Channels shall incorporate a positive-sealing gasket material to seal the top and bottom of the filter cartridge frames to prevent bypass. Provide factory installed gasketing to prevent leakage between cartridges, and between cartridges and doors.

E. Holding Frame System: To be constructed of 16-gage galvanized steel. Frames to be equipped with polyurethane foam gaskets and filter centering dimples. All framing members shall be permanently gasketed to prevent any bypass of air.

F. The framing system shall include a factory installed positive sealing device for each row of filters. This device shall allow for easy installation and removal of cartridges and shall insure the seal between the gasketed filter elements while the bank is in operation.

G. Provide Magnehelic Differential Pressure Gauges at each air unit's filter section. Gages to be nominal 4 inches diameter with a zero to 2 range.

2.03 PRE-FILTER 2 INCHES THICK, MERV VALUE 5 (DISPOSABLE)

A. Filter shall be equal to Farr 30/30 series, 2 inches thick, pleated, of the disposable type. Filter media shall consist of non-woven cotton fabric with supporting grid and frame mounted. The filter shall be listed by Underwriters Laboratories with Class 2 Classification.

B. The filter media shall have an efficiency resistance per MERV standards in accordance with ASHRAE Testing Standard 52.2. The initial resistance shall not exceed 0.28 inches W. G. at 500 FPM velocity.

C. The media shall be supported on a wire grid with an effective free area of 96 percent. The wire grip to be bonded to the filter to prevent media from pulling away.

D. The holding frame shall be constructed of 16-gage galvanized steel. The frame shall be gasket equipped and held in place with spring loaded fasteners.

2.04 FILTERS 4 INCHES THICK, MERV VALUE 5 (DISPOSABEL)

A. Filter shall be equal to Farr 30/30 series, 4 inches thick, pleated, of the disposable type. Filter media shall consist of non-woven cotton fabric with supporting grid and frame mounted. The filter shall carry an Underwriters Laboratories as Class 2 Classification.

B. The filter media shall have efficiency per ASHRAE Test Standard 52.2 MERV values. Filters shall have an average arrestance of 90-92 percent, in accordance with the Standard Testing.

C. The media shall be supported on welded wire grid with an effective free area of not less that 96 percent. The wire grid to be bonded to the filter to prevent media from pulling away.

D. The enclosing frame shall be constructed of a rigid, heavy duty beverage board with diagonal support members bonded to each side of the filter to insure pleat stability. The inside periphery of the enclosing frame shall be bonded to the filter pack to eliminate possibility of air bypasses.

E. The holding frame shall be constructed of 16 gage galvanized steel. The frame shall be gasket and held in place equipped with spring loaded fasteners.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supports, filters, housing and gages in accordance with manufacturer's instructions.

3.02 START-UP AND TEMPORARY USE

A. Prior to the start-up of all air handling units, all AHU's, and plenums to be cleaned inside and out to the satisfaction of the ENGINEER.

B. Provide and install new filter media as specified into each air system. Provide and deliver replacement filters to the Owner as directed by the Engineer.

3.03 SPARES

A. Provide two (2) extra sets of replacement filters of each type for each air system.

END OF SECTION

SECTION 23 62 00 PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified is subject to the provisions of Section 23 05 10, “HVAC General Requirements”.

1.02 COORDINATION

A. The units of one manufacturer have been used as a basis of design. Any modifications to ductwork, piping, wiring, building structure, etc., that result from the use of any other units shall be coordinated with all trades prior to delivery of approved equipment from the manufacturer to the job site. Any costs incurred because of these modifications shall be the responsibility of the Contractor.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The manufacturer shall have a local distributor with repair parts in stock or have access to repair parts within a 24-hour period. The following manufacturers are acceptable on this project:

1. Trane
2. York
3. Lennox

2.02 CONDENSING UNIT

A. Air-cooled outdoor unit shall be factory assembled into a weatherproof cabinet. Unit shall be UL Listed and comply with ARI Standard No. 240.

B. Cabinet shall be heavy-gauge, zinc coated steel, phosphatized, painted with an epoxy resin primer (exterior) and finished with an acrylic topcoat. Electrical and refrigeration connections shall be located at accessible pints. Removable panel shall allow access to all components and connections. Drainage hole shall be provided in drain pan for removal of coil condensate.

C. Condensing units shall consist of the following components: compressor(s), condenser coil, condenser fans, refrigerant receiver, sight glass charging valves, controls, precharged with refrigerant, filter dryer, low pressure cut-outs, crankcase heater, and service valves.

D. Compressors up to 20 tons capacity shall be welded steel, hermetic type.

E. Compressors shall be equipped with built-in crank case heaters, high/low pressure cutouts and anti-slugging controls.

F. Condenser coils shall be constructed with cooper tubes that are mechanically bonded to aluminum fins. Coils to be factory pressure tested to 425 psig. Condenser coils shall include a protective, coated, metal grille guard on all sides of unit.

G. Condensing fans shall be propeller type, with direct drive motors. Fans shall be statically and dynamically balanced at factory. Motor shall be waterproofed, heavy duty, ball bearing type with built-in thermal overload protection.

H. Defrost controls shall be activated by ambient temperature on coil. Provide a timer control to activate defrost cycle if coil temperature is low enough to cause frosting conditions. On split system with more than one circuit of refrigeration, provide controls that will prevent simultaneous defrosting of each circuit.

I. Provide an outside thermostat to sense outside ambient temperature, set at 42 degrees F to control operation of electric resistant heat.

J. See capacities and unit characteristics as scheduled on Contract Documents.

2.03 CONTROL SYSTEM

A. Unit shall be complete with a manufacturer's supplied solid state temperature controls package.

2.04 WARRANTY

A. Condensing units to be complete with manufacture's five-(5) year, non-prorated parts, labor and refrigerant warranty.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Condensing units and associated items shall be installed in complete conformance with the manufacturer's recommendations and these Contract Documents.

B. All low voltage wiring shall be installed in conduit by a licensed electrician. Low voltage control wiring shall be installed under this division. All line voltage wiring (115V and higher) shall be installed under Division 26, Electrical.

END OF SECTION

SECTION 23 73 00 INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 – GENERAL

1.01 GENERAL

A. Manufacturer must clearly define any exceptions made to the Plans and Specifications Mechanical contractor is responsible for expenses that occur due to exceptions made.

B. Unit must be specifically designed for outdoor installation. Weatherized indoor air handlers are not acceptable for outdoor application.

C. Fabricate units with fan or fan and coil section plus accessories, including heating coil, cooling coil, mixing box section, filter section, coil section(s), air flow measuring station and final filter section.

D. Unit casing shall be leak-proof and constructed to withstand suction pressure of 2.0 inch water gauge.

1.02 RELATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Section 23 05 10 “HVAC General Requirements” apply to all work specified in this Section.

B. Refer to Specification Section 23 05 11 titled "HVAC Submittal Data" for the submittal and approval requirements regarding the piping system.

C. Furnish and install all required equipment, appurtenances, and accessories for a complete heating and cooling system.

D. Refer to the contract drawings where equipment capacities and characteristics are scheduled.

1.03 COORDINATION

A. Units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

B. Motors required in connection with equipment shall be of sufficient size and speed for duty to be performed; not exceeding their full-rated load when driven equipment is operated at specified capacity under most severe conditions likely to be encountered.

C. Belt drives shall be adjustable "V" Belt Type. Selection shall be based on 150 percent of the motor horsepower. Selection shall be factory-set so that specified capacity is at midpoint setting, allowing 20 percent overall speed adjustment. Motors shall be selected on 110 percent of the brake horsepower required with a service factor of 1. Motors and/or drives shall be changed if required to deliver specified CFM should static pressure differ from that specified. All exposed rotating machinery shall be equipped with guards.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Air Handling Unit shall be equal to one of the following:

1. Trane
2. York
3. Lennox.

2.02 CENTRAL-STATION AIR-HANDLING UNITS

A. Casings:

1. Construct casings of minimum 16-gage G90-u galvanized steel structural frames and base. Construct double wall panels of minimum 18-gage G90-u galvanized steel exterior panels and minimum 22-gage solid G90-u galvanized steel interior panels. Contractor shall be responsible to provide connection flanges and all other framework that is needed on unit to ensure that removal of unit's double wall panels shall not affect structural integrity of unit.
2. Panels shall be fully removable to allow for a proper way to thoroughly clean panels of microbial growth and to access internal parts. Secure panels to structural frames with yellow di-chromate plated screws. If panels are not removable, then manufacturer shall provide access sections with doors between all internal components to ensure access for cleaning of the air handler.
3. Casing shall have removable full size access panels or double wall doors as indicated on the drawings. Construct access doors of minimum 18-gage G90-u galvanized steel exterior panels and minimum 22-gage perforated G90-u galvanized steel interior panels. Provide automotive style neoprene gasket around full perimeter of access doors to prevent air leakage. Provide "ventlock" style non-corrosive allow latches operable from the inside or outside of unit. If access doors do not open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement. Insulate access doors with 2 inches thick 1-1/2 LB per cubic foot density, matte faced, fiber glass insulation.
4. Insulate casing sections with 2 inches thick 1-1/2 LB per cubic foot density matte faced fiberglass insulation. Provide double wall casing construction and encase insulation between exterior and interior casing panels such that no insulation is exposed to air-stream. Insulate all structural channels connected to casing panels and cover openings in structural channels with galvanized steel. Insulation shall comply with NFPA 90A.

B. Fans:

1. Provide fan sections with double width, double inlet centrifugal fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. All fan wheels shall be keyed to fan shaft to prevent slipping.
2. Mount fans on minimum 16 gauge steel isolation bases. Internally mount motors on same isolation bases and internally isolate fans with 2 inch spring isolators. Install flexible canvas ducts between fan and casings to ensure proper isolation. Flexible canvas ducts shall comply with NFPA 90A. If no flexible canvas duct is provided, then the entire unit shall be externally isolated from the supply ductwork and piping by contractor in order to avoid transmission of noise and vibration

through the ductwork.

C. Motors and Drives:

1. Provide factory installed motors on slide base to permit adjustment of belt tension.
2. Fan motors shall be heavy duty, high efficiency and open drip proof type.
3. V-Belt drive shall be variable pitch rated at 1.2 time the motor nameplate.

D. Coils:

1. The same manufacturer shall supply both coils and air handling units. Coils shall be factory Installed so that headers and return bends are enclosed within the same unit casing.
2. Construct coils of configuration plate fins and seamless copper tubes. Fins shall have collars drawn and firmly bonded to tubes by means of mechanical expansion of tubes. Do not use soldering or tinning in bonding process.
3. Construct coil casings of minimum 16 gauge galvanized steel with formed end supports and top and bottom channels. Where two or more coils are stacked in a unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through air-stream.
4. Water Coils:
   a. Clearly label supply and return headers on outside of units so that direction of water flow is counter to direction of unit air flow.
   b. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
   c. Headers may be constructed of round copper pipe or cast iron.
   d. Construct tubes of 1/2 inch OD copper and construct fins of aluminum.

E. Filters:

1. Provide factory fabricated filter section of the same construction and finish as unit casings. Filter sections shall have filter guides and full height, double wall, hinged, removable access doors for filter removal. Construct doors in accordance with Article 2.03 Paragraph E. Filter sections shall be flanged to other unit components. Provide filter block-off blanks as required to prevent air bypass around filters.
2. Provide 2 inch angled filter sections with maximum face velocity of 500 feet per minute with pleated media or renewable media filters. Filters shall be as specified in Section 23 41 00 “Particulate Air Filtration”.

F. Dampers:

1. Provide internally mounted low leak outside air, return air or exhaust air dampers to modulate the volume of outside and return air. Damper blades shall be a minimum 14 gauge galvanized steel and damper frames of minimum 16 gauge galvanized steel and mechanically fastened to an axle rod rotating on bearings. Leakage rate shall not exceed 1 percent of nominal CFM at one inch water gauge. All leakage testing and pressure ratings will be based on AMCA Publication 500.

G. Airflow Measurement Station:

1. Provide solid state electronic air measurement system (EAMS) on each AHU. Contractor is responsible for mounting EAMS in strict accordance with manufacturer's recommendations. EAMS station shall be capable of functioning accurately between minus 20 degrees F and plus 158 degrees F and have the ability to transmit a 2-10 Vdc linear signal representative of velocity. The measurement system shall be factory calibrated with a total accuracy of plus or minus 5 percent of actual flow down to 15 percent of the following: temperature, compensation, humidity, repeatability, turbulence and placement. If required, field assembly and field calibration of the airflow measurement stations shall be the responsibility of the installing contractor.
2. See specification Section 23 09 10, "Airflow/Temperature Measuring Station".

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.

B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.

C. Coordinate all work with other trades as necessary for proper interfacing.

D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

3.02 AIRFLOW CONTROL SYSTEM INSTALLATION

A. The electrical contractor shall wire a dedicated 120 VAC single phase power circuit to each wall-mounted power supply. ATC contractor shall install all wall-mounted power supplies in conduit and junction boxes as specified in Division 26.

B. ATC contractor shall terminate and connect all cables for the airflow control system. Cables and connectors shall be furnished by the ATC Sub-Contractor.

C. The mechanical contractor shall install all airflow control valves in the ductwork. After said installation, the mechanical contractor shall make all clevis and cotter pin connections for actuators and reversing linkages, as well as pivot arm pin connections for constant volume valves. All reheat coils, transitions and insulation shall be furnished by the mechanical contractor.

3.03 START-UP

A. An authorized representative of the equipment manufacturer shall provide the initial start-up. Said start-up shall include verification of proper installation and wiring and verification of proper operation of the airflow control systems. The balancing sub-contractor shall be responsible for final verification and reporting of all airflow rates and pressurization.

B. The air flow control system manufacturer shall furnish a minimum of four hours of owner training to provide an overview of the job specific airflow control components and general troubleshooting procedures.

3.04 ADJUSTMENT

A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

END OF SECTION

SECTION 23 81 23 COMPUTER-ROOM AIR-CONDITIONERS

PART 1 – GENERAL

1.01 UNIT DESCRIPTION

A. Provide and install a vertical draw through computer room unit as indicated on plans. Unit shall be factory assembled, factory supplied, including condensate drain pan, centrifugal fan assembly with fan motor, drives, belts, filters, strip heat for humidity control, remote humidistat, and thermostat and all related controls.

1.02 RELATED SECTIONS

A. Section 23 05 10 – HVAC General Requirements

B. Section 23 05 11– HVAC Submittal data

C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

D. Section 23 05 15 – Design Conditions

E. Section 23 23 00 - Refrigerant Piping

1.03 SUBMITTALS

A. The system shall be designed to maintain temperature and humidity conditions in the room containing electronic equipment.

B. The manufacturers shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.

C. Submittals shall be provided and shall include the following:

Single line diagrams, dimensional, electrical and capacity data, piping and electrical connection drawings.

1.04 DESIGN REQUIREMENTS

A. The computer room air conditioning unit shall be a factory assembled unit with split refrigeration system. The evaporator section shall be designed for above-ceiling installation. Condensing unit(s) shall be designed for outdoor installation. See mechanical plans for scheduled unit capacities and characteristics.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Computer room air conditioning unit shall be as manufactured by Liebert or as approved by Engineer of Record.

B. Equivalent products by the following manufacturers are acceptable:

1. Stulz Air Technology Systems, Inc.
2. Data Aire, Inc.

C. Substitutions shall fully comply with the specified requirements and Section 01 62 14 Product Options and Substitution Procedures.

2.02 EVAPORATOR CABINET CONSTRUCTION

A. The cabinet and chassis shall be constructed of heavy gauge galvanized steel and shall be serviceable from one side only. Mounting brackets shall be factory-attached to the cabinet. Internal cabinet insulation shall meet ASHRAE 62.1 requirements for Mold Growth, Humidity and Erosion, tested per UL 181 and ASTM 1338 standards.

2.03 AIR DISTRIBUTION

A. The fan shall be the belt-drive, centrifugal type, double width, double inlet. The shaft shall be heavy-duty steel with self-aligning ball bearings with minimum life of 100,000 hours. The fan motor shall be 1750 rpm and mounted on an adjustable base. The drive package shall be equipped with an adjustable motor pulley. The fan/motor assembly shall be mounted on vibration isolators. System shall be suitable for ducted air distribution.

2.04 MICROPROCESSOR CONTROL

A. The control system shall be microprocessor-based, factory-wired into the system cabinet and tested prior to shipment. The wall-mounted control enclosure shall include a 2-line by 16-character liquid crystal display (LCD) providing continuous display of operating status and alarm condition which is wired into the control board using 4-conductor field-supplied wire. A 7-key membrane keypad for setpoint/program control and unit On/Off shall be located below the display. The control shall be capable of displaying values in °F or °C. The microprocessor shall provide three stages of cooling. The microprocessor shall determine the optimal stage to run based on historical run data.

B. Monitoring: The LCD shall provide an On/Off indication, operating mode indication (cooling, heating, humidifying, dehumidifying) and current day, time, temperature and humidity (if applicable) indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the monitoring system.

C. Control Setpoint Parameters:

1. Temp. Setpoint 65-85 degrees F (18-29 degrees C)
2. Temp. Sensitivity 1-9.9 degrees F (1-5 degrees C)
3. Humidity Setpoint 20-80 percent RH
4. Humidity Sensitivity 1-30 percent RH

D. Unit Controls:

1. Compressor Short-Cycle Control: The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.
2. Common Alarm and Remote On/Off: A common alarm relay shall provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote On/Off control. Individual alarms shall be “enabled” or “disabled” from reporting to the common alarm.
3. Setback Control: The control shall be user-configurable to use a manual setpoint control or a programmable, time-based setback control. The setback control will

be based on a 5 day/2 day programmed weekly schedule with capability of accepting 2 events per program day.

4. Temperature Calibration: The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 10 to 90 seconds. The control shall be capable of displaying temperature values in degrees F or degrees C.
5. System Auto Restart: For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the wall-mounted controller or from the central, site-monitoring system.

2.05 ALARMS

A. Unit Alarm: The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:

1. High Temperature
2. Low Temperature
3. High Humidity
4. Low Humidity
5. High Water Alarm - Lockout Unit Operation
6. High Head Pressure #1 and #2
7. Loss of Power
8. Compressor Short Cycle #1 and #2
9. Humidifier Problem
10. Filter Clog

B. Custom Alarms (3x):

1. Smoke Detected
2. Standby Unit On
3. Water Flow Loss
4. Standby GC Pump
5. Custom 1
6. Custom 2
7. Custom 3

User-customized text can be entered for the three (3) custom alarms.

C. Alarm Controls: Each alarm (unit and custom) shall be individually enabled or disabled (except for high head pressure and high water in condensate pan) and can be programmed for a time delay of 0 to 255 seconds of continuous alarm condition to be recognized as an alarm. Each alarm can also be enabled or disabled to activate the common alarm (except high head pressure and high water in condensate pan).

D. Audible Alarm: The audible alarm shall annunciate at the LCD wall box any alarm that is enabled by the operator.

E. Common Alarm: A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device. Alarms shall be enabled or disabled from reporting to the common alarm.

F. Remote Monitoring: All alarms shall be communicated to the Liebert site monitoring system with the following information: date and time of occurrence, unit number and present temperature and humidity.

2.06 DIRECT EXPANSION SYSTEM EVAPORATOR COMPONENTS

A. Direct Expansion Coil

1. The evaporator section shall include evaporator coil, thermostatic expansion valve and filter driers.
2. The evaporator coil shall have two circuits, 4 rows deep, constructed of copper tubes and aluminum fins. Externally equalized thermostatic expansion valves shall control refrigerant flow. The evaporator unit shall be factory-charged with R-407C refrigerant and sealed.
3. The coil shall be provided with a stainless steel drain pan, with an internally trapped drain line. The evaporator drain pan shall include a factory-installed float switch to shut down the evaporator upon high water condition.

2.07 OUTDOOR AIR-COOLED PROP FAN CONDENSING UNIT

A. The condenser coil shall be constructed of copper tubes and aluminum fins with a direct-drive propeller-type fan, and shall scroll compressors, high-pressure switches, Lee-Temp refrigerant receivers, head pressure control valves and liquid line solenoid valves. All components shall be factory-assembled, charged with R-407C refrigerant and sealed. No internal piping, brazing, dehydration or charging shall be required.

B. Condensing unit shall be designed for 95 degrees F (35 degrees C) ambient and be capable of operation to minus 30 degrees F (minus 34.4 degrees C).

C. Hot gas bypass shall be provided for each circuit to reduce compressor cycling and optimize performance under low load conditions.

D. The coils shall be phenolic-coated for extended coil life in coastal areas.

2.08 FACTORY-INSTALLED OPTIONS

A. Steam Generating Humidifier: The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" (25.4 mm) air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the microprocessor wall box control panel. The humidifier shall have a capacity of 4.5 lb/hr (10 kg/h). An LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions.

B. Electric Reheat: The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include an agency-approved safety switch to protect the system from overheating.

C. Disconnect Switch, Non-Locking: The non-automatic, non-locking, molded case circuit interrupter shall be factory mounted in the high-voltage section of the electrical panel. The switch handle shall be accessible from the unit front and mounted on the evaporator unit.

D. High-Temperature Sensor: The high-temperature sensor shall immediately shut down the system when high temperatures (125 degrees F, 51.7 degrees C) are detected. The high-temperature sensor shall be mounted with the sensing element in the return air.

E. Smoke Sensor: The smoke sensor shall immediately shut down the environmental control system and activate the alarm system when activated. The sensing element shall be located in the return air compartment. This smoke sensor shall not function or replace any room smoke detection system that may be required by local or national codes.

F. Filter Clog Switch: The filter clog switch senses pressure drop across the filters and shall annunciate the wall-box display upon exceeding the adjustable setpoint.

2.09 SHIP-LOOSE ACCESSORIES

A. Remote Sensors: The unit shall be supplied with remote temperature and humidity sensors.

B. Air Filter Box: The evaporator section shall be supplied with an air filter box for use with ducted installations. Two (2) filters shall be included, deep-pleated type, with a MERV 8 rating, based on ASHRAE 52.2.

C. Condensate Pump: The condensate pump shall be complete with integral float switch, discharge check valve, pump, motor assembly and reservoir. A secondary float switch shall be provided to permit field wiring to the unit control to shut down the evaporator upon a high water level condition.

D. Condensate Pump Bracket: A condensate pump bracket shall be provided to mount condensate pump to the end of the unit and allow easy alignment and installation of the condensate pump.

E. Refrigerant Line Sweat Adapter Kit: Provide a sweat adapter kit to permit field brazing of refrigerant line connections.

PART 3 – EXECUTION

3.01 INSTALLATION OF COMPUTER ROOM AIR CONDITIONING UNITS

A. General: Install computer room air conditioning units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.

B. Electrical Wiring: Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

C. Piping Connections: Install and connect devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

D. Field-Supplied Pan: A field-supplied pan with drain shall be installed beneath cooling units.

3.02 FIELD QUALITY CONTROL

A. Startup air conditioning units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

END OF SECTION

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

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. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.06 QUALITY ASSURANCE

A. 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.

B. 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.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW and THHN-THWN.

2.02 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.04 CONNECTIONS

A. 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.

B. Feeders #4 AWG or larger shall not be spliced. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors 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. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

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 SUBMITTALS

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

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS.
   a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
   b. Include recommended testing intervals.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.02 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.05 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

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. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

2. For handholes and boxes for underground wiring, including the following:
   a. Duct entry provisions, including locations and duct sizes.
   b. Frame and cover design.
   c. Grounding details.
   d. Joint details.

1.05 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel compression type.

3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Screw-cover type.

F. Finish: Manufacturer's standard enamel finish.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Spring City Electrical Manufacturing Company.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured

B. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Armorcast Products Company.
2. Carson Industries LLC.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carson Industries LLC.
   b. Christy Concrete Products.
   c. Nordic Fiberglass, Inc.

2.05 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.06 SLEEVE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit, IMC.
2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:
    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass enclosures with polymer-concrete frame and cover, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.

7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches on center. Align planks along the width and along the centerline of conduit.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 12” below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less MDOT – 6th District –Harrison and no side greater than 16 inches, thickness shall be 0.052 inc.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.08 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
2. Handholes and pull boxes.

1.03 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, pull boxes, and other utility structures.
4. Warning tape.
5. Warning planks.

1.05 QUALITY ASSURANCE

A. Comply with IEEE C2.

B. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

1.07 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 Architect no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Architect's written permission.

1.08 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and pull boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and pull boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES

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. AFC Cable Systems.
2. ARNCO Corporation.
3. Beck Manufacturing.
4. Cantex, Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. DCX-CHOL Enterprises, Inc.; ELECSYS Division.
8. Electri-Flex Company.
9. IPEX Inc.
10. Lamson & Sessions; Carlon Electrical Products.
11. Manhattan Wire Products; a Belden company.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and retained to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inchesin size, manufactured from 6000-psiconcrete.
   a. Color: Red dye added to concrete during batching.
   b. Mark each plank with "ELECTRIC" in 2-inch-high, 3/8-inch-deep letters.

2.03 HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering,
   a. As indicated for each service.
   b. Tier level number, indicating that the unit complies with the structural load test for that tier according to SCTE 77.
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, retained to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Fiberglass Handholes and Pull Boxes with Polymer Concrete Frame and Cover: Complying with SCTE 77 Tier 15 loading. Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

1. 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:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. Christy Concrete Products.
   d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

C. Fiberglass Handholes and Pull Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete, complying with SCTE 77 Tier 5 loading.

1. 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:
   a. Carson Industries LLC.
   b. Christy Concrete Products.
   c. Nordic Fiberglass, Inc.

PART 3 - EXECUTION

3.01 CORROSION PROTECTION

A. Aluminum shall not be installed in contact with earth or concrete.

3.02 UNDERGROUND DUCT

A. Ducts for Electrical Cables over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank unless otherwise indicated.

D. Underground Ducts Crossing Paved Paths, Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.03 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Pull Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass enclosed with polymer concrete frame and cover, SCTE 77, Tier 15.
2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
3. Units Subject to Light-Duty Pedestrian Traffic Only: High-density plastic, structurally tested according to SCTE 77 with 3000-lbf "Light-Duty" vertical loading.

3.04 EARTHWORK.

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.05 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5 ft., both horizontally and vertically, at other locations unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches on center for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 ft. from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 ft outside the building wall without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf-test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 ft of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
   a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
   b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 ft. of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches on center. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.06 INSTALLATION OF HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use pull box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level 6-inch-thick bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: Set so cover surface will be flush with finished grade.

D. Install handholes and pull boxes with bottom below the frost line, 12 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Retain arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.07 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.09 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 44 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Division 07 Section "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

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 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. 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:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS.

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. 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:
   a. Presealed Systems.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

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 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.04 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.05 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.06 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils.
3. Weight: 18.5 lb/1000 sq. ft.
4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

2.07 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.08 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.09 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.10 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.11 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
   c. Colors for 480/277-V Circuits:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Emergency system boxes and enclosures.

g. Enclosed switches.
h. Enclosed circuit breakers.
i. Enclosed controllers.
j. Variable-speed controllers.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Power-generating units.
p. Monitoring and control equipment.

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 13 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 13.

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 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.
5. Emergency shunt relays.

B. Related Requirements:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

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 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS.

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by the following may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.

3. Invensys Controls.
4. Leviton Mfg. Company Inc.
5. NSi Industries LLC; TORK Products.
6. Tyco Electronics; ALR Brand.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 30-A inductive or resistive, 240-V ac.
4. Programs: two channels; each channel is individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand

C. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.03 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.

3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.04 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with HOAcontrol and pilot devices, matching the NEMA type specified for the enclosure.

2.05 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 24 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.07 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Division 26 Section "Network Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

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. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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 PB 1.

F. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.07 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's written permission.
3. Comply with NFPA 70E.

1.08 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:
   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Same finish as panels and trim.
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
7. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Overcurrent Protective Devices: Fused switches.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: Two normally open and normally closed contact(s) that operate with switch handle operation.

2.05 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Liebert Corporation.
5. Siemens Energy & Automation, Inc.
6. Square D; a brand of Schneider Electric

D. Surge Protection Device: IEEE C62.41-compliant, separately mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:
   a. Fuses rated at 200-kA interrupting capacity.
   b. Fabrication using bolted compression lugs for internal wiring.
   c. Integral disconnect switch.
   d. Redundant suppression circuits.
   e. Redundant replaceable modules.
   f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   g. LED indicator lights for power and protection status.
   h. Audible alarm, with silencing switch, to indicate when protection has failed.
   i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
   j. Six-digit, transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
   a. Line to Neutral: 70,000 A.
   b. Line to Ground: 70,000 A.
   c. Neutral to Ground: 50,000 A.
4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:
   a. Line to Neutral: 800 V for 480Y/277.
   b. Line to Ground: 800 V for 480Y/277.
   c. Neutral to Ground: 800 V for 480Y/277.

2.06 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

   1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 13 ELECTRICITY METERING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes equipment for electricity metering by utility company.

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 SUBMITTALS

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

1.04 QUALITY ASSURANCE

A. 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.

1.05 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 Architect no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's written permission.

1.06 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Snap switches and wall-box dimmers.
3. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

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 EMI: Electromagnetic interference.

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. RFI: Radio-frequency interference.

D. TVSS: Transient voltage surge suppressor.

E. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. 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.

C. Comply with NFPA 70.

1.06 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.07 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 5351 (single), 5352 (duplex).
   b. Hubbell; HBL5351 (single), CR5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; GF20.
   b. Pass & Seymour; 2084.
   c. Hubbell; GF20

2.04 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; L520R.
   b. Hubbell; HBL2310.
   c. Leviton; 2310.
   d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; IG2310.
   b. Leviton; 2310-IG.
   c. Pass and Seymour; IG5361
3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.05 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.06 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.07 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass & Seymour; PS20AC1-PLR for 120 V.
3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.
3. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 1995.
   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.

2.08 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 2000 W; dimmers Illuminated when "OFF."

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.09 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 MULTIOUTLET ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).
3. Mono Systems, Inc.

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Wire: No. 12 AWG.

2.11 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 28 13 FUSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers and motor-control centers.
2. Spare-fuse cabinets.

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 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Coordination charts and tables and related data.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. 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.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.06 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.03 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2 inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.02 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's written permission.
4. Comply with NFPA 70E.

1.07 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric. Retain one of last two options in first paragraph below depending on whether fuse applications and class designations are indicated on Drawings or specified in Division 26 Section "Fuses." Show fuse ampere ratings on Drawings.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.02 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

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 cooling system.
3. Unit-mounted and remote-mounting control and monitoring.
4. Performance requirements for sensitive loads.
5. Load banks.
6. Outdoor enclosure.

B. Related Sections include the following:

1. Division 26 Section "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 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. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For installer, manufacturer and testing agency.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "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.

G. Warranty: Special warranty specified in this Section.

1.05 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. 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), 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.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. 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.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. 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.

1.06 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 Architect no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect'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.

1.07 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 in Division 03.

1.08 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: 5 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products 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.

E. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
   a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.

4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. 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.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
    a. Provide permanent magnet excitation for power source to voltage regulator.
10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE

A. Fuel: Fuel oil, Grade DF-2

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. 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 System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

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: Adjustable isochronous, with speed sensing.

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. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.04 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for 36 hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.05 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. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. 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.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. 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.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

E. 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.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

G. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

H. 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.

I. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.06 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. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.07 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. Instrument Transformers: Mounted within generator enclosure.

H. 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.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.08 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.Coordinate first paragraph and subparagraphs below with Drawings showing features, construction details, and equipment arrangement.

B. Description: Prefabricated enclosure with the following features:

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed enclsure.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
4. Hinged Doors: With padlocking provisions.
5. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
6. Muffler Location: External to enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system co ponents 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
2. drainable louvers prevent entry of rain and snow.
3. 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. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.09 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.
2. Durometer Rating: 30.
3. Number of Layers: Three.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

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 elastomeric isolator pads having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

E. Fuel: Following all testing and demonstrations, generator tank shall be full of fuel.

3.03 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "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. Perform tests and inspections and prepare test reports.

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.

C. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection **(**except those indicated to be optional) 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.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. 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.

F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and retest as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. 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.

L. 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.

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 Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 36 00 TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Remote annunciation systems.

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 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "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.

1.04 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 remote annunciators 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 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.

1.05 PROJECT

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. Notify Architect no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's written permission.

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:
   a. Caterpillar; Engine Div.
   b. Emerson; ASCO Power Technologies, LP.
   c. Generac Power Systems, Inc.

d. GE Zenith Controls.
e. Kohler Power Systems; Generator Division.
f. Onan/Cummins Power Generation; Industrial Business Group.
g. Russelectric, Inc.

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. Neutral Switching. Where four-pole switches are indicated, provide overlapping neutral contacts.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

K. Battery Charger: For generator starting batteries.

1. Float type rated 2 A.
2. Ammeter to display charging current.

3. Fused ac inputs and dc outputs.

L. 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.

M. 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 Division 26 Section "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.

N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 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. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.
2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Initiation occurs without active control of generator.
   b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.

4. Failure of power source serving load initiates automatic break-before-make transfer.

H. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

I. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

J. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

K. 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 ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:

1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Indication of switch position.
3. Indication of switch in test mode.
4. Indication of failure of digital communication link.
5. Key-switch or user-code access to control functions of panel.
6. Control of switch-test initiation.
7. Control of switch operation in either direction.
8. Control of time-delay bypass for transfer to normal source.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:

1. Controls and indicating lights grouped together for each transfer switch.
2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
3. Digital Communication Capability: Matched to that of transfer switches supervised.
4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

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. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

B. Identify components according to Division 26 Section "Identification for Electrical Systems."

C. 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 Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 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. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. 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.
5. 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. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. 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.
g. 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.

6. 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.

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 Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 43 13 TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

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. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Qualification Data: For qualified testing agency.

C. Product Certificates: For TVSS devices, from manufacturer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

D. Comply with NEMA LS 1.

E. Comply with UL 1449.

F. Comply with NFPA 70.

1.06 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 Architect no fewer than two days in advance of proposed electrical service interruptions.
2. Do not proceed with interruption of electrical service without Architect's written permission.

B. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.07 COORDINATION

A. Coordinate location of field-mounted TVSS devices to allow adequate clearances for maintenance.

B. Coordinate TVSS devices with Division 26 Section "Electrical Power Monitoring and Control."

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.01 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.; Danaher Power Solutions.
3. Liebert Corporation; a division of Emerson Network Power.

B. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design (with field-replaceable modules).
3. Fuses, rated at 200-kA interrupting capacity.
4. Fabrication using bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. Redundant replaceable modules.
8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.
11. Audible alarm, with silencing switch, to indicate when protection has failed.
12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
13. Four-digit transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2

1. Line to Neutral: 70,000 A.
2. Line to Ground: 70,000 A.
3. Neutral to Ground: 50,000 A.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277 V.
2. Line to Ground: 800 V for 480Y/277 V.
3. Neutral to Ground: 800 V for 480Y/277 V.

2.02 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, 60-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.02 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.

1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. 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.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup checks according to manufacturer's written instructions.

D. TVSS device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Do not energize or connect service entrance equipment panelboards to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION

SECTION 26 51 00 INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

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. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.

5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:
    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.
7. Perimeter moldings.

F. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

G. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

H. Field quality-control reports.

I. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

J. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. 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.

D. Comply with NFPA 70

1.06 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.
2. Glass: Annealed crystal glass unless otherwise indicated.

I. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.03 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.

4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5, T8 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 1 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

2.04 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.

5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.05 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F.
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.06 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.07 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

D. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.08 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

2.09 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.02 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.03 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION

SECTION 26 56 00 EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

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. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 90 mph.
   a. Wind Importance Factor: 1.0.
   b. Minimum Design Life: 25 years.
   c. Velocity Conversion Factors: 1.0.

1.05 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
   a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

C. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

D. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. 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.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   a. Color: As selected by Architect from manufacturer's standard catalog of colors.

N. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:
   a. "USES ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.03 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F and higher.

2.04 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F.
3. Normal Ambient Operating Temperature: 104 deg F.
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

2.05 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.06 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws. Provide on all.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.07 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209, 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as luminaire.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   a. Color: As selected by Architect from manufacturer's standard catalog of colors.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.02 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.03 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.06 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

END OF SECTION

SECTION 27 11 16 COMPUTER EQUIPMENT RACKS

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies the minimum requirements for computer equipment racks installed on this project as shown on the plans or as directed by MDOT.

B. Drawings And Specifications:

1. Contractor shall carefully study the Drawings and Specifications, and shall at once report any error, unforeseen circumstances, inconsistency or omission he may discover.

1.02 PROJECT DEFINITIONS

A. 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.
      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. Regulatory Approvals: EIA-310-D

C. Standards: UL 60950

1.04 SYSTEM DESCRIPTION

A. The computer equipment racks shall be installed at the locations shown in the plans.

1.05 SUBMITTALS

A. Product Data: Submit nine (9) sets of manufacturer's cut sheets detailing full compliance with these specifications.

B. Shop Drawings: Submit nine (9) copies of each submittal.

1. Diagrams of rack layouts and wiring details.

1.06 QUALITY ASSURANCE

A. 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.

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.

B. Safety:

1. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.
2. Contractor shall comply with all local, state, and federal regulations and laws for the safety of the work place.

C. Accident Reports:

1. Serious or fatal accidents shall be reported immediately by telephone or radio to the MDOT or MDOT's representative.

PART 2 - PRODUCTS

2.01 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. Contractor shall provide all components needed for complete and satisfactory operation.

B. All 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, all shall be identical and provided by the same manufacturer.

2.02 Computer Equipment Racks

A. The Equipment Racks shall be standard enclosed type racks with side panels and front/rear doors and shall meet the following material requirements:

1.	Nominal Net weight	275 lbs.
2.	Approximate height	78 inches
3.	Approximate width	24 inches
4.	Approximate depth	42 inches
5.	Weight capacity (static load)	3000.00 lbs.
6.	Weight capacity (dynamic load)	2250.00 lbs.
7.	Minimum mounting depth	7.5 inches
8.	Maximum mounting depth	36 inches
9.	Rack height	42U
10.	Color	Black
11.	Vertical posts	16 gage
12.	Front door	16 gage
13.	Rear door	18 gage
14.	Roof	18 gage
15.	EIA mounting rails	14 gage
16.	Removable Side panels	18 gage

17. Doors shall include vents to allow ample ventilation for servers and networking equipment.
18. Cable management channels shall be provided along the entire height of the rack.
19. A minimum of two shelves shall be provided for each rack.
20. Each rack shall include power strips providing a minimum of 16 power outlets spread out throughout the height of the rack.
21. Front and rear posts shall both allow rack mounting.
22. Documentation shall be provided
23. All doors shall be keyed alike.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

A. Racks shall be installed and mounted to the floor.

END OF SECTION

SECTION 27 41 14 VIDEO WALL CONTROL SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Note: the video wall control system includes technology that changes often. This video wall control system will be installed near the end of the project and the latest models and technology may be different at that time than when the job is bid. Therefore, the video wall control system is being set up as an allowance amount to ensure the most current models and technology are used at the time of installation. Refer to Specification Section 01 21 00 “allowances” for additional details on the allowance procedures and amount to include as the allowance. The allowance amount described in that specification shall include the equipment costs only. The costs for installing and testing the video wall equipment shall be included in the lump sum price of the overall building.

B. The video wall system shall be installed and tested prior to overall substantial completion but after all other construction activities in the TMC room and computer room are complete. The specification provided below is tentative and is what would be required if the equipment was being installed now and establishes the minimum criteria. However, since this is being set up as an allowance amount, at the appropriate time later in the construction process MDOT will coordinate with the contractor to finalize this specification and adjust for any changes in technology and models. At that time the contractor will then submit for approval the proposed equipment to meet that udpated specification.

1.02 SUMMARY

A. This section describes the specifications and requirements for the video wall control system (VCS) to be built into the new MDOT Lyman, Mississippi Gulf Coast Regional Office Building / First Responder’s Shelter, and which shall be provided as part of the building construction in the Transportation Management Center Room. The video wall control system includes the video monitors, and the video wall controller and related appurtenances. The contractor will be responsible for the exact dimensioning of the wall display as determined by the actual size of the display units, and shall furnish detailed installation detail plans as described in this document.

B. The Video Wall Control System shall incorporate the following:

1. Eight 55” nominal LCD video modules arrayed in a 4 X 2 configuration
2. Video wall control system controller
3. Digital Video Recorder

C. The Contractor shall provide and pay for all 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:

Contractor shall carefully study the Drawings and Specifications, and shall at once report any error, unforeseen circumstances, inconsistency or omission he may discover.

1.03 PROJECT DEFINITIONS

A. General Definitions:

1. VCS: Video Wall Control System
2. CCTV: Closed-Circuit Television.
3. DVR: Digital Video Recorder
4. I/O: Input/Output.
5. LAN: Local Area Network.
6. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
7. RS-485: TIA/EIA standard for multipoint communications.
8. TCP/IP: Transport Control Protocol/Internet Protocol incorporated into Microsoft Windows.
9. TMC: Transportation Management Center
10. UPS: Uninterruptible Power Supply.
11. 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.)

1.04 SYSTEM DESCRIPTION

A. The Video Wall Control System for the new MDOT Lyman, Mississippi Gulf Coast Regional Office Building / First Responder's Shelter shall be provided as part of the building construction in the Transportation Management Center Room. The displays will be mounted on the wall of the room separating the TMC from the electrical/communications room and visible from the adjacent meeting room. The system shall include eight (8) high resolution LED backlit LCD 55" video monitors, mounted and arranged in a four across by two high matrix, with an adjustable display mounting system. The system shall include a video wall controller and operating system to accept inputs from a variety of video, data, and cable or satellite television display sources simultaneously, provide decoding/conversion of the signals from a variety of compressed video signals and direct the video to the display wall. Digital video recording capability shall be included as part of the installation.

B. The system shall include all electronic equipment needed to support and make fully functional the display of video from a variety of sources, and inputs to both the integrated display wall described above and in other sections of this specification.

C. The system shall include power supplies, cabling, digital video recorder, video wall monitors, video wall controller, and operating system in an integrated system that shall be compatible with the MDOT ITS network and include all integration, drivers and installation/operational support. Management of the system will be through a graphical user interface. This system will support and be fully compatible with the MDOT OTN communications network and shall be capable of selecting and displaying video from the existing WOWZA video distribution server (H.264 encoded video).

1.05 SUBMITTALS

A. Product Data: For each type of product indicated and selected for installation, submit nine (9) sets of three-ring 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.
3. Rack diagrams showing rack mounted equipment.

C. Field quality-control test report showing all displays, encoders, modules and the digital video recorders devices are installed, tested and functioning correctly.

D. Project Record Drawings:

1. The purpose of Project Record Drawings is to provide factual information regarding all 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 all Work, including the equipment locations, 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. Displays, power supplies, and digital video recorder(s).
   b. Cable runs
   c. Project Record Drawings shall show the physical placement of each system component installed in any part of the building. Where the building plan conflicts with actual building construction, the Contractor shall amend the construction plan as required. Indicate exact description of conduit runs and cable runs.
   d. Project Record Drawings shall show wire and cable runs, electrical panel/circuit breaker numbers from which equipment is powered, and splice points. Such information may be shown on the building plans or on system diagrams provided for this purpose, but all system diagrams shall be schematically correct and show the actual location of the equipment as installed in the racks provided, or as otherwise located/mounted in the TMC and the TMC electrical/communications room.
   e. 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.
   f. All final Project Record Drawings shall be provided to the MDOT or MDOT's Representative.
6. Closeout Submittals:
   a. Provide a set of 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 the Video Wall Control System.
2. The video wall installer shall be certified by the video wall manufacturer.

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, principal, 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. All electronic systems Work shall be performed by electronic technicians thoroughly trained in the installation and service of Video Display 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. All incidental Work, such as cutting and patching, hardware installation, painting, carpentry, and the like, shall be accomplished by skilled crafts persons regularly engaged in such type of work. All such Work shall comply with industry standards applicable to that respective industry or craft.
4. All 120 VAC power wiring and connections are to be performed by a qualified Journeyman Wireman, licensed to perform such Work.

D. Supervision And Construction Procedures:

1. The Contractor shall supervise and direct the Work, using his best skill and attention. Contractor is solely responsible for all construction means, methods, and techniques.
2. The Contractor shall 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 all communications given to the Foreman shall be as binding as if given to the Contractor.

E. Regulatory Requirements and Permits:

1. All Work shall conform to all applicable building, fire, and electrical codes and ordinances. In case of conflict between the Drawings/Specifications and codes, the codes shall govern. The Contractor shall inform the MDOT's Representative of any such conflicts.
2. Contractor shall secure and pay for all licenses, permits, plan reviews, engineering certifications, and inspections required by regulatory agencies. Contractor shall prepare, at Contractor's expense, any documents, including drawings, that may be required by regulatory agencies.
3. The Contractor shall make application for and obtain any and all permits required by federal, state, county, city, or other authority having jurisdiction over the work.

F. Electrical Components, Devices, and Accessories: All devices, cabling and incidental equipment should be listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.

G. 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. The Video Wall Control System shall NOT be installed until the substantial completion of the facility. Specifically, all construction, finishing, painting, lighting, ceiling and wall construction must be completed before the installation of the VCS to avoid any damage or adverse affect on the system operation or appearance.
2. Dust Control: Make provisions to control all dust, dirt, and foreign material caused by the performance of the Work or encountered during the execution of the work.
3. Notify MDOT's Representative immediately of any damage or possible damage to any other equipment.

B. Clean-Up:

1. Contractor shall clean-up, on a daily basis as the Work progresses, all 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, drills, tools, test equipment, protective equipment, and other such facilities and equipment.
2. Contractor shall provide all 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. Contractor shall comply with all local, state, and federal regulations and laws for the safety of the work place.

E. Accident Reports:

1. All work-related accidents shall be reported immediately by telephone or radio to the MDOT or MDOT's Representative.

1.09 SEQUENCING

A. Description: The following describes the general approach that shall be followed in order to minimize the time for the Video Wall Control System to be operational.

B. Approach: Contractor shall plan and schedule all work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order all equipment needed and notify any subcontractors to schedule their participation.
2. Ensure there are an adequate number of power receptacles and circuits to operate all equipment and coordinate with MDOT or MDOT's Representatives to determine where power is available.
3. Perform all system layout work.
4. Provide shop drawings to verify location of all equipment, conduit runs, power connections, etc. Submit shop drawings to MDOT or MDOT's Representative.
5. Coordinate with MDOT or MDOT's Representative the access to the indicated location.
6. Prepare, program, configure and pre-test all equipment to the greatest extent possible.
7. Install all equipment.

8. Test and inspect all systems.
9. Perform all other Work as required.
10. Perform the Acceptance Test.
11. Provide training.
12. Provide as-built drawings.

1.10 COMMISSIONING

A. After all Work is completed, and prior to requesting the Acceptance Test, Contractor shall conduct an inspection, and pre-test all equipment and system features. Contractor shall correct any deficiencies discovered as the result of the inspection and pre-test. Refer to Section 3.05 for details on the Acceptance Test.

PART 2 - PRODUCTS

2.02 EQUIPMENT AND MATERIALS

A. Drawings and Specifications indicate major system components and locations, and do not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.

B. All products provided 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, all shall be identical and provided by the same manufacturer.

D. Product Availability:

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

2.03 VIDEO WALL MONITORS

A. Available Manufacturers may include:

1. Planar
2. Others that are equivalent and meet the specifications

B. MONITORS

1. Monitor Requirements
   a. Type - LCD
   b. Backlight type – Edge lit LED
   c. Diagonal measurement per monitor – 55 inches (nominal)
   d. Thin profile design, with depth (screen to back of monitor) not to exceed 4 inches
   e. Tiled bezel width less than 6mm
   f. Tiled image-to-image gap less than 6mm

g. Resolution – 1920 X 1080
h. Brightness - adjustable to 700 nits
i. Contrast ratio (full field typical) – 3000:1 (minimum)
j. Power consumption – Max 350 watts
k. Heat load (maximum backlight) – 940 BTU/hr
l. Full viewing angle – 178 degrees
m. Operating temperature – 5 to 35 degrees C
n. Operating humidity range – 20 to 90% (relative humidity)
o. Specifically designed and developed for 24 X 7 continuous operation.
p. Reduced heat load distributed design with off-board power, video and control signals located in a rack mounted location (equipment room).

2. Mounting – Wall attached
   a. 4 X 2 display matrix array (eight units) – one mount per display module
   b. Each monitor shall allow/facilitate adjustment cams for precise 6-axis alignment for a uniform, image-to image gap.
   c. Each mounting unit will be designed and constructed to accommodate the minimum protrusion from the mounting wall.
   d. Each wall mounting unit shall allow a positioning of the display monitor to allow access for servicing, maintenance and connections.
3. Video Wall Dimension
   a. The contractor will be responsible for the determination of the exact dimensions of the completed video wall, which shall be provided on the wall between the TMC and the equipment/communications room.
   b. The monitors shall be arranged in a four across by two high matrix, with an adjustable display mounting system.
   c. The video wall will be positioned so that the center of the video wall is as near the center line of the layout of the consoles as possible, allowing for doors, switches and other room fixtures. The mounting height to the bottom of the video wall shall be 60 inches to allow viewing of the wall from the operators seated at the consoles in the room and from the adjoining meeting room.
   d. The video shall be designed for minimal profile (depth measurement) surface mounted units.
   e. The video wall shall utilize ultra-narrow bezel monitors with pixel-to-pixel gaps not greater than 6 mm between images on adjacent panels in the video wall.

2.04 Video Wall Control System (VCS) Controller

A. Available Manufacturers may include:

1. Barco
2. Jupiter
3. Others that are equivalent and meet the specifications

B. General Requirements

1. The VCS shall include all necessary hardware and operating system software to function as a fully integrated network-based system for the control of the video display wall and to provide output video displays utilizing the current camera control software (Chameleon 360) and video streams from/to the WOWZA video distribution server.
2. The VCS operating software and hardware/equipment shall be fully integrated.
3. The VCS shall be designed for high performance and reliability for control room applications.

4. The VCS shall accommodate all of the visual data sources found in a control room environment and display them on the specified video display wall monitors in moveable, scalable windows on a virtual display comprised of the eight video displays provided for the video wall. The system shall be capable of displaying 32 or more views simultaneously to the video wall. The VCS shall accommodate various video/data sources, including network video streams (H.264), RGB streams, directly connected SD and HD video, VGA/XVGA and HDMI.
5. The VCS shall provide and include all equipment for the input, conversion and display of not fewer than 32 simultaneous digital video streams. The VCS shall also accommodate a minimum of four (4) analog video streams. The inputs must accommodate input, decoding and displays from MPEG-2, MPEG-4, H.264, and MJPEG. Conversion can be accomplished by either hardware or software, or both, but must meet all requirements regardless of which option is chosen.

C. VCS Controller

1. The VCS controller and associated support modules shall be rack mountable, and utilize the latest Intel microprocessor technology and commercial off-the-shelf components to allow for future upgrades. At a minimum, the main chassis shall utilize a Dual Intel Quad Core Xeon (2.0 GHz) processor with 8GB of system memory and be upgradable to 64GB. The system shall provide multiple hot swappable hard disk storage devices.
2. The VCS controller shall be designed for continuous operation, with redundant components including hot-swappable N + 1 redundant power supplies, hot-swappable system fans, and hot-swappable disk drives configured as RAID 1 array.
3. The VCS shall provide for hardware and software system monitoring for chassis temperatures, power supply voltages, CPU temperatures, power supply voltages, cooling fan operation, and memory performance, automatically alerting users to conditions requiring direct intervention. System events must be logged and displayed in report formats.
4. The VCS shall include standard Ethernet interface with standard dual 10/100/1000 Mbps RJ45 ports.
5. The VCS shall utilize and include standard input devices including a USB 104-key keyboard, scroll mouse with 2-buttons + wheel/button.

D. VCS Controller Operating System

1. A network-based control room operating system shall be provided to configure and manage the system via a graphical user interface.
2. The Contractor shall provide and install the VCS software, and configure software to the project requirements.
3. The VCS shall allow the operator to define the outputs and layout to the video wall in the system. Each layout shall be able to be saved and shared with other displays or users within the system.
4. The VCS shall allow the operator to use his local keyboard and mouse to control the applications on the video wall as if the keyboard and mouse were physically connected to the video wall.
5. The VCS shall provide an application to manage and control the video wall and video input/output via a Graphical User Interface. This application shall be able to allow the user to query current wall status, query the available layouts, define new layouts, save the layouts, switch current layouts, query overall system status, launch applications and perform other maintenance or configuration functions.
6. The VCS shall be compatible with the existing Camelion 360 software such that the 360 software can be used to manage and control the video wall layout and select the video streams.

7. The VCS shall provide diagnostic capability for the video wall and the controller.
8. The VCS shall be able to access and display networked windows workstation desktops as sized and positioned windows on the video wall or other monitors without the use of RGB splitters. The VCS shall be able to share complete and/or partial desktop contents between workstations and between the video walls/monitors.
9. Layouts will include launching and minimizing of applications, placement of windows and sizing of windows.
10. The VCS shall include all licenses necessary to display the number of simultaneous images defined above for the video wall and LCD monitors, and be able to fully control and configure the software configurations from a minimum of 4 workstations within the TMC or surrounding offices. The licenses for the monitors shall also allow for complete control from a computer at each monitor location.
11. Assign the appropriate VCS software licenses to MDOT.
12. The VCS will allow complete operation of the video wall, including selection of specific video images, via IP address, for each window.
13. It should be possible to drag application windows from panel to panel and to expand single windows to span panel boundaries, even filling the entire display wall, if desired.
14. The VCS should allow the cycling of different video sources (touring) within a video window.

2.05 DIGITAL VIDEO RECORDER (DVR)

A. The VCS shall provide digital video recording capability for a minimum of 4 simultaneous video streams from the existing WOWZA server. for all individual video inputs and not fewer than four inputs simultaneously. It shall also provide recording of the graphical content of the display wall and the graphical content of the workstations associated with the VCS.

B. The digital video recorder shall have the following features:

1. User-friendly interface
2. Network capable to allow selected mangers viewable controls
3. Search for events by date, time, or alarm event
4. Storage up to 1 TB
5. Recording of a minimum of 4 simultaneous video streams.
6. Local live viewing on the real time display
7. Recording resolutions up to 1920 X 1080
8. On board recording archive DVD = R/-R dual layer compatible

C. Product submittals: As stated in section 1.04, product cut sheets shall be submitted for the DVR for approval.

2.06 POWER SUPPLIES

Redundant power supply – rack mounted video processing and power supply units shall support the eight LCD modules and the VCS utilizing an N + 1 redundant and hot-swappable power supply and include a redundant design so that if one power supply within the unit fails, the remaining units will continue to function with uninterrupted operation. Multiple power supply modules are acceptable.

PART 3 - EXECUTION

3.01 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. All 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; whichever 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. Do not support conduit from mechanical, plumbing, or fire sprinkler systems.

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.

3.02 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. At completion, shop drawings shall reflect as-built conditions.

3.03 INSTALLATION

A. The Contractor shall provide for the delivery of all hardware, software, documentation and equipment specified. The Contractor must provide MDOT with an Installation Schedule. The Contractor shall wait for approval from MDOT before delivery and installation. The Contractor shall coordinate the access to the site with MDOT. The Contractor shall conform to the following delivery, storage, and handling procedures:

1. Protect video wall components and other equipment from damage during delivery, handling, storage, and installation.
2. Store video wall components in manufacturer’s protective packages until the time of installation in a position that complies with screen manufacturer’s directions.
3. Protect surfaces of video wall components from damage due to abrasion, dust, and other conditions.
4. Install the VCS according to the manufacturer’s standards and requirements for installation, power and system configuration.

B. The Contractor shall:

1. Provide any tools and materials required for proper installation of the equipment according to the applicable standards for electrical and electronic equipment.
2. Mechanical set up of the wall, including assembly of the modules and mounts,
3. Connect the modules to the video wall controller and connect the video wall controller to the Ethernet switch.
4. Clearly mark each connecting wire/cable indicating source and destination. The labeling shall correspond to the provided documentation.
5. Adjust and set up all input source parameters.
6. Color balance the video wall to match all sources.

7. Create up to five (5) pre-set wall configurations on the control software.
8. Integrate video wall to ensure that each video image can be selected by an operator at a workstation and displayed on the desired video wall location and on additional PCs and LCD monitors throughout the building.
9. Submit shop drawings and construction plans for review and approval by MDOT. Contractor shall provide detailed mounting and installation plans for each of the video wall units. The mounting plans shall include details that illustrate support design, ventilation, cable routing, and maintenance accessibility.

3.04 QUALITY CONTROL

A. Provide diagrams and labeling charts to properly identify all installation details.

B. If corrections are needed, the Contractor shall perform the needed corrections within 24 hours.

3.05 ACCEPTANCE TESTING

1. The Contractor shall perform Acceptance Tests to validate the requirements of these specifications and to verify operation of the system as described in these specifications.
2. The Contractor shall prepare Acceptance Test procedures to verify operation of the system with these specifications. The Contractor shall provide MDOT with two copies each of the procedures for review at least three (3) weeks prior to the commencement of the Acceptance Test.
3. The Contractor shall coordinate Acceptance Testing with MDOT and shall conduct the tests in the presence of the MDOT Representative.
4. The Contractor shall be responsible for documenting the results of the tests and forwarding them to the MDOT Representative within one week of test completion. Contractor's test plans shall cover all areas of the system functionality and shall be in accordance with the manufacturer's recommendations.
5. All equipment and software must be fully functional and pass a Final Inspection before being accepted by the MDOT Representative.
6. As a minimum, the Contractor shall demonstrate the following:
    a. Simultaneous display of up to 32 input sources on the video wall and the adjustment of the display brightness for each projection cube. These 32 inputs can composed of any configuration of digital, analog, and data windows, and either cable or satellite TV.
    b. Ability to switch between a minimum of five (5) pre-configured screen setups.
    c. Demonstration of all required software features.

B. The Contractor shall supply any diagnostic and test software and computers necessary to perform the testing for the duration of the tests.

3.06 TRAINING

A. Engage authorized service representative to train MDOT's maintenance personnel to adjust, operate, and maintain Video Display wall and Video Distribution System.

B. Provide eight (8) hours of on-site training for operation and maintenance of system.

C. Conduct a training class for personnel who will operate and maintain the system. The class will cover operations and maintenance of the system. It shall instruct personnel on how to use all features and functions of the systems and shall include “hands-on” activities with the equipment and software.

D. Provide training that covers the system architecture, operations, and maintenance of the video wall including the video wall panels, video wall controller, and controller software.

E. Provide training and maintenance materials for each display device including detailed specifications and information pertaining to each device in the system.

F. Provide documentation that details the technical and operational aspects of the completed system, including operational and maintenance manuals, system diagrams, cabling diagrams and mounting/positioning details. Supply emergency contact information and necessary procedures for obtaining vital replacement parts within a designated, agreed upon time frame.

G. If training requirements include travel on the part of training participants, the cost of travel shall be included.

3.07 WARRANTY AND SERVICE REQUIREMENTS

A. Provide a complete parts list to MDOT upon installation identifying all replacement and serviceable components in the video wall system. All components shall be free of defects in workmanship and materials for a minimum of twelve (12) months and shall have a minimum two (2) year full parts and labor replacement warranty.

B. Supply contact information and necessary procedures for obtaining vital replacement parts within the designate timeframe.

C. Provide parts and on-site service warranties that have a 2-business day replacement guarantee. In lieu of a 2-business day replacement guarantee for video wall display monitors, the Contractor may elect to provide to MDOT one (1) spare 55” video wall panel to be used as a ready spare. Any warranted parts or items used from the ready spare supply should be replenished within seven (7) calendar days. Upon expiration of all warranties or extended warranties, MDOT shall purchase or return the spares to the Contractor or warranty agent.

D. The Contractor and/or warranty agent shall be solely responsible for all expenses incurred for upgrades, modifications or replacements required due to part or component obsolescence during the warranty period.

E. Replacement parts and warranty items must be received and installed prior to return of defective parts to the manufacturer or warranty agent.

END OF SECTION

SECTION 27 41 15 VIDEO CONTROL CONSOLES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section includes requirements furnishing all labor, equipment and materials for the fabrication and complete installation of six modular design video control consoles as indicated on the Drawings.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, specifications, and installation instructions of all components.

B. Shop Drawings: Provide details drawings of console and equipment layouts of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Shop drawings shall clearly indicate locations of joints in wood pieces, countertops, laminates, and other materials.

C. Submit list of completed installations.

D. Submit installer's experience record.

E. Samples:

1. Submit two sets of color chips of all color samples for all components to be selected from manufacturer's full line or custom finishes as indicated for color selection.
2. Submit one sample of the following components, which demonstrate workmanship and product quality:
   a. Worksurface sample with ergonomic nosing
   b. Sample panel construction with finish materials

1.03 QUALITY ASSURANCE

A. Minimum ten years experience in the manufacturing and installation of video console s.

B. Minimum of five completed installations of equal size and provide references.

C. All modular video consoles and related components shall be manufactured and installed by one manufacturer and supplied under his direction to eliminate any divided responsibility.

D. All work surfaces for casework and equipment consoles shall be constructed to within tolerances of plus or minus 1/64". All equipment consoles shall be constructed to within tolerances of plus or minus 0.020" for metal components and 1/32" for case work components of equipment consoles.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pack and ship units per manufacture's requirements.

B. Protect consoles during transit, delivery, storage and handling to prevent damage, soiling, and deterioration. Do not deliver consoles until painting, wet work, grinding and similar operations which could damage, soil, or deteriorate consoles have been completed in installation areas. Carpet tile shall be fully installed under console area prior to installation.

1.05 JOB 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. The Installer shall advise the Contractor of temperature and humidity requirements for the console installation areas. Do not install consoles until the required temperature and relative humidity have been stabilized and will be maintained in installation areas.

C. Maintain temperature and humidity in installation area as required to maintain moisture content of installed consoles within a 1.0 percent tolerance of the optimum moisture content from the date of installation through the remainder of the construction period.

D. Do not deliver, store, or install consoles until building is fully enclosed, wet work is complete, and HVAC system is operating and will maintain a temperature between 60 and 90 degrees F and relative humidity between 17% and 50% during the remainder of the construction period. The fabricator of the consoles shall determine the optimum moisture content and required temperature and humidity conditions

1.06 WARRANTY

A. All video control consoles shall be free from defects in materials and workmanship from the Date of Substantial Completion as follows:

1. Lifetime Warranty on all fixed structural frame components.
2. Lifetime Warranty for parts and Five Year Warranty for labor on all static exterior panels and work surface component parts.
3. Lifetime Warranty for parts and Five Year Warranty for labor on all adjustable, sliding, or hinged mechanisms or parts.
4. OEM Warranty on all buyouts including Five years on all E-Line Products (unless specifically defined by product line).

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Drawings and specifications are based on the Strategy Console manufactured by Evans Consoles Inc., 1115,381 Park Ave South, New York, NY 10016, Tel: 403-291-4444, Fax: 403-250-6549.

B. Or equal.

2.02 GENERAL

A. The consoles must be of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure or exterior elements.

B. The console structure, sub structure and frame must form a free standing unit independent of the exterior cladding.

C. The consoles must be manufactured to industry recognized ISO 9001:2008 quality standards.

D. Consoles shall be designed in accordance with the ergonomic standards of ISO, ANSI, BIFMA, and CSA.

E. Consoles shall be designed to comply with ADA 2010.

F. The work surface platform shall have smooth edges and transitions. Sharp edges at the console base and in the CPU cavity are not acceptable. All transitions and curves shall have a minimum five inch radius.

2.03 CONSOLE FRAME STRUCTURE

A. All sheet metal for structural components shall be cold rolled steel. All metal parts shall be finished with a durable black, electrostatic powder coating. Components shall be minimum gauge indicated:

1.	Foot	2 inches x 1 inch steel tube, powder coated
2.	Door columns	14 gage cold rolled steel, powder coated
3.	Corner modules	14 gage cold rolled steel, powder coated
4.	Front and Rear stringers	14 gage cold rolled steel, powder coated
5.	Work surface support arm	12 gage cold rolled steel, powder coated
6.	Work surface support stiffener	12 gage cold rolled steel, powder coated
7.	Fixed processor shelf	16 gage cold rolled steel, powder coated

B. Processor Shelf

1. Fixed Shelf for reduced depth module – 200 pound (90Kg) load, 14 gage CRS, powder coated black, at each console.

2.04 WORKSURFACES AND PANELS

A. Work Surfaces and Panels shall have the following properties:

1. Work surface shall be 30 inch reduced depth desktop modules, individual radiused modules as indicated on the drawings.
2. Materials: 1 inch (25mm) particle board, high pressure laminate surface.
3. Finish: High pressure laminate, custom.
   a. Work surface to match PL#3 – Formica; #7215-58 Earthen Terra.
   b. Vertical surfaces to match PL#4 – Formica, #5881-58 Chocolate Warp.
4. Static Load: 50-lb/linear ft

5. The consoles shall have hinged back panels to hinge from the column. Surface to be high pressure laminate in custom finish as indicated.
6. Slatwall: 12 inch high slatwall / paneling system with 6 inch tier front slatwall extrusion kits.

B. Rounded Polyurethane Work surface Nosing: Polyurethane foam secured over an aluminum extrusion carrier.

C. Electrical Devices: Provide industrial grade, internal mounted 120 V, 15 amp., 6 outlet, power bar with 6 foot grounded powercord at each console.

D. ACCESSORIES

1. Tasklight: Koncept, Z-Bar tasklight with extended arm length, high power daylight LED lamps (40,000 lamp life), 4 step dimmer, adapter cord and plug, and slatwall mounting bracket. One at each console. Equal to Evans DT-TSKLSWM.
2. Telephone shelf: Slatwall mounted telephone shelf on single tier articulating arm. One at each console. Equal to Evans SW-SMTS.
3. Monitor Arm: Slatwall mounted single high articulating monitor arm with nominal 20 inch extension, 12” pole height. Provide slatwall mount and VESA adapter plate. Accommodates monitor weighing up to 40 pounds. Three at each console. Equal to Evans E-Arm-20-SW-SH.
4. Bookcase: Under counter open bookcase with adjustable shelf at pie piece at console joins. High pressure laminate equal to custom vertical surfaces laminate indicated.
5. Storage Pedistal: Under counter fixed storage pedestal with one letter file and two box drawers with lock. High pressure laminate equal to custom vertical surfaces laminate indicated. One at each console.

PART 3 – EXECUTION

3.01 PREPARATION

A. Condition consoles to average prevailing humidity conditions in installation areas prior to installing.

B. Installer shall provide installation labor and site supervision.

3.02 INSTALLATION

A. Modules shall be able to be assembled using standard tools without any site cutting or drilling. Each module shall be rigid and self supporting.

B. Install work plumb, level, true and straight with no distortions.

C. Anchor consoles to access flooring panels.

3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective components wherever possible to eliminate defects functionally and visually. Where not possible to repair properly, replace. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate as needed, and make final adjustments for proper operation. Clean all exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

C. The installer shall advise the Contractor of final protection and maintenance conditions necessary to ensure the work will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 27 51 16 PUBLIC ADDRESS SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Preamplifiers.
2. Power amplifiers.
3. Microphones.
4. Volume limiter/compressors.
5. Equipment rack.
6. Loudspeakers.
7. Microphone and headphone outlets.
8. Conductors and cables.
9. Raceways.

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. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

B. VU: Volume unit.

C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

C. Qualification Data: For qualified Installer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

1. Testing Agency's Field Supervisor: Currently certified by NICET at Level III to supervise on-site testing.

C. Source Limitations: Obtain public address and mass notification systems from single source from 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 NFPA 70.

1.07 COORDINATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Microphone: One.

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. Alpha Communications.
2. Altec Lansing Technologies, Inc.
3. Atlas Sound LP.
4. Bogen Communications, Inc.
5. Dukane Communication Systems; part of GE Infrastructure, Security.
6. Edwards Signaling & Security Systems; part of GE Infrastructure, Security.
7. Electro-Voice; Telex Communications, Inc.
8. Federal Signal Corporation; Electrical Products Division.
9. Peavey Electronics.
10. Rauland-Borg Corporation.
11. Whelen Engineering Company, Inc.

2.02 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.03 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with TIA/EIA-310-D.

2.04 PREAMPLIFIERS

A. Preamplifier: Integral to power amplifier.

B. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

C. Total Harmonic Distortion: Less than 1 percent.

D. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

E. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

F. Minimum Noise Level: Minus 55 dB below rated output.

G. Controls: On-off, input levels, and master gain.

2.05 POWER AMPLIFIERS

A. Mounting: Rack.

B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.

C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

D. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

E. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.06 MICROPHONES

A. Hand-held Microphone: Electrovoice Cat. No. RE2-M21, one each, or equal as accepted.

B. Wireless Microphone: Electrovoice Cat. No. Re2-N2, one each, or equal as accepted.

2.07 VOLUME LIMITER/COMPRESSOR

A. Minimum Performance Requirements:

1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
2. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.
3. Distortion: 1 percent, maximum.
4. Rated Output: Minimum of plus 14 dB.
5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
6. Rack mounting.

2.08 EQUIPMENT RACK

A. Racks: 19 inches standard, complying with TIA/EIA-310-D.

B. Power-Supply Connections: Compatible plugs and receptacles.

C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.

D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.

E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.

F. Service Light: At top rear of rack with an adjacent control switch.

G. Vertical Plug Strip: Grounded receptacles, 12 inches on center; the full height of rack.

H. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.

I. Spare Capacity: 20 percent in rack for future equipment.

2.09 LOUDSPEAKERS

A. Cone-Type Loudspeakers:

1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
3. Size: 8 inches with 1-inch voice coil and minimum 5-oz.ceramic magnet.
4. Minimum Dispersion Angle: 100 degrees.
5. Rated Output Level: 10 W.
6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch steel and whole assembly rust proofed and shop primed for field painting.
8. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.

2.10 NOISE-OPERATED GAIN CONTROLLER

A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.

B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.

C. Level Adjustment Range: 20 dB minimum.

D. Maximum Distortion: 1 percent.

E. Control: Permits adjustment of sensing level of device.

2.11 OUTLETS

A. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.

2.12 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multipair, untinned solid copper.

1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.
2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
3. Plenum Cable: Listed and labeled for plenum installation.

2.13 RACEWAYS

A. Conduit and Boxes: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Outlet boxes shall be not less than 2 inches wide, 3 inches high and 2-1/2 inches deep.

PART 3 - EXECUTION

3.01 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.02 INSTALLATION OF RACEWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.03 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.04 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

D. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

E. Wall-Mounted Outlets: Flush mounted.

F. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

G. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

H. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.05 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.06 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.

B. 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.

C. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing public address systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
   a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
   b. Repeat test for each separately controlled zone of loudspeakers.
   c. Minimum acceptance ratio is 50 dB.
5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
8. Signal Ground Test: Measure and report ground resistance at pubic address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

E. Public address systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.07 STARTUP SERVICE

A. Perform startup service.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.08 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

3.09 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the public address and mass notification systems and equipment.

END OF SECTION

SECTION 28 05 05 SPECIAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL

A. The following systems indicated below and specified in detail hereinafter require specialized skill and experience in their installation and shall be furnished and installed by the MDOT's Security Vendor.

Section Number	Title
28 10 00	Electronic Access Control
28 23 00	Video Surveillance

B. Equipment described in the specifications noted above will be provided and installed by the MDOT Security Vendor thru a separate contract.

1. However, the Contractor is responsible for providing and installing required conduit for communications / power cabling and for providing and installing required power at each location.
2. In addition, the Contractor is responsible for coordinating with the MDOT security vendor throughout all phases of the project to ensure security components are installed in appropriate sequence and timeline to not delay the overall project.

C. The MDOT Security Vendor that should be coordinated with for this work is shown below:

1. Infrasafe, Inc.
Curtis Hrncirik, Business Development Manager
12612 Challenger Pkwy, Suite 300, Orlando, FL 32826-2700,
Phone: 407.926.6975, Fax: 407.859.5205

D. The Contractor shall coordinate with the MDOT security vendor throughout all phases of the project to ensure that correct conduit and power are installed at appropriate locations.

1.02 COORDINATION DRAWINGS AND APPROVALS:

A. Prior to any conduit installation, the Contractor shall coordinate with the security vendor and submit shop drawings showing locations for all security conduit routing and power location points and power requirements at each location. These drawings shall include approval signatures from both the Contractor and the security Vendor demonstrating that the required coordination has occurred. The drawings shall show each component, all interconnecting wiring with wire size and conduit size, numbering of all terminal strips, all pull or junction boxes, zones where applicable, and any other information which is deemed necessary. The diagram shall be done with drawing instruments so as to be neat, legible and all lettering upper case. CAD drawings may also be used.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. System wiring, though not shown on the Drawings, shall be furnished and installed in accordance with the intent of the plans and specifications and the one-line diagram. It shall be in conduit, unless otherwise noted. Type, size, and number of cables shall be in accord with manufacturer's recommendations.

B. System component locations shown on the Drawings are for estimating purposes only. Actual location shall be coordinated with the architectural finishes encountered, other equipment and structural elements, and shall be properly located for maximum system performance. Furnish all necessary mounting accessories for area involved.

END OF SECTION

SECTION 28 10 00 ELECTRONIC ACCESS CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This document covers the installation of a card reader Access Control System (ACS) which will be integrated into MDOT's state wide security system.

B. The equipment described in this specification will be provided and installed by the MDOT Security Vendor thru a separate contract. However, the Contractor is responsible for providing and installing the required conduit for the communications / power cabling and for providing and installing the required power at each location. In addition, the Contractor is responsible for coordinating with the MDOT security vendor throughout all phases of the project to ensure security components are installed in appropriate sequence and timeline to not delay the overall project.

C. The MDOT Security Vendor that should be coordinated with for this work is shown below:

1. Infrasafe, Inc.
Curtis Hrncirik, Business Development Manager
12612 Challenger Pkwy, Suite 300, Orlando, FL 32826-2700,
Phone: 407.926.6975, Fax: 407.859.5205

The Contractor shall coordinate with the MDOT security vendor throughout all phases of the project to ensure that the correct conduit and power are installed at the appropriate locations.

D. The security access system shall incorporate the following:

1. System Software
2. Security Panels
3. Power Supplies
4. Card Readers.
5. Door Position Switches
6. Door Control Devices

E. Drawings and Specifications:

1. Contractor shall carefully study the Drawings and Specifications, and shall at once report any error, unforeseen circumstances, inconsistency or omission he may discover.

1.02 PROJECT DEFINITIONS

A. General Definitions:

1. Access Control System (ACS): Electronic door control system which grants access through a door based on valid information on a credential card which is read by a card reader at the door.
2. Badges are credential cards that do not contain data to be read by card readers
3. Credential cards shall store uniquely coded data used by card readers as an Identifier.

4. CCTV: Closed-Circuit Television.
5. Central Station: The main controlling PC or server of the security access system.
6. DPDT: Double pole double throw switch.
7. Security Panel: An intelligent peripheral control unit that uses a computer for controlling its operation and controls directly card readers, locking devices and sensors.
8. Credential: Data assigned to an entity and used to identify that entity. (Card)
9. dpi: Dots per inch.
10. I/O: Input / Output.
11. LAN: Local Area Network.
12. NC: Normally closed contacts
13. NO: Normally open contacts
14. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
15. ROM: Read-only memory. ROM data is maintained through losses of power.
16. RS-485: TIA/EIA standard for multipoint communications.
17. SPST: Single pole single throw switch
18. TCP/IP: Transport Control Protocol/Internet Protocol incorporated into Microsoft Windows.
19. UPS: Uninterruptible Power Supply.
20. Wiegand:
    a. Patented magnetic principle that uses specially treated wires embedded in the credential card.
    b. Format which a card reader communicates with it respective security panel.
21. 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.
        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 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. UL294 - Standard for Access Control Systems
C. NFPA 72 - National Fire Alarm Code

D. NFPA 101 - Life Safety Code

E. UL 1449 - Surge Protective Devices

1.04 SYSTEM DESCRIPTION

A. The project shall include installing an Advantor INF SFX SV 2 SFX-I Server, Badging Printer and SFX-I software and related equipment.

B. This project shall include the installation of a card reader ACS which shall be compatible with the MDOT security standard.

C. The project shall be controlled from the District Security Center with backup control over the MDOT WAN for the MDOT security center in Jackson.

D. The project shall be based on the Advantor SF/X-I security system.

E. The project includes the installation of card reader and locking devices and accompanying hardware and cabling on the indicated portals.

F. Card readers shall report to the security panel indicated. The new card reader shall be a proximity type card reader compatible with the existing card reader format and communicate with the Advantor security panels.

G. The Advantor Security Panel shall communicate with or control the door hardware. The door hardware includes card readers, electric locking devices , power transfer push buttons, relays and power supplies

H. Door Hardware Interface: Coordinate with the specify door hardware required to be monitored or controlled by the security access system. The Security Panels in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware to function with the controls and PC-based software and hardware in this Section.

1.05 SUBMITTALS

A. Coordination Drawings and Approvals: Prior to any conduit installation, the Contractor shall coordinate with the security vendor and submit shop drawings showings the locations for all security conduit routing and power location points and power requirements at each location. These drawings shall include approval signatures from both the Contractor and the security Vendor the demonstrate that the required coordination has occurred. The drawings shall show each component, all interconnecting wiring with wire size and conduit size, numbering of all terminal strips, all pull or junction boxes, zones where applicable, and any other information which is deemed necessary. The diagram shall be done with drawing instruments so as to be neat, legible and all lettering upper case. CAD drawings may also be used.

B. Product Data (from Security Vendor): 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.

C. Shop Drawings (from Security Vendor): Submit nine (9) copies of each submittal.

1. Diagrams of cable layout with system labeling schedule.
2. Wiring diagrams.

D. Field quality-control test report showing all card readers, electric locking devices, and intercom devices are installed and functioning correctly.

E. Project Record Drawings:

1. The purpose of Project Record Drawings is to provide factual information regarding all aspects of the Work, to enable future service, modifications, and additions to the Work. They shall include documentation of all Work, including the documentation of existing card format, equipment, wiring, conduits, and raceways.
2. 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.
3. Project Record Drawings shall accurately show the physical placement of the following:
   a. Equipment and devices
   b. Conduit and raceways.
   c. Junction and pull box locations.
   d. Door hardware, and interface locations.
   e. Project Record Drawings shall show the physical placement of each device and conduit or aerial center line, to be accurate to within one foot 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
   f. Project Record Drawings shall show wire and cable runs, zone numbers, tamper circuit configuration, panel/circuit breaker numbers from which equipment is powered, and splice points. Such information may be shown on the site plans.
   g. Upon completion of Work, and prior to Final Acceptance, Contractor shall prepare and submit final record set of Project Record Drawings. This set shall consist of all data transferred from the working set, supplemented by Riser Diagrams and other information. The final record set of Project Record Drawings shall be drafted by a skilled draftsperson, under the supervision of Contractor. All final Project Record Drawings shall be provided to the MDOT or MDOT's representative.

4 System Documentation:
   a. Contractor shall maintain a file of System Documentation at the project site throughout the course of the Work. Such file shall be updated with new information as equipment is received and installed. System Documentation shall be available for inspection on a daily basis.
   b. Upon completion of Work, and prior to final Acceptance, Contractor shall prepare and submit three (9) sets of System Documentation.

5. Closeout Submittals:
   a. Provide a set Project Record Drawings to the MDOT or MDOT's representative including:
      1) As-Built Drawings
      2) Mounting Details
      3) Product Data
      4) Installation Manuals
      5) Operating Manuals
      6) Maintenance/Service Manuals

1.06 QUALITY ASSURANCE (applies to MDOT Security Vendor)

A. Contractor Minimum Qualifications:

1. Contractor shall be an installation and service contractor regularly engaged in the sale, installation, maintenance and service of Access Control Systems.
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. All electronic systems Work shall be performed by electronic technicians thoroughly trained in the installation and service of specialty low-voltage electronic 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. All 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. All such Work shall comply with the highest standards applicable to that respective industry or craft.
4. All 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 on the Bid Form.
2. The Contractor shall 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 all 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 all the obligations and responsibilities which the Contractor, by these documents, assumes.

E. Supervision and Construction Procedures:

1. The Contractor shall supervise and direct the Work, using his best skill and attention. Contractor is solely responsible for all construction means, methods, and techniques.
2. The Contractor shall 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 all communications given to the foreman shall be as binding as if given to the Contractor.

F. Regulatory Requirements and Permits:

1. All Work shall conform to all applicable building, fire, and electrical codes and ordinances. In case of conflict between the Drawings/Specifications and codes, the codes shall govern. The Contractor shall inform the Project Engineer or the MDOT's representative of any such conflicts.
2. Contractor shall secure and pay for all licenses, permits, plan reviews, engineering certifications, and inspections required by regulatory agencies. Contractor shall prepare, at Contractor's expense, any documents, including drawings that may be required by regulatory agencies.
3. The Contractor shall make application for and obtain any and all 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 the following:

1. NFPA 70, "National Electrical Code."
2. NFPA 101, "Life Safety Code."
3. UL294 B Standard for Access Control Systems

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 all 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. Contractor shall clean-up, on a daily basis as the Work progresses, all dirt, dust and debris caused by Contractor's operations. Clean-up shall be completed by the end of each workday to the satisfaction of MDOT's on-site representative.
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. Contractor shall provide all 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. Contractor shall comply with all local, state, and federal regulations and laws for the safety of the work place.

E. Accident Reports: 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 Access Control Systems to be operational.

B. Approach: Contractor and Security Vendor shall plan and schedule all work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order all equipment needed and notify any subcontractors to schedule their participation.
2. Perform all system layout work.

3. Insure there are an adequate number of power receptacles available to operate all security equipment and coordinate with MDOT or MDOT's representatives to where power is available.
4. Provide shop drawings to verify location of all equipment, conduit runs, power connections, etc. Submit shop drawings to MDOT or MDOT's representative.
5. Coordinate with MDOT or MDOT's representatives the wall space needed in each of the indicated rooms. Pre-mount Security Panels and Power Supplies on plywood back board.
6. Prepare and pre-test all equipment to the greatest extent possible.
7. Install all equipment.
8. Test and inspect all systems.
9. Perform all other Work as required.
10. Perform the Acceptance Test.
11. Provide training.
12. Provide as-built drawings.

1.10 COMMISSIONING

A. After all Work is completed, and prior to requesting the Acceptance test, Contractor shall coordinate with the security vendor to conduct a final inspection, and pre-test all equipment and system features. Security vendor shall correct any deficiencies discovered as the result of the inspection and pre-test.

B. Contractor and Security Vendor shall 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 that all Work is complete and has been pre-tested, and that all corrections have been made.

C. During Acceptance test, the Security Vendor shall demonstrate all 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. Security vendor shall promptly correct all deficiencies. Upon correction of deficiencies, Contractor shall submit a request in writing to MDOT or MDOT's representative for another Acceptance Test.

1.11 MAINTENANCE

A. Provide full procedures for testing battery condition on all security panels and power supplies.

B. Provide full procedures for any other tasks that must be performed to ensure the warranty remains intact.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Advantor contact information:

1. Curtis Hrncirik, Business Development Manager, Infrasafe, Inc., 12612 Challenger Pkwy, Suite 300, Orlando, FL 32826-2700, Phone: 407.926.6975, Fax: 407.859.5205

2.02 EQUIPMENT 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. Contractor shall provide all components needed for complete and satisfactory operation.

B. All products not provided by MDOT or MDOT's representative 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, all shall be identical and provided by the same manufacturer.

2.03 WIRE AND CABLE

A. General: Provide all wire and cable required to install systems as indicated. Wire and cable shall be sized to provide minimum voltage drop and minimum resistance to the devices being supplied.

B. All cables shall be specifically designed for their intended use.

C. Comply with equipment manufacturers recommendations for wire and cable size and type.

D. Comply with all applicable codes and ordinances.

2.04 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. All interior and exterior boxes shall have their covers fastened using security screws.

D. Lightning Protection:

1. The Contractor shall provide suitable lightning protection for all security panels.
2. All lightning protection equipment shall be UL listed.

2.05 HEAD END EQUIPMENT

A. Server: Advantor INF SFX SV 2 SFX-I Server

B. Color Badging Printer: Advantor 08504653 DAT 717512 Sp55

C. Advantor SFX-I software and license

2.06 SECURITY PANEL

A. Panel Provider: Advantor:

1. Provide Infraguard panels from Advantor.

2.07 CARD READERS

A. Proximity Card Reader: HID PR-40 Dual iClass/Prox Card Reader Family matching existing or HID Prox Pro I card format and configuration.

2.08 MAGNETIC DOOR CONTACTS

A. Manufacturers:

1. Sentrol; a GE company.
2. Securitron Magnalock Corporation; an ASSA ABLOY Group Company.
3. Dortronics Systems, Inc.

B. Electrical Requirements:

1. Voltage rating: 50 V dc
2. Power rating: 3 watts minim

C. Environmental:

1. Temperature range: -40 to 150 degrees Fahrenheit
2. Shock: 50 G's at 11 milliseconds
3. Reed switch internal atmosphere: dry nitrogen

D. Application:

1. Sensor recessed in top of door:
   a. Sensor Diameter: one inch.
   b. Gap distance in wood: two inches.
   c. Gap distance in steel: one inch.
   d. Electrical Configuration: SPDT
   e. Typical GE R1076W, 1078W or equal
   f. Provide spacers in the steel channel to bring the magnet to with in one half of the gape distance.
2. Sensor surface mount on top door:
   a. Sensor Diameter: one inch.
   b. Gap distance to make: three inches.
   c. Electrical Configuration: SPDT.
   d. Typical GE R1044TW or equal.

3. Doors with thresholds:
   a. Sensor Diameter: one fourth inch.
   b. Electrical Configuration: NO.
   c. Typical GE R1055W with 1921 magnet or equal.
4. Sensor deeply recessed in top of door:
   a. Sensor Diameter: one inch.
   b. Gap distance in wood: two inches.
   c. Gap distance in steel: Up to one inch.
   d. Electrical Configuration: NO.
   e. Provide bracket to bring magnet to within one fourth inch of switch.
   f. Typical GE 1082TW or equal.
5. Sensor for top or side of overhead or curtain doors:
   a. Gap distance: six inches.
   b. Electrical Configuration: NO.
   c. Typical GE 2515A or equal.
6. Sensor for bottom mounting of overhead or curtain doors:
   a. Gap distance: six inches.
   b. Electrical Configuration: NO.
   c. Typical GE 2204A and 1982 magnet or equal.

2.09 REQUEST TO EXIT PUSH-BUTTON

A. Manufacturers:

1. Securitron Magnalock Corporation; an ASSA ABLOY Group Company.
2. Dortronics Systems, Inc.

B. Electrical Ratings:

1. Minimum continuous current rating of 10 A at 120 V ac or 5 A dc.
2. Contacts that will make or brake 720 VA at 60 A inductive.

C. Enclosures Type:

1. Flush or surface mounting.
2. Single gang.
3. Suitable for flush mounting in the switch enclosures.
4. Plate and switch enclosures shall be stainless-steel.
5. Tamper mounting screws.

D. Push-Button Switches: Momentary-contact.

1. Push Button: two inches or larger mushroom
2. Mounting: Single gang plate
3. Electrical configuration: 1 NO and 1 NC
4. Dortronics Systems Moderl 5216-MP23 or equal

E. Push-Button Pneumatic Switches:

1. Push Button: two inches or larger mushroom.
2. Mounting: Single gang plate.
3. Momentary-contact adjustable delay.
4. Time delay module in compliance with NFPA 101.

5. Electrical configuration: 1 NO and 1 NC.
6. Dortronics Systems Model 5216-MP23DA or equal.

F. Touch Sense Exit Bar:

1. Length: thirty-six inch or forty-eight inches as required.
2. Electrical Configuration: DPDT.
3. Operation Power: 12 or 24 V ac or dc.
4. UL Listed.
5. Securitron TSB-3 Touch Sense Exit Bar or equal.

2.10 DOOR HARDWARE

A. Exit Devices:

1. Type:
   a. Rim type devices
   b. Electric Mortise type devices
      1) Surface mount vertical rod devices
      2) Concealed vertical rod devices
      3) Three-point latching devices
2. Electrical Configuration
   a. 24 V DC operation.
   b. Feedback sensors:
      1) Electric latch retraction (EL) contacts.
      2) Request to exit switch (RX).
3. Von Duprin 98/99 Series or equal.
4. VonDuprin Chexit Electromagnetic Locking Time Delay.

B. Electric Strikes:

1. Coordinate with door hardware, door frame and intended operation
2. Type:
   a. Strikes for Rim Exit.
   b. Strikes for Mortise and Cylindrical Locks.
3. Von Duprin Series 6000 24 V dc or equal.

C. Magnetic Lock:

1. Holding force one thousand two hundred pounds.
2. Anti tamper switch and fasteners.
3. Voltage 24 V dc.
4. Provide with mounting brackets or spaces as required.
5. Location:
   a. Interior Application: Securitron M68 Series or equal.
   b. Exterior Application: Securitron M62 Series or equal.

D. Electrical Power Transfer:

1. Type:
   a. New Construction: Concealed with in door. Von Duprin EPT-2, EPT-10, GVUX (fire door) or equal
   b. Retrofit: Securitron TSB-C or equal.

2.11 CABLES

A. For use in conduit:

1. PVC-Jacketed, provide with adequate number and size for the indicated task.
   a. NFPA 70, Type CM.
   b. Flame Resistance: UL 1581 Vertical Tray.

B. Interior cable tray or exposed:

1. Plenum-Type, provide with adequate number and size for the indicated task.
   a. NFPA 70, Type CMP.
   b. Flame Resistance: NFPA 262 Flame Test.

2.12 POWER SUPPLY

A. Manufacturers:

1. Altronix
2. Von Duprin

B. The power supply shall provide power for security panels, electric strikes, magnetic locks and detection devices.

C. Rated at a minimum of 1.2 the current draw of devices served.

D. Coordinate with MDOT or electrical contractor for electrical power requirements.
. Power supply enclosure:

1. Interior shall be minimum NEMA 1 rated.
2. Exterior shall be minimum NEMA 4 or NEMA 4R rated

E. Power supply enclosure:

1. Interior shall be minimum NEMA 1 rated.
2. Exterior shall be minimum NEMA 4 or NEMA 4R rated

F. Individually fused output for each locking device.

G. Input for connection to a UL listed fire alarm output which will upon a fire alarm disconnect lock power to allow free egress.

H. UL Listed for Access Control Systems (UL294).

2.13 NETWORK SWITCH

A. For each network switch required in the project plans, provide network switch meeting the following minimum requirements:

1. Type: Minimum of 24 10/100 Ethernet ports
2. Cisco Catalyst 2950 series network switch or equal

2.14 UNINTERRUPTIBLE POWER SUPPLY

A. Acceptable Manufactures:

1. APC (Schneider).
2. Black Box.
3. Sola.
4. Falcon.

B. Output:

1. Output power capacity: 2700 W/3000 VA.
2. Output voltage: 120 Vac.
3. Full load efficiency: 95 percent.
4. Output power distortion: Less than 5 percent at full load.
5. Output frequency: 57 -63 Hz.
6. Crest factor: Less than 5:1.
7. Waveform type: Sine wave.

C. Input:

1. Voltage: 120 Vac.
2. Frequency: 60 Hz.
3. Input voltage range: 82 -144 Hz.

D. Battery:

1. Type: Lead Acid B Maintenance Free
2. Full recharge time: 3 hr max
3. Backup time half load: Minimum 11 minutes
4. Backup full load: Minimum 3 minutes

E. UPS Management:

1. anel display of load and overload and on battery alarms.
2. Network or active device indication of load and overload and on battery alarms.

F. Filtering and Surge Protection:

1. RF filter.
2. Surge protection.
3. Surge energy rating: 480 Joules.
4. Complies with UL 1449.

G. Physical:

1. Rack Mountable
2. Rack Height 2U

H. Environmental:

1. Operation temperature: 32 B 104 Deg. F.
2. Operating Humidity: 0 to 95 percent non condensing.
3. Noise: Less than 47 dBA at 1 meter for surface.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

A. Field located security panels where indicated.

B. Mount field hardware (Security Panel, Card Readers, Electrified Locking Devices Locks, Time Delay Electrified Exit Devices, Power Supplies, Push Buttons, Request to Exit Sensors, etc.) and run connecting cables to indicated security panes.

1. Provide card interface module for each card reader.
2. Field locate cables from security panel to security work station.
3. Field locate cable and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other adverse conditions affecting installation.
4. Install, setup and configure all equipment, software and settings for a fully functioning security access control system.

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 one and one half inches deep. Provide box covers as required.
2. Exterior Boxes: Exterior boxes shall be NEMA 4 or NEMA 3R, watertight and dust-tight.
3. All interior and exterior boxes shall have their covers fastened using security screws.

B. Lightning Protection:

1. The Contractor shall provide suitable lightning protection for all security panels.
2. All lightning protection equipment shall be UL listed.

C. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

D. Examine roughing-in for LAN and control cable conduit systems to PCs, Security Panels, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

E. 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. All splices shall be made in junction boxes (except at equipment). Splices shall be made with an approved crimp connection. Wire nuts shall not be used on any low-voltage wiring unless the device to be connected comes with a pigtail.

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. Install cables and wiring according to requirements in Division 26 Electrical Specifications.

F. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

G. 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.

H. 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. Note Category 6 cable may be used in place of Category 5e if installed to Category 6 performance requirements.

I. Install cables without damaging conductors, shield, or jacket.

J. 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.

K. Install end-of-line resistors at the field device location and not at the Security Panel or panel location.

3.04 CABLE APPLICATION

A. 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.

B. Conduit And Raceway Installation:

1. Lay-out, size and plan conduit and raceway systems as indicated or as required.
2. Route exposed conduit and raceway parallel and perpendicular to walls and adjacent piping.
3. Maintain minimum six 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 all 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 feet.

C. 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.

D. Card Readers:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.
2. Unless manufacturer recommends larger conductors, install umber twenty-two AWG wire if maximum distance from Security Panel to the reader is two hundred fifty feet or less.,

E. Install minimum number sixteen AWG cable from Security Panel to electrically powered locks and from power supplies to locks or Security Panels.

3.05 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements of TIA/EIA-606.

B. Cable Administration Drawings for system identification, testing, and management. 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.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All 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.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

3.06 SYSTEM SOFTWARE

A. Provide and install Advantor SF/X-I software. Configure software to meet project requirements. Develop, install, and test databases for the complete and proper operation of systems involved. Assign software license to MDOT.

3.07 FIELD QUALITY CONTROL

A. During the Formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to remove devices from their mounts to inspect wiring connections.
B. Provide wiring diagrams and labeling charts to properly identify all wiring.

C. If corrections are needed, the Contractor shall perform the needed corrections in a timely fashion.

3.08 STARTUP SERVICE

A. Provide an Advantor authorized service representative to supervise and assist with startup service.

B. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

C. Enroll the MDOT provided badges and access information and verify correct operation.

3.09 DEMONSTRATION - TRAINING

A. Engage authorized service representative to train MDOT's maintenance personnel to adjust, operate, and maintain security access system.

END OF SECTION

SECTION 28 16 00 INTRUSION DETECTION

PART 1 - GENERAL

1.01 GENERAL

A. This specification outlines the requirements for intrusion detection throughout the building. All elements in this specification shall be supplied and installed by the contractor. Note that this is in addition to the access control system that will be provided separately as described in Section 28 10 00 Electronic Access Control

B. Conductors shall be installed in conduit where feasible. Provide raceway to frames as required and utilize same for “raceway” for door intrusion detection.

C. See Section 26 05 10 “Electrical General Requirements” for additional requirements.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. The system shall include: Motion detectors, glass breakage detectors, interior and exterior sirens, keypads, control station / panel, interconnecting cable.

NOTE: Equipment locations are not shown on the Drawings and shall be field coordinated with MDOT. The minimum system requirements include the following:

1. Motion Detectors in the hallway / entry way near each exterior door.
2. Glass breakage detectors in each office / room that has exterior windows.
3. Interior sirens located in both the front and back portions of the building that can be heard throughout the building.
4. Exterior sirens located at the front and back of the building.
5. Location of control station / panel and keypads to be field coordinated.

B. Interlock keypad with electric lock near entry door.

C. Provide security breach signal to external horns (minimum of 10’ AFG) location. This signal shall also be routed to internally located horns.

D. The following components are suggested as standard for quality with all system components:

1.	Glass Breakage Detector	C & K FG730
2.	Motion detector	IS-290CM-N (Long Range – Ceiling Mount)
3.	Panel	Ademco Vista 20SE
4.	Keypad	Ademco 6128 Alpha Numeric Back Lit
5.	Zone Expander	Ademco 4219
6.	Auxiliary Power Supply	Moose MP-CH12A
7.	Interior Siren	Ademco Wave II
8.	Outdoor Siren	Moose/Ariteck 44 Watt
9.	Battery Backup	Yuasa 7.0 Amp Hour

F. Horns for combination fire and burglary are allowable if the shared horn has distinct signals for each.

G. Provide 120 volt dedicated power circuit for the system, as required.

H. The system shall be equipped with a backup battery for loss of power situations.

PART 3 - EXECUTION

3.01 FIELD INSTALLATION

A. Field locate security panel, keypads and all equipment with MDOT representative in the field.

3.02 FIELD QUALITY CONTROL

A. Provide wiring diagrams and labeling charts to properly identify all wiring.

B. If corrections are needed, the Contractor shall perform the needed corrections in a timely fashion.

3.03 DEMONSTRATION - TRAINING

A. An authorized service representative shall train MDOT's personnel to adjust, operate, and maintain security system.

END OF SECTION

SECTION 28 23 00 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 equipment described in this specification will be provided and installed by the MDOT Security Vendor thru a separate contract. However, the Contractor is responsible for providing and installing the required conduit for the communications/power cabling and for providing and installing the required power at each location. In addition, the Contractor is responsible for coordinating with the MDOT security vendor throughout all phases of the project to ensure the security components are installed in the appropriate sequence and timeline to not delay the overall project.**

C. **The MDOT Security Vendor that should be coordinated with for this work is shown below:**

Infrasafe, Inc.
Curtis Hrncirik, Business Development Manager
12612 Challenger Pkwy, Suite 300, Orlando, FL 32826-2700,
Phone: 407.926.6975, Fax: 407.859.5205

The Contractor shall coordinate with the MDOT security vendor throughout all phases of the project to ensure correct conduit and power are installed at appropriate locations.

D. 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

E. Drawings and Specifications:

1. Contractor shall carefully study the Drawings and Specifications, and shall at once report any error, unforeseen circumstances, inconsistency or omission he may discover.

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
      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.
      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. **COORDINATION DRAWINGS AND APPROVALS: Prior to any conduit installation, the Contractor shall coordinate with the security vendor and submit shop drawings showings locations for all security conduit routing and power location points and power requirements at each location. These drawings shall include approval signatures from both the Contractor and the security Vendor to demonstrate required coordination has occurred. The drawings shall show each component, all interconnecting wiring with wire size and conduit size, numbering of all terminal strips, all pull or junction boxes, zones where applicable, and any other information which is deemed necessary. The diagram shall be done with drawing instruments so as to be neat, legible and all lettering upper case. CAD drawings may also be used.**

B. Product Data (from Security Vendor): 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

C. Shop Drawings (from Security Vendor): Submit nine (9) copies of each submittal.

1. Diagrams of cable layout with system labeling schedule.
2. Wiring diagrams.

D. From Security Vendor: Field quality-control test report showing all cameras and digital video recorders / devices are installed / tested and are functioning correctly.

E. Project Record Drawings:

1. The purpose of Project Record Drawings is to provide factual information regarding all 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 all 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 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. All 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 Drawing
2) Product Data
3) Installation Manuals
4) Operating Manuals
5) Maintenance/Service Manuals

1.06 QUALITY ASSURANCE (applies to MDOT Security Vendor)

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. All 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. All 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. All such Work shall comply with the highest standards applicable to that respective industry or craft.
4. All 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. The Contractor shall 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 all 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 all the obligations and responsibilities which the Contractor, by these documents, assumes.

E. Supervision and Construction Procedures:

1. The Contractor shall supervise and direct the Work, using his best skill and attention. Contractor is solely responsible for all construction means, methods, and techniques.
2. The Contractor shall 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 all communications given to the foreman shall be as binding as if given to the Contractor.

F. Regulatory Requirements and Permits:

1. All Work shall conform to all applicable building, fire, and electrical codes and ordinances. In case of conflict between the Drawings/Specifications and codes, the codes shall govern. The Contractor shall inform the MDOT's representative of any such conflicts.
2. Contractor shall secure and pay for all licenses, permits, plan reviews, engineering certifications, and inspections required by regulatory agencies. Contractor shall prepare, at Contractor's expense, any documents, including drawings, that may be required by regulatory agencies.
3. The Contractor shall make application for and obtain any and all 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, Article100, 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 all 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. Contractor shall clean-up, on a daily basis as the Work progresses, all 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. Contractor shall provide all Construction Aids required in the execution of the Work. Construction Aids that are the property of MDOTor 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. Contractor shall comply with all 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 and Security Vendor shall plan and schedule all work in such a sequence as to minimize the time before the system is operational. The following is a suggested work sequence:

1. Order all equipment needed and notify any subcontractors to schedule their participation.
2. Insure there are an adequate number of power receptacles available to operate all CCTV equipment and coordinate with MDOT or MDOT's representatives to where power is available.
3. Perform all system layout work.
4. Provide shop drawings to verify location of all 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 all equipment.
8. Test and inspect all systems.
9. Perform all other Work as required.
10. Perform the Acceptance Test.
11. Provide training.
12. Provide as-built drawings.

1.10 COMMISSIONING

A. After all Work is completed, and prior to requesting the Acceptance test, Contractor shall coordinate with security vendor to conduct a final inspection, and pre-test all equipment and system features. Security vendor shall correct any deficiencies discovered as the result of the inspection and pre-test.

B. Contractor and Security Vendor shall 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 that all Work is complete and has been pre-tested, and that all corrections have been made.

C. During Acceptance test, the Security Vendor shall demonstrate all 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. Security Vendor shall promptly correct all deficiencies. Upon correction of deficiencies, Contractor shall submit a request in writing to MDOT or MDOT's representative for another 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

2.01 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. Contractor shall provide all components needed for complete and satisfactory operation.

B. All 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, all shall be identical and provided by the same manufacturer.

2.02 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: one third 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 Camera: (All Exterior Installations)

1. Assembled and tested as a manufactured unit, containing a dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.
   a. Horizontal Resolution: 540 lines.
   b. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.With AGC, manually selectable on or off.
   c. Sensitivity: Camera indicated shall be combination day/night cameras.
   d. 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.

e. Manually selectable modes for backlight compensation or normal lighting.

f. Pan and Tilt: Direct-drive motor, 360-degree rotation angle. Pan-and-tilt speed shall be variable controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.

g. Preset positioning: minimum 8 user-definable scenes, each allowing 16-character titles. Controls shall include the following:
   1) In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
   2) Motion detection shall be available at each camera position.
   3) 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.

h. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

i. Software: Shall include the vendor supplied software necessary to control the Pan, Tilt, Zoom features.

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 B Pelco model PP350 or equal
2. Parapet rooftop mount B Pelco model PP351 or equal
3. Wall mount B Pelco model WM2000 or equal
4. Corner mount adaptor for WM2000 B Pelco model CM100 or equal.

2.03 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 twenty percent safety factor.

2.04 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

2.05 DIGITAL VIDEO RECORDS

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.

2.06 LCD MONITOR

A. Type: Flat panel LCD

B. Size: 19 inches minimum

C. Input: VGA

D. Resolution: Supports up to one thousand two hundred eighty by one thousand twenty-four for SXGA input

E. Brightness: adjustable to 300 cd/m5

F. Minimum Contrast Ratio: 500:1

G. Maximum Response Time: 12 ms

H. Industrial rated for 24 hour times 7 days a week operation

I. Power: 120 V ac at 50 Watts

2.07 WIRE AND CABLE

A. General: Provide all 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. All 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.

2.08 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 one and one half inches deep. Provide box covers as required.

B. Exterior Boxes: Exterior boxes shall NEMA 4 or NEMA 3R, watertight and dust-tight.

C. All interior and exterior boxes shall have their covers fastened using security screws.

D. Lightning Protection:

1. The Contractor shall provide suitable lightning protection for all security panels.
2. All 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 to 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 one and one half inches deep. Provide box covers as required.
2. Exterior Boxes: Exterior boxes shall be NEMA 4 or NEMA 3R, watertight and dust-tight.
3. All 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. All 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. All 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 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 all 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 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. All 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 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Firefighters' two-way telephone communication service.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.
11. System printer.

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. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.04 SYSTEM DESCRIPTION.

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.05 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.

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

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer.

C. 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.

D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Keys and Tools: One extra set for access to locked and tamperproofed components.
5. Audible and Visual Notification Appliances: One of each type installed.
6. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Commercial Products Group/CPG Life Safety Signals.
2. Faraday; Siemens Building Technologies, Inc.
3. Federal Signal Corporation.
4. Fire Control Instruments, Inc.; a Honeywell company.
5. NOTIFIER; a Honeywell company.
6. Siemens Building Technologies, Inc.; Fire Safety Division.
7. SimplexGrinnell LP; a Tyco International company.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

3. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
4. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
   a. Initiating Device Circuits: Style A.
   b. Notification Appliance Circuits: Style W.
   c. Signaling Line Circuits: Style 0.5.
   d. Install no more than 50 addressable devices on each signaling line circuit.
2. Serial Interfaces: Two RS-232 ports for printers.

D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

1. Pressurization starts when any alarm is received at fire-alarm control unit.
2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.

4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.
   a. Elevator lobby detectors except the lobby detector on the designated floor.
   b. Smoke detector in elevator machine room.
   c. Smoke detectors in elevator hoistway.
2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
   a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg Fper minute.
   b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
   c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg For a rate of rise that exceeds 15 deg Fper minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feetfrom the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

D. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: Semirecessed.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.08 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.09 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inchesabove the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.

3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

K. Annunciator: Install with top of panel not more than 72 inches bove the finished floor.

3.02 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feetfrom the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to elevator recall system and components.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at elevator shunt trip breaker.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.04 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

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.

B. 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.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 05 13 SOILS FOR EARTHWORK

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Subsoil and topsoil materials.

1.02 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving.

B. Section 31 23 17 - Trenching.

1.03 REFERENCES

A. ASTM C33 - Concrete Aggregates.

B. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

D. ASTM D2487 - Classification of Soils for Engineering Purposes.

E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Materials Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires approval.

PART 2-PRODUCTS

2.01 SOIL MATERIALS

A. Type S1 - Select Fill: Material shall consist of select, nonorganic and debris-free silty clays (CL) or sandy clays (CL) having a plasticity index (PI) within the range of 3 to 25 and a liquid limit less than 45. To be classified as silty clays (CL) or sandy clays (CL), the fill soils must have more than 50 percent fines passing the No. 200 sieve.

B. Type S2 - Course Aggregate: Washed stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C33, size number 467.

C. Type S3 - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded to the following:

1. Minimum Size: 1/4 inch.
2. Maximum Size: 5/8 inch.

D. Type S4 - Sand: Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C33.

E. Type S5 - Crushed Stone: Crushed Limestone, No. 610 gradation.

2.02 SOURCE QUALITY CONTROL

A. Tests and analysis of soil material will be performed in accordance with ASTM D4318 or ASTM C136.

B. If tests indicate materials do not meet specified requirements, change material and retest at no cost to Owner.

C. Maximum dry density of the soil materials will be determined by ASTM D698 and field density of in place materials by ASTM D2922.

PART 3- EXECUTION

3.01 STOCKPILING

A. Stockpile materials on site in sufficient quantities to meet project schedule and requirements.

B. Separate differing materials with dividers or stockpile apart to prevent mixing.

C. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.02 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 20 00 EARTH MOVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cutting, grading, filling and rough contouring the site for structures, paving, landscaping and etc.

1.02 RELATED SECTIONS

A. Section 01 45 29 - Testing Laboratory Services-MDOT.

C. Section 31 05 13 - Soils for Earthwork.

D. Section 31 23 17 - Trenching.

1.03 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

C. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

D. ASTM D4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

1.05 STRUCTURAL SPECIAL INSPECTION AND TESTING

A. Inspector shall observe and check material at bottom of footings and grade.

B. Verify excavations are at proper depth prior to concrete placement.

C. Perform classification and testing of controlled fill material. Refer to Paragraph 3.07.

D. Monitor and check for proper materials, densities, and lift thickness, during placement and compaction of controlled fill.

E. Prior to filling, observe proof rolling to determine that subgrade has been prepared properly.

PART 2-PRODUCTS

2.01 MATERIALS

A. Fill: Type S1 as specified in Section 31 05 13 unless noted otherwise.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. After stripping and/or excavation, proofroll building sites and pavement areas with a loaded dump truck. Excavate pumping or yielding areas and backfill with S1 material compacted to 95% maximum ASTM D698 density.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage.

D. Notify utility company to remove and/or relocate utilities, as necessary.

E. Protect above and below grade utilities that remain.

3.03 SUBSOIL EXCAVATION

A. Prior to excavating, strip a minimum of six inches of soil from the surface of the area to be excavated and stockpile for use as topsoil.

B. Excavate subsoil from areas required by the drawings.

C. Excavated material may be reused or stockpiled provided the material meets the requirements of Soil Material Type S1. Submit test reports to verify soil properties.

D. All excess material and material not suitable for fill material shall be removed from the site.

E. After excavation and prior to placing fill or pavements, scarify the top 6 inches of soil from ground surface and recompact to 95% ASTM D 698 density with stability. If soil is unstable, adjust moisture content as described in paragraph 3.04 G of this Section.

3.04 FILLING

A. Prior to placing fill, strip a minimum of six inches of soil from the surface of the area to be filled and stockpile for use as topsoil.

B. After stripping and proofrolling, scarify the top 6 inches of the ground surface and recompact to 95 percent maximum ASTM D698 density with stability. If soil is unstable, adjust moisture content as described in paragraph 3.04 G of this Section.

C. Fill areas to contours and elevations with type S1 material unless shown or specified otherwise.

D. Employ a placement method that does not disturb or damage other work.

E. Fill simultaneously on each side of unsupported foundation walls until supports are in place.

F. In building area, place fill materials in continuous 9 inch thick horizontally placed loose layers and compact to 98% ASTM D698 maximum density with stability (stability is defined as the absence of significant pumping or yielding of soils under compactive effort). In all other areas, place fill materials in continuous 9 inch thick horizontally placed loose layers and compact to 95% ASTM D698 maximum dry density with stability. Loose layers shall be 5 inch thickness when hand-held compaction is used.

G. Adjust moisture content of fill materials to within 3 percentage points of the optimum water content. ***The natural soils at this site are susceptible to a lack of stability (pumping) under wet conditions. The actual condition of these natural soils at the time of construction will be strongly influenced by the season of the year and the rainfall conditions preceding and during construction. If pumping is present, treating or drying of soils will be required to restore stability.***

H. The surface of each lift shall be scarified prior to placement of subsequent lifts.

I. Make grade changes gradual. Blend slope into level areas.

J. All areas not meeting required density or stability shall be excavated, reworked and retested.

K. Reshape and recompact fills subject to vehicular traffic.

L. Slope grade away from building.

3.05 DRAINAGE AND DEWATERING

A. The Contractor shall keep the area of work properly drained at all times during the time of the Contract. He shall construct and maintain, as required, any and all necessary ditches, flumes, and other temporary diversion and protective measures necessary. Any such protective measures other than channels or ditches called for on the plans or authorized by the Engineer shall be provided at the Contractor's expense. The Contractor shall furnish, install, maintain, and operate at his expense all necessary pumps, well points, deepwells, and/or other equipment required for dewatering the various parts of the work, and for maintaining the foundations, embankments, and other parts of the work, free from water as required for construction.

3.06 TOLERANCES

A. Top surface under paved areas and buildings: plus or minus .04 feet from required elevations.

B. Top Surface of Other Areas: Plus or minus 1/10 foot.

3.07 FIELD QUALITY CONTROL:

A. The Owner will provide testing as specified in Section 01 45 29 - Testing Laboratory Services.

B. Laboratory classification tests including Atterburg limit determinations and grain size analysis shall be performed on the fill and backfill soils initially and routinely during earthwork operations to check for compliance with the requirements for S1 fill.

C. Compaction testing will be performed in accordance with ANSI/ASTM D698 and/or ASTM D4254 and ASTM D2922.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: Compaction tests shall be taken at the rate of one per 5,000 sq.ft. per lift in pavement areas and one per 2,500 sq.ft. per lift in building areas.

END OF SECTION

SECTION 31 23 17 TRENCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavating trenches for utilities from outside of building.

B. Compacted fill from top of utility bedding.

C. Backfilling and compaction.

1.02 RELATED SECTIONS

A. Section 01 45 29 - Testing Laboratory Services-MDOT.

B. Section 31 05 13 - Soils for Earthwork.

C. Section 31 20 00 - Earth Moving.

D. Section 33 11 16 - Site Water Utility Distribution Piping.

E. Section 33 31 00 - Sanitary Utility Sewerage Piping.

1.03 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

C. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.04 DEFINITIONS

A. Utility: Any buried pipe, conduit, or cable.

1.05 FIELD MEASUREMENTS

A. Verify that survey bench mark and intended elevations for the Work are as shown on Drawings.

1.06 COORDINATION

A. Coordinate work with other trades.

B. Verify work associated with lower elevation utilities are complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Fill Type S1, S2, S3, or S4: As specified in Section 31 05 13 and as indicated on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect bench marks, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

E. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Fill Type S1 and compact to density equal to or greater than requirements for subsequent backfill material.

3.02 EXCAVATION

A. Excavate subsoil required for utilities.

B. Cut trenches sufficiently wide to enable installation and allow inspection.

C. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

D. Remove lumped subsoil.

E. Correct areas over excavated in accordance with Section 31 20 00.

3.03 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Granular Fill Type S2, S3, and S4: Place and compact materials as illustrated on the drawings in continuous layers not exceeding 6 inches compacted depth. Compact with vibratory equipment.

D. Soil Fill Type S1: Place and compact material in continuous layers not exceeding 8 inches compacted depth. Compact to 95% of standard proctor density (ASTM D698).

E. Employ a placement method that does not disturb or damage pipe in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Remove surplus fill materials from site.

3.04 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 0.08 feet from required elevations.

3.05 FIELD QUALITY CONTROL

A. The Owner will provide testing as specified in Section 01 45 29 - Testing Laboratory Services-MDOT.

B. Compaction testing will be performed in accordance with ANSI/ASTM D698 and ASTM D2922.

C. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

D. Frequency of Tests: Compaction tests shall be taken each lift at 200 feet intervals.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 31 16 SOIL TREATMENT FOR TERMITE CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil treatment for control of all species of subterranean termites including Formosan termites.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data and application instructions prior to application for Project Engineer's approval. DO NOT submit Material Safety Data Sheets for approval.

B. 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 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. 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. 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.

C. 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.

D. Comply with Mississippi Regulations Governing Pest Control Operators in following the labels of the termiticide.

1.04 PROJECT CONDITIONS

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with other handling and application instructions of the soil toxicant manufacturer.

C. Remove all non-pressure treated wood contacting soil. Remove grade stakes prior to applying horizontal barrier and all form boards, stakes and concrete over pour prior to applying vertical soil treatment.

1.04 GUARANTEE

A. Furnish 3 copies of written guarantee 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 any damage caused by termite infestation WITHOUT EXPENSE to the Owner. Provide guarantee for a period of 5 YEARS from the date of treatment, signed by the Applicator and the Contractor.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT SOLUTION

A. 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 INSPECTION

A. Applicator must examine the areas and conditions under which soil treatment for termite control is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.

3.02 APPLICATION

A. Remove foreign matter, which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

B. Application Rates: Under slab-on-grade, suspended slab, foundation footings and other similar structures, treat the soil before concrete slabs are poured using either power sprayer or tank-type garden sprayer. Apply soil treatment solution, USING COLOR DYE MARKING AGENT to insure the area is treated, as follows:

1. Termiticide applied for the prevention of termites shall comply with the manufacturer's label and shall not be applied at concentrations or volumes less than specified on the label.
2. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

C. Allow a minimum of 12 hours for drying after application, before beginning concrete placement or other construction activities.

3.03 PROTECTION

A. Prior to each application, the applicator shall notify the Contractor of the intended application and instruct the responsible person to notify construction workers and other site individuals to leave the treated area and not to return until chemical has been installed into the soil.

B. Post signs in the areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

END OF SECTION

SECTION 32 16 23 SIDEWALKS

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks.

1.02 RELATED SECTIONS

A. Section 01 45 29 - Testing Laboratory Services-MDOT.

B. Section 03 10 00 - Concrete Forming and Accessories.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 03 30 00 - Cast-in-Place Concrete.

E. Section 31 20 00 - Earth Moving.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ASTM C94 - Ready-Mixed Concrete.

D. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 SUBMITTALS

A. Product Data: Provide data on joint filler, admixtures, curing compounds, and sealants.

B. Concrete Mix Design.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F or surface is wet or frozen.

PART 2-PRODUCTS

2.01 FORM MATERIALS

A. Wood or Steel form material, profiled to suit conditions.

B. Joint Filler: ANSI/ASTM D1751.

2.02 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03 30 00.

2.03 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

B. Sealant: Silicone joint sealant Dow Corning 888 or equal.

2.04 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1 or Method 2.

C. Provide concrete to the following criteria:

1. Compressive Strength: 4,000 psi @ 28 days.
2. Slump: 3 to 5 inches.
3. Air Entrained: 6 percent.

D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Do not use calcium chloride.

F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

2.05 SOURCE QUALITY CONTROL

A. Submit proposed mix design to Architect/Engineer for review prior to commencement of work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manholes and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 PLACING CONCRETE

A. Place concrete as specified in Section 03 30 00.

B. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.05 JOINTS

A. Place expansion and contraction joints as shown on the drawings. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2 inch for sealant placement. Install sealer in accordance with manufacturer's recommendations.

3.06 FINISHING

A. Sidewalk paving: Light broom, across the traffic flow.

B. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.07 FIELD QUALITY CONTROL: The Owner will provide testing as specified in Section 01 45 29 - Testing Laboratory Services.

A. Laboratory shall take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

B. Three concrete test cylinders will be taken for every 50 or less cu yds of each class of concrete placed each day.

C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.08 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 32 92 23 SODDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Topsoil salvage and spreading.

B. Preparation of seedbed.

C. Lime and fertilizer application.

D. Sodding.

1.02 RELATED SECTIONS

A. Section 31 05 13 - Soils for Earthwork

B. Section 31 20 00 - Earth Moving.

1.03 QUALITY ASSURANCE

A. Provide fertilizer of good quality meeting the specified nutrient content specified for the site.

B. Sod shall have a minimum age of 12 months with root development, sufficient to support its own weight without tearing when suspended vertically by holding the upper two corners. Submit sod certification for grass specie and location of sod source.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery of lime or fertilizer in bulk or in bags shall be stored in a safe, dry place. Bags shall not be placed on the ground. Bulk materials may be spread immediately when delivered in bulk spreading vehicles.

B. Sod delivered to the site shall be stored, handled and protected according to the producers instructions. All exposed roots shall be protected from dehydration. All sod delivered shall not be stored longer than 24 hours.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Existing topsoil on the construction site shall be salvaged. This shall consist of the top 4-6 inches of soil from the disturbed areas after site clearing is complete. The topsoil shall be a rich, friable soil containing decaying organic matter but will be free of large stones, roots, sticks, weeds and any toxic material harmful to plant growth.

B. Additional topsoil, if needed, shall be imported from an off-site source provided by the Contractor. Natural on-site soils may be blended with imported materials to provide desired results.

2.02 SOD

A. Sod shall be ASPA certified field grown, cultivated bermuda grass with a strong fibrous root system, free of stones or bare spots, and contain no more than 10 weeds per 1,000 sq.ft.

B. Sod shall be harvested (machine cut) in accordance with ASPA guidelines.

2.03 ACCESSORIES

A. Fertilizer: Use a common 13-13-13 mixture at a rate of 600 lbs per acre.

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

C. Lime: Ground agricultural limestone.

D. Wood Pegs: Softwood, sufficient in size and length to ensure anchorage of sod on slope.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all other work has been competed that would disrupt or disturb the sodded areas.

3.02 PREPARATION OF SOIL

A. Prepare soil to eliminate low spots, uneven areas, or erosion gullies. Maintain lines, grades, profiles and contours shown on the plans. Make changes gradual and blend slopes into level areas.

B. Remove foreign materials, weeds, and undesirable plants. Cover any exposed subsoil.

C. Except in areas of future buildings and pavement, spread topsoil to a minimum depth of 6 inches to the cut and fill slopes and to other unpaved areas.

D. Scarify subsoil to a depth of 4-inches. Repeat scarifying in areas where hauling and spreading equipment has compacted the subsoil.

3.03 LIME

A. Apply lime at a uniform rate of 2 tons per acre after topsoil has been applied. Apply 1 ton/ac. of lime on 2 separate passes in cross directions.

B. Mix lime into the upper 4 inches of soil by disking.

3.04 FERTILIZER

A. Apply fertilizer at a uniform rate of 600 #/acre over all disturbed areas after topsoil, if required, has been applied.

B. Do not apply fertilizer at the same time or with the same machine that will be used to apply the seed.

C. Mix the fertilizer thoroughly into the upper 4" of soil by disking.

3.05 SODDING

A. All disturbed areas not receiving pavement or landscaping that is on a slope greater than 4H to 1V shall be sodded.

B. Prepare the site so sod will lay smooth with any adjacent concrete surface. Loosen the soil slightly for root penetration and moisten the surface immediately prior to laying sod.

C. Lay sod immediately after delivery to site to prevent root and plant deterioration.

D. Lay sod tight with no open joints visible and do not overlap. Stagger end joints 12 inches minimum and lay smooth without stretching.

E. On slopes, lay sod perpendicular to the slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.

F. Water sodded areas immediately after installation. Saturate the sod and wet seedbed to a depth of 4 inches.

G. After sod and soil have drained but still wet, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.06 MAINTENANCE

A. Provide maintenance as needed after seeding and sodding operations (or separate portions thereof) are complete and continue until final acceptance of the contract.

B. Needed maintenance will include reseeding, watering, mowing, repairing erosion rills and gullies, and other necessary operations to establish and maintain a vigorous vegetative cover.

C. Water at 7-day intervals if rainfall exceeding 1.0 inch accumulation has not been received. Apply 1.0 inches of water at each application.

D. Mow grass as needed to maintain grass in the 2.5 inch (minimum) to 4.0 inch (maximum) height range. Do not cut more than 1/3 of the grass blade at any one mowing. Do not mow within first 21 days after grass emergence. Use only a rotary or reel mower with sharp blades (no bushhog or flail mowers).

END OF SECTION

SECTION 33 09 20 INSTRUMENTATION AND CONTROL FOR WELLS

PART 1 - GENERAL

1.01 SCOPE

A. This item consists of supplying all labor, equipment, materials, tools, and incidentals required for designing, furnishing and installing controls for operating the new water well, chlorination system and fluoridation system as indicated on the drawings and specified herein.

B. Control panel shall be located outside as indicated on the drawings.

C. Controls supplier or Contractor shall have a local office within 100 miles of the job site, staffed with trained personnel fully capable of providing instruction, routine maintenance and emergency maintenance service on all system components. The controls supplier shall have a three year experience record in the design and installation of system similar in scope and performance to that specified herein, and shall be prepared to provide evidence for Professional's review and approval.

1.02 RELATED SECTIONS

A. Section 33 21 14 - Permanent Water Well.

B. Division 26 Electrical Sections.

1.03 SUBMITTALS

A. Submit in bound booklet form four (4) copies of approval documents to include a written description of the proposed system, data on components, catalog cuts, manufacturer's information, enclosures, wiring diagrams, controls diagrams and operating instructions.

1.04 COORDINATION

A. Controls supplier shall coordinate control requirements and power requirements with well pump, chlorination system and fluoridation system suppliers.

1.05 WARRANTY REQUIREMENTS

A. Workmanship and material shall be warranted for one year from date of final acceptance.

1.06 SYSTEM START-UP

A. The controls supplier shall furnish the services of a qualified field engineer to check installation, start-up and instruct operating personnel in the proper operation and maintenance of the equipment.

PART 2 - PRODUCTS

2.01 MASTER DISCONNECT SWITCH

A. The Contractor shall furnish and install a weatherproof fused master disconnect switch of proper size for all electrical demands of installed equipment. This switch shall be separate from the control panel and shall provide for complete power shutdown on the well and all appurtenances.

2.02 CONTROL PANEL

A. General:

1. The control panel encloser shall be a weatherproof enclosure, sized to contain the controls, have means for padlocking and shall be rated NEMA 3R.
2. All circuit breakers, selector switches, pilot lights and control devices shall be visible and operable from interior dead front panel. The dead front panel shall be constructed of anodized aluminum and shall have continuous aluminum hinges.
3. Main service to be 460 volt, 3 phase, 4 wire. Provide system phase failure, phase reversal, low voltage and lightning protection.
4. All points necessary for external connection in the controller, whether power or control, shall be wired to a terminal strip located at the top or bottom of the enclosure. The terminal strip shall be permanently marked with the same designation as the wire connected to it and have a 600 volt rating. The control system shall have a main ground lug as well as ground lugs for the pump motors.
5. All power and control wires shall be marked at both ends using self-adhering wire markers. No two wires having different functions shall have the same designation.
6. Control power shall be 120 volts, and be protected by correctly sized circuit breaker. Additionally, provide a properly sized control power transformer with primary over current protection.

2.03 WELL PUMP CONTROLS

A. Provide a properly sized combination circuit breaker magnetic motor starter with the following additional equipment and features:

1. The well shall be controlled by a simplex controller per component specifications.
2. In the automatic mode, the simplex controller shall receive start/stop commands from the level meter/controller per component specifications.
3. Provide an elapsed time meter per component specifications. The elapsed timer meter shall provide indication of the well motor total running time.
4. Controls shall be provided to operate the chlorination system and fluoridation system when the well pump is running. Controls shall include an adjustable time relay switch.
5. Provide a field adjustable water lube solenoid timer to activate the lube solenoid prior to operating the well. The solenoid provided shall be a "fail open" type.

2.04 SIMPLEX CONTROLLER

A. Provide a simplex controller including the following control functions and auxiliaries:

1. Manual-Off-Automatic selector switch along with an amber "call for" light, a red "failure light" and a green "running" light for each motor circuit.
2. Provide a field adjustable time delay to start motor after motor "call for" signal is received. This time delay shall be field selectable to occur each time the motor is called to operate or only after a power failure or during initial startup. Timing period shall be adjustable from 13 to 150 seconds.
3. A soft start and stop feature shall be included to prevent water hammer.
4. Provide a field adjustable time delay to prevent motor failure from being activated until the controller has had time to receive a positive motor running signal. The timing range shall be adjustable from 7 to 75 seconds.

5. Each alarm function shall flash individual red pilot lights as well as activate a common alarm and common alarm light. Provide an exterior alarm light output which allows the light to glow dim under normal conditions to indicate power on and lamp good. The light shall flash brightly on and off during any alarm condition. Provide a lamp test feature to light all front panel pilot lights. Provide a horn that will activate during an alarm condition.
6. Simplex controller shall be solid state and easily replaceable. Conventional relay and time construction or PLC control is not acceptable.

2.05 LEVEL/METER/CONTROLLER

A. Provide an electronic solid-state proportional level meter/control that will accept a four (4) to twenty (20) mill amp or one (1) to five (5) volt DC signal, condition the signal to provide a valid basis for control and then perform on/off or open/close discrete dry type set point contact conditions based on the input value of the analog input signal. Input for the level meter/controller shall be from the pressure sensor. The level meter/controller shall have the following features.

1. Provided with a 3-1/2 digit LED readout meter in psi of water.
2. Provide at least three separate setpoints each with discrete, isolated sealed SPDT relay output contacts. One set point will turn well off, one set point to turn well on, and one set point for low water pressure alarm.
3. Provide excitation voltage to drive a transducer/transmitter and condition its output signal to provide a continuous display of level.
4. The setpoints shall be field adjustable to operate on rising above or falling below the setpoint.
5. An LED indicator shall be provided for each setpoint to indicate when it is activated.
6. The actual setting of each setpoint shall be able to be displayed on the digital readout at any time.
7. The setting of each setpoint shall be field adjustable throughout the complete signal range from the front of the meter/controller. The signal range shall be between 0 - 60 psi.
8. Provide a means of manually ramping the meter/controller up and down, throughout its complete signal range, to test the operation of the set points.
9. Provide a lamp test feature to test all front panel LED indicators and digital display segments.

2.06 ELAPSED TIME METER

A. Elapsed time meter shall register up to 99,999.9 hours of well pump motor running time. The meter shall be of the nonreset type, be flush mounted and be U.L. recognized.

2.07 PRESSURE/LEVEL SENSOR

A. Provide a pressure/level transducer system to measure pressure in the water line and transmit a signal to the level/meter controller.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor to verify electrical requirements, motor size and all requirements for controls.

B. Install controls as indicated on the drawings and manufacturer's written instructions.

C. Provide instruction and training for operation and maintenance to Owner's operating personnel.

END OF SECTION

SECTION 33 11 16 SITE WATER UTILITY DISTRIBUTION PIPING

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines.

B. Valves.

1.02 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving.

B. Section 31 23 17 - Trenching.

C. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

B. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

C. ANSI/AWWA C110/A21.10 - Ductile Iron and Gray-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.

D. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

E. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.

F. ANSI/AWWA C153/A21.53 - Ductile Iron Compact Fittings, 3 in. through 16 in. for Water and Other Liquids.

G. ANSI/AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.

H. ANSI/AWWA C502 - Dry-Barrel Fire Hydrants.

I. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

J. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

K. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

L. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe(SDR-PR).

M. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

N. ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe Systems.

O. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

P. UL 262 - Gate Valves for Fire-Protection Service.

Q. UL 789 - Indicator Posts for Fire-Protection Service.

PART 2-PRODUCTS

2.01 PIPE, COUPLINGS AND ACCESSORIES

A. PVC Pipe:

1. All PVC pipe and fittings four (4) inches and larger in diameter shall conform to the latest edition of AWWA C-900 and shall be made from Class 12454-A or B materials per the latest edition of ASTM D-1784. Pipe shall be a minimum of DR 18 unless otherwise specified, for a working pressure rating of 150 PSI. All pipe shall conform with the outside diameter (OD) dimensions of ductile iron pipe to facilitate use of DIP fittings, standard cast iron valves and specials. All joints shall have elastomeric seals conforming to the latest edition of ASTM F-477. All pipe shall bear the seal of the National Sanitation Foundation (NSF). All jointing shall be made in accordance with the manufacturer's recommendations. Provide a magnetic detectable tracer wire with a plastic covering imprinted with water service 18 inches above top of pipe.
2. All PVC pipe three (3) inches and smaller in diameter shall conform to the latest edition of ASTM D-2241 and shall be made from Type 1120 material. Pipe shall be a minimum of SDR 26 unless otherwise specified, for a working pressure of 160 PSI. All joints shall be solvent weld in accordance with the latest edition of ASTM D-2855 with the solvent cement conforming to the latest edition of ASTM D-2564. All pipe shall bear the seal of the NSF. All jointing shall be made in accordance with the manufacturer's recommendations. Provide a magnetic detectable tracer wire with a plastic covering imprinted with water service 18 inches above top of pipe.

B. Ductile Cast Iron Pipe: All pipe shall be centrifugally cast manufactured in accordance with the latest edition of ANSI A21.51 (AWWA C 151). Pipe shall be pressure class 350 psi. All pipes and fittings shall be factory-coated on the outside with coal tar enamel conforming to the latest edition of A 21.5 and lined inside with a minimum of 1/16 inch cement lining in accordance with the latest edition of ANSI A 21.4 (AWWA C-104).

1. Joints for ductile cast iron pipe shall be slip-on type unless otherwise specified. All joints for fittings, valves and specials shall be mechanical joints. Slip-on pipe joint for ductile cast iron pipe shall conform to the latest edition of ANSI A 21.11 (AWWA C 111) except that the joints shall be made with a special gasket seal Super-Bel Tite as manufactured by Clow Corporation or approved equal. Lubricants shall be non-toxic, odorless, tasteless and shall not support bacteria and shall be specifically manufactured for the pipe utilized. Mechanical joints shall conform to the latest edition of ANSI A 21.11 (AWWA C 111).
2. All fittings shall be ductile iron and shall conform to the latest edition of AWWA C110 or C153 for ductile iron fittings.
3. All fittings shall be tar coated outside and cement lined inside in accordance with the latest edition of AWWA C-104 (ANSI 21-4), except cement lining may be half of thickness (enameline type) with bituminous seal coating.

C. Valves:

1. Gate Valves larger than 3-inch - Shall comply with the latest edition of AWWA C-500 as manufactured by Mueller, American-Darling or approved equal. Gate valves shall be iron body, fully bronze mounted, double disc, parallel seat, non-rising stem, and shall open counterclockwise. All gate valves shall have a maximum working pressure of 200 PSI and be tested at 400 PSI. The thrust collar and other bearing surfaces shall be permanently lubricated with oil. The disc mechanism shall be designed so that the seating pressure is applied equally at multiple separate contact points near the outer edge of each disc by a bronze or alloy wedging mechanism. Gate valves shall be equipped with mechanical joint connections unless otherwise specified.
2. Valve Boxes - Cast iron box having top section and cover with lettering water. Bottom section with base of size to fit over valve and barrel approximately 5" in diameter, and adjustable cast-iron extension of length required for depth of bury of valve. Provide steel T-handle wrench with each valve box.
3. Post Indicator Valves - Provide with operating nut located about 3 feet above finish grade. Gate valves for use with indicator posts shall conform to U.L. 262. Indicator posts shall conform to U.L. 789. Provide each indicator post with one coat of primer and two coats of red enamel paint. Valves and posts shall be similar and equal to Mueller or American Darling.
4. Check Valves - Shall be iron body, spring loaded, swing type with straight-away passage of full pipe area and renewable bronze seat ring with resilient faced disc. Valves shall be as manufactured by Mueller, American-Darling or approved equal.
5. Gate Valves smaller than 3-inch shall be Class 200, solid wedge, nonrising stem. Valves shall have flanged end connections or threaded end connections with a union on one side of valve.

D. Services: Service piping shall be 200 PSI Polybutyl or Type "K" copper and shall conform to the applicable AWWA/ASTM/ANSI Standards and designed for working pressure compatible with the water mains specified above.

E. Specials: Specials shall be of the same material as the pipe material being used or as approved by the Engineer. The term specials shall include plugs, caps, and other items as needed. Specials shall conform to the applicable AWWA/ASTM/ANSI Standards and shall be designed for the working pressure of the water mains on which they are being installed.

F. System Materials: Pipe materials shall comply with the following schedule:

SYSTEM	MATERIAL
Yard Piping	PVC

G. Fire Hydrants

1. Fire hydrants shall be 5-1/4" valve opening and be Mueller A-436 or American Flow Control B-84-B. Fire hydrants shall comply with the latest edition of AWWA C502. Each hydrant shall be 6 inch mechanical joint ends with harnessing lugs ("dog ears") and shall open by turning to the left (counterclockwise). Fire hydrant shall be of ample length for 3-1/2 foot depth of bury. It shall be provided with two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle, all having National Standard hose threads approved by the Local Fire Department. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1-1/2" point to flat). Fire hydrants shall be equipped with "O-Ring" packing. Fire hydrant shall be furnished with two coats of red alkyd gloss enamel paint over a prime coat.

H. Backflow Prevention Assembly

1. Shall be listed in the latest version of the "List of Approved Backflow Prevention Assemblies" published by the Mississippi State Department of Health, Division of Water Supply, or as approved by the University of Southern California's Foundation for Cross Connection Control and Hydraulic Research. These assemblies shall be furnished as a complete set with the approved shut-off valves specified in the above lists.

I. Heated Insulated Enclosure for Backflow Prevention Assembly

1. Shall be fabricated from aluminum. Insulation shall be a minimum of 1.5 inches of polyisocyanurate foam or board stock laminated between two layers of fiberglass mat. Structural members shall be aluminum. Roof and wall panels shall be factory assembled with no on-site drilling required. Multi sectional enclosures shall fit together with overlapping tongue and groove joints. The unit shall be fastened to the concrete foundation. Access panels shall be provided to allow for easy access for operation, maintenance, and testing of backflow prevention assembly without removal or disassembly. Access panels shall be lockable. Heating equipment shall maintain an interior temperature of + 40°F with and exterior outside temperature of 0°F with a wind velocity of 15 mph. Heating equipment shall be UL, ETL or CSA certified. Electric power source for heat and accessories shall be G.F.I. protected. Hardware shall be stainless steel or aluminum.

PART 3-EXECUTION

3.01 PIPE LAYING

A. General: Pipe shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations.

B. Pipe, appurtenances, and fittings shall be laid to the line and grade established on the plans. Standard cover depth shall be 3' minimum.

C. The inside of the bells and the outside of the spigots shall be thoroughly cleaned before they are placed. The inside of all pipe shall be thoroughly swabbed to ensure that the pipe is clean and free of obstructions and foreign matter until the work is completed.

D. Where pipe laying ceases at the end of the day or for any cause, the end of the pipe shall be securely closed in order to prevent the entrance of water, mud or any other objectionable matter.

E. Pipe shall not be lain when water is in the trench.

F. Thrust Blocking shall be installed at locations as indicated on the drawings.

3.02 MAKING JOINTS

A. All joints shall be constructed in accordance with the manufacturer's recommendations using the jointing materials, specials and lubricants specified by the manufacturer and approved by the Engineer. Restrain joints as required to prevent separation.

3.03 SETTING FITTINGS, VALVES, AND SPECIALS

A. All fittings, valves, valve boxes, and other appurtenances shall be set at the location indicated on the plans. Omission of any of these items shall be corrected by the Contractor without extra cost to the Owner. Valves and fittings shall be jointed to pipe as recommended by manufacturers.

B. All buried valves, including by-pass valves, shall be provided with a valve box. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut with the cover flush with the pavement surface or such other level as directed. Valve box slabs or marker posts shall be provided where specified on the drawings.

3.04 SERVICE ASSEMBLIES AND SERVICE LINE INSTALLATION

A. Assemblies shall consist of a corporation stop, service clamp, curb stop and other appurtenances needed to complete the assembly in accordance with the plans. They shall be installed in a good and workmanlike manner in the places designated on the plans or as directed by the Engineer.

3.05 CONNECTION TO EXISTING MAINS

A. Where indicated on the Plan, cut-ins must be made by the Contractor in order to connect the new main with existing water mains. The Contractor shall coordinate connections with the utility owner. The Contractor shall furnish all labor and materials and service required for the excavating, cutting the existing mains, removal and relocation of sections of old, connecting the new main with the pipe, de-watering the trench old and the setting of necessary fittings, specials and valves as shown on the PLANS. Connection to existing mains shall be made after the new line has been disinfected and tested.

B. The Contractor shall provide temporary blocking and bracing a properly placed to prevent movement or blowing off of any pipe, valves or fittings due to water pressure on the main. All connections shall be made in a most expeditious and workmanlike manner to cause the least inconvenience.

C. Any time that the interruption of water service in the existing system is necessary because of operations under this Contract, the Contractor shall notify the Owner at least 48 hours in advance. Interruptions of water service shall be coordinated with the Owner. The developed schedule will be strictly adhered to.

3.06 SEPARATION OF WATER AND SEWER MAINS

A. Water Piping installation Parallel with Sanitary Sewer Piping

1. Normal Conditions. Water Piping shall be laid at least 10 feet horizontally from a sewer manhole whenever possible. Distance shall be measured edge to edge.
2. Unusual Conditions. When local conditions prevent a horizontal separation of 10 feet, water piping may be laid closer to a sewer or sewer manhole provided:
   a. Bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
   b. Where this vertical separation cannot be obtained, sewer piping shall be constructed of AWWA-approved water pipe, pressure tested in place without leakage prior to backfilling.
   c. Sewer manhole shall be of watertight construction and tested in place.

B. Installation of Water Piping Crossing Sanitary Sewer Piping

1. Normal Conditions. Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping. The length (minimum 18 feet) of water piping shall be centered at the point of crossing so that joints shall be equidistant and as far as possible from sewer piping.
2. Unusual Conditions. When local conditions prevent a vertical separation described above, the following construction shall be used:
   a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water piping, pressure tested in place without leakage prior to backfilling.
   b. Water piping passing under sewer piping shall, in addition, be protected by providing the following. A vertical separation of at least 18 inches between bottom of sewer piping and top of water piping; adequate structural support for sewer piping to prevent excessive deflection of joints and settling on and breaking of water piping; and that the length (minimum 18 feet) of water piping be centered at the point of crossing so that joints shall be equidistant and as far as possible from sewer piping.

C. Sanitary Sewer Piping or Sanitary Sewer Manholes. No water piping shall pass through or come in contact with any part of a sewer manhole.

3.07 HYDROSTATIC TESTS

A. After the pipe is laid and the line flushed, it shall be filled with water with care being exercised to expel all air from the pipe. During the test period all pipe, valves, fittings, and joints shall be examined carefully for defects. Any observed leaks or defective pipe shall be satisfactorily repaired or replaced, at the expense of the Contractor and the test repeated until the section tested is within the limits prescribed hereinafter. The entire distribution system or parts thereof shall be tested under hydrostatic pressure of 150 psi, for a period of 4 hours, if joints are exposed, or for an 8 hour period, if joints are covered. Repairs shall be made using approved materials and new replacement fittings, specials, of gaskets where leakage occurs.

B. Leakage shall be measured by an approved calibrated meter through which all of the water required to maintain test pressure shall be pumped. All testing shall be performed in the presence of the Engineer or his authorized representative, and the Engineer shall be notified at least 24 hours in advance of the start of the test.

C. The Contractor shall furnish the pump, pipe connections, fittings, gates, meters, and all necessary apparatus and shall furnish all labor and work required to make the tests. All costs of testing shall be borne by the Contractor and testing operations shall remain in operation until approved by the Engineer. Allowable leakage shall not exceed 10 gallons per 24 hours per inch of diameter per mile of pipe, at the specified test pressure.

D. Tests shall be completed in accordance with the latest edition of AWWA C-600 except as modified herein.

3.08 DISINFECTION OF PIPELINES

A. Disinfecting of water lines shall be in accordance with Section 33 13 13.

END OF SECTION

SECTION 33 13 13 DISINFECTION AND TESTING FOR WATER LINES

PART 1-GENERAL

1.01 GENERAL

A. This item includes furnishing all labor, materials, equipment and incidentals for disinfecting and testing the water lines.

B. The Contractor shall disinfect all constructed water lines in strict accordance with Mississippi State Board of Health guidelines and AWWA C651.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 33 11 16 - Site Water Utility Distribution Piping.

PART 2-PRODUCTS

2.01 MATERIALS

A. Materials used for disinfection shall conform to AWWA-C651, Section 2.

PART 3-EXECUTION

3.01 WATER LINES

A. Any connection of new water line to the active distribution system prior to receipt of satisfactory bacteriological samples may constitute a cross-connection. The new water line must be isolated until bacteriological test in paragraph C below are satisfactorily completed.

B. After completion of the construction and pressure testing of water lines, they shall be flushed and disinfected using at least a 50 mg/L free chlorine solution for 24 hours or as described in AWWA C651.

C. Before a water line can be placed in operation, water samples shall be taken and analyzed in accordance to Mississippi State Board of Health requirements. Disinfection will continue until the water shows no coliform bacteria and no confluent growth. Samples shall be taken by the system operator or county sanitarian.

END OF SECTION

SECTION 33 21 14 PERMANENT WATER WELL

PART 1-GENERAL

1.01 SCOPE

A. The work to be done under these specifications includes furnishing all materials, labor, supervision, tools and equipment necessary for the completion of a potable water well as shown on the Drawings and as specified herein.

1. The Contractor is to develop a usable and reliable groundwater supply with a design yield of 15 gpm at an above ground head of 60 psi.

B. Only experienced water well contractors licensed by the Mississippi Department of Environmental Quality who have drilled at least five (5) potable water wells of similar capacity and depth within the last two (2) years will be acceptable to the Owner. The Contractor shall submit this list including names, addresses, and telephone numbers of contact persons along with bid documents.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 11 23 00 – Controls.

C. Section 31 25 13 - Erosion Controls.

D. Section 33 11 16 - Site Water Utility Distribution Piping.

E. Section 33 11 17 - Disinfection and Testing for Water Lines.

F. Electrical Sections.

1.03 REFERENCES

A. American Water Works Association, Inc. (AWWA) Standards.

1. A100-90 - Water Wells

B. American Welding Society

C. American Petroleum Institute Welding Specifications

1.04 WELL DATA SUMMARY

A. General

1.	Ground Elevation at Site (Approx.)	44 feet
2.	Required Well Capacity	200 gpm
3.	Required Discharge Head	60 psi
4.	Anticipated Test Hole Depth	825 feet
5.	Anticipated Test Well depth	800 feet
6.	Anticipated Permanent Well Depth	800 feet
7.	Surface Casing	Optional
8.	Outer Casing Size (Nominal)	12 inches

9.	Outer Casing Material	Steel
10.	Coating Inside of Outer Casing	Yes
11.	Inner Casing or Lap Pipe Size (Nominal)	8 inch
12.	Inner Casing or Lap Pipe Material	Steel
13.	Coating Inside and Outside of Lap Pipe	Yes
14.	Lap Pipe Length (Minimum)	60 feet
15.	Screen Size (Nominal)	8 inch
16.	Screen Material	304 ss
17.	Screen Length (Minimum) est.	50 feet
18.	Gravel Pack or Natural Development	Gravel
19.	Type of Pumping Equipment	Vertical Turbine
20.	Type of Lubrication	Water
21.	Discharge Fittings and Accessories	
a)	Dresser Coupling	One - 6"
b)	Standard Flanged Check Valve	One - 6"
c)	Standard Flanged Gate Valve	One - 6"
d)	Standard Flanged Tee	Two - 6"
e)	Standard Flanged 45 Degree Ell	Three - 6"
f)	Standard Flanged 90 Degree Ell	One - 6"
g)	Standard Flanged Spool Piece	One - 6" x 36"
h)	Standard Flanged Spool Piece	One - 6" x 12"
i)	Air Release Valve	One - 2"
j)	Standard Sampling Faucet	One - 3/4"
k)	Master Meter	One - 6"
l)	Pressure Sensor and Pressure Gage	Yes
m)	Insulation	Yes
n)	Connection to Main	Yes
o)	Chlorination	Yes
p)	Fluoridation	Yes

1.05 SUBMITTALS

A. General: In accordance with Section 01 33 00 – Submittal Procedures

B. Test Hole

1. Driller's log
2. Formation samples
3. Sieve analysis
4. Geophysical log(s)

C. Test Well

1. Hydraulic test results
2. Water samples(s)
3. Contractor’s Hydrologist report and evaluation

D. Permanent Well

1. Casing coating materials
2. Hydraulic test report
3. Pump test and bacteriological test reports

1.06 QUALITY ASSURANCE

A. Contractor to exercise all diligent and reasonable precautions to prevent contaminated water or water having undesirable physical or chemical characteristics from entering the well and/or aquifer or aquifers through which the hole has been drilled. The Contractor will prevent contaminated water, gasoline or other toxic substances from entering the well through the well bore or by seepage through the ground surface.

B. Should the well become contaminated with water having undesirable chemical or physical characteristics or with any other chemical or toxic substance through negligence by the Contractor or his employees, the Contractor, at his own expense, shall provide casings, seals, sterilizing agents or any other required material or equipment to eliminate the contamination.

C. The bore hole and drilling mud pits shall be protected by dikes and ditches to prevent any surface run-off from entering the mud circulating system. At all times during the progress of the work, the Contractor shall protect the well in such manner as effective to prevent either tampering with the well or the entrance of foreign matter into it. The Contractor shall erect and maintain a fence around the mud pit for protection of campus personnel and students.

D. All water used in the drilling operation shall be obtained from sources of proven satisfactory bacteriological quality. Routine samples from public supplies may be used as a basis for determining compliance. It shall be the responsibility of the Contractor to make his own arrangements for providing water at the drilling site. The Owner will provide water at no cost, if available, at the nearest available outlet.

E. It is understood and agreed that the Contractor cannot guarantee the natural chemical quality of the water that comes from the well other than the water will meet the sanitary requirements of the Mississippi State Department of Health for safe drinking water.

F. All work conducted and all materials supplied under this contract are subject to inspection by the Owner, Owner's representative or Engineer. The Contractor shall provide the Engineer with at least twenty-four (24) hours advance notice prior to performing the following work or installations and such work shall only be conducted in the presence of, or with the authorization of the Engineer.

1. Location of well on site
2. Geophysical logging of test hole
3. Installing test well screen
4. Hydraulic testing of test well
5. Water sampling of test well
6. Removing casing and screen from test well
7. Abandoning and grouting test well if required
8. Installing permanent well outer casing
9. Grouting permanent well outer casing
10. Installing screen and lap pipe
11. Installing gravel pack material
12. Permanent well development
13. Hydraulic testing of permanent well
14. Installing permanent pump bowl and column assembly
15. Permanent pump hydraulic test
16. Final inspection

G. In order to assure the quality of materials used in constructing this well and appurtenances, the Contractor shall submit all supporting data, including pertinent drawings and brochures, for approval prior to installation on the following items:

1. Steel outer casing
2. Steel inner casing
3. Stainless steel screen and backwash valve
4. Gravel pack material
5. Permanent pump
6. Electric motor
7. Check valves
8. Gate valves
9. Master meter
10. Air release valve
11. Insulation
12. Controls

H. Abandonment and Abrogation

In the event the Contractor is unable to locate a water-bearing formation of adequate permeability and thickness to facilitate construction of the proposed production well at the initial location, the Engineer shall decide if the Contractor shall drill again, under the same conditions as prevailed at the first site, at another location to be provided by the Owner. The Contractor shall be paid for all completed test holes, logging, testing and water samples in accordance with an approved schedule of values. Should the Contractor fail or be unable to complete the well in compliance with this contract, he shall be required to fill any abandoned hole he might leave. This fill shall be performed in accordance with current State regulations, including filling the well to the ground surface in accordance with Mississippi Department of Environmental Quality requirements for abandoning wells. After this fill has been made, the Contractor shall have the right to remove all drilling equipment, tools or materials, that he may own from the Owner's property within a reasonable length of time and neither party shall be liable to the other for any sum whatsoever, provided the Contractor submits paid bills and payrolls, Surety Release an Lien Waiver and any other cost items incurred on this job, and said evidence has been submitted that all bills have been paid. This clause does not waive the Surety Bond from any obligation incurred prior to the abandonment of the well.

PART 2-EXECUTION

2.01 TEST HOLE

A. Drilling Method

1. The Contractor shall drill a test hole not less than 8 inches in diameter to the depth specified in the well data summary. However, additional test drilling may be required and if so, shall be by the direction of the Engineer and payment for which will be made at the per foot price stated in the bid proposal. The Contractor may use the test hole as a pilot hole in the construction of a permanent well. Any test holes not used for a pilot hole shall be backfilled in accordance with current State regulations governing abandoned holes.

B. Formation Samples

1. The driller shall keep an accurate log of all formations encountered which shall be recorded in a driller's log book. This log book shall be kept at the drill site during all periods of drilling operation and shall be available for inspection by the Engineer. A description of formation samples shall be recorded in the log book in ten (10) - foot increments or at any formation change. Formation samples are to be collected at ten (10) - foot intervals and each strata change and retained in properly labeled and identified cloth sample bags through any zones of sand in the test hole which may be potential aquifers. Two sets of these samples shall be collected; one for laboratory analysis and one for the Contractor. The Contractor shall, at his own expense, have the samples analyzed by a commercial firm or screen manufacturer in order to determine selection of screen slot openings and proper gravel pack size. This analysis shall be reported on a standard sand sieve analysis graph as cumulative percent retained.

C. Geophysical Logging: When the test hole has been drilled to the required depth or depth approved by the Engineer, the Contractor shall, at his own expense, obtain a complete and continuous geophysical log of the test hole. This log shall consist of a long (64") normal resistivity curve, a short (16") normal resistivity curve, a spontaneous potential curve and a gamma ray curve. Five (5) field copies and five (5) final copies of the log are required.

D. Depth of Payment: Payments to the Contractor for the depth of the test hole shall be based on the maximum depth obtained by the geophysical log.

E. Inspection: The Engineer shall be given at least twenty-four (24) hours notice prior to logging the test hole. Such work shall only be conducted in the presence of, or with the authorization of the Engineer.

2.02 TEST WELL

A. General: After the test hole sand samples, driller's log, sand sieve analysis graphs and geophysical logs have been submitted to the Engineer, and after they have been evaluated, the Contractor may be required to complete a test well and obtain one (1) or more representative water samples from any sands considered for construction of the permanent well.

B. Depth: Based on the evaluation of the test hole data and Contractor's recommendations, the depth of the zone selected for obtaining a water sample shall be determined by the Engineer.

C. Diameter: The test hole shall be reamed, if necessary, to a diameter large enough to adequately accommodate six (6.625)-inch steel well casing to a depth far enough below the anticipated pumping water level for adequate pump submergence when the well is pumped at a minimum rate of 100 gpm. The remainder of the casing down to the screen interval shall be four (4.50)-inch steel casing.

D. Casing:

1. The test well casing shall be steel threaded and coupled pipe. The inside of all pipe shall be clear of rust and scale which could adversely affect chemical quality measurements. The Contractor, at his option, may use inside only epoxy coated casing to comply with this requirement.
2. Casing pipe and pipe couplings shall be of sufficient weight and material strength to be reasonably expected to withstand anticipated removal forces upon completion of the test well.

E. Screen:

1. The test well screen shall be a minimum four inches in diameter and may be either the wire wrapped rod base type or the wire wrapped pipe base type and shall be constructed with 304 stainless steel wire. The screen shall be new and completely free of rust or any other contaminants which might adversely affect chemical quality measurements. The screen material shall be of sufficient strength to be retrieved from the test well, and such strength calculations shall be provided by the well screen manufacturer before the screen is ordered.
2. The screen slot size shall be determined from the sand analysis of the formation obtained from the test hole and shall be sized to retain seventy (70) to ninety (90) percent of this formation.
3. THE ENGINEER SHALL BE CONSULTED BEFORE THE TEST WELL SCREEN IS ORDERED. THE ENGINEER SHALL BE GIVEN AT LEAST TWENTY-FOUR (24) HOURS NOTICE PRIOR TO INSTALLATION OF THE TEST WELL SCREEN. INSTALLATION OF THE TEST WELL SCREEN SHALL BE IN THE PRESENCE OF, OR WITH THE AUTHORIZATION OF THE ENGINEER.
4. The screen shall be plugged at the bottom end with an appropriately sized back-wash valve.
5. Length of screen shall be a minimum of fifty (50) percent of the aquifer thickness.

F. Development:

1. After the screen has been set, the formation shall be developed by such methods as to effectively remove from the formation the borehole wall mud cake and surrounding fine formation materials. Development may be done with any method which may effectively develop the well and is done in such a manner that it does not affect the integrity of the screen or well casing and does not affect the seal above or below the screen.
2. Development shall continue until the water is clear and free of drilling fluid and sand for the total length of the screened section.

G. Capacity: The test well capacity shall be a minimum one hundred (100) gallons per minute when pumped continuously for a minimum eight (8)-hour time period.

H. Hydraulic Testing:

1. The Contractor shall provide a test pump, of a type other than air lift and approved by the Engineer, capable of producing a minimum capacity of one hundred (100) gpm with adequate total dynamic head, considering anticipated final pumping water level and friction losses, to deliver one hundred (100) gpm at the ground surface.
2. A foot valve shall be required at or near the bottom of the pump column to prevent instantaneous recharge to the aquifer during the recovery test.
3. The well shall be pumped continuously at a constant rate for a minimum eight (8)-hour period. The rate shall be measured by the orifice method. The Contractor shall furnish all necessary equipment to conduct this measurement.
4. Provision shall be made for measuring water levels, before, during, and after pumping. Measurements shall be made by electric tape or air line method.
5. During the capacity test, data on flow and pumping water level shall be recorded as follows:
   a) Every minute for first ten minutes (0-10)
   b) Every two minutes for second ten minutes (10-20)
   c) Every five minutes for first hour (20-60)
   d) Every ten minutes for second hour (60-120)
   e) Every twenty minutes for third hour (120-180)
   f) Every thirty minutes for remainder of test

6. The water level recovery shall be taken when the pump is stopped. Water level data shall be recorded as follows:
   a) Every minute for first ten minutes (0-10)
   b) Every two minutes for second ten minutes (10-20)
   c) Every five minutes for first hour (20-60)
   d) Every ten minutes for second hour (60-120)
   e) Every twenty minutes for third hour (120-180)
   f) Every thirty minutes until water level recovers to or near beginning static water level
7. The Contractor shall make satisfactory provisions for the test flow to be conducted to a place adjacent to the well site or a natural or man-made ditch where it is not objectionable to surrounding property owners or where it creates a nuisance.

I. Water Samples

1. After the test well has been pumped continuously for not less than six (6) hours and near the end of the eight (8)-hour capacity, a sample of the water shall be taken in three containers, one for the Owner, one for the Engineer, and one for the Mississippi State Department of Health for testing. Prior to sampling, the Contractor shall communicate with the Mississippi State Dept. of Health and request written instructions for the sampling procedure. The Contractor shall submit sample(s) for testing to the Mississippi State Department of Health, Division of Water Supply. (Bottles may be obtained from the Mississippi State Department of Health, Division of Water Supply.)
2. Each container shall be securely closed to avoid contamination and spillage and shall be clearly labeled with a black permanent waterproof marker with the following information:
   a) Owner
   b) Name or number and location of well
   c) Depth interval represented by the sample
   d) Screen size and length
   e) Date and time taken
   f) Well yield when sampled
   g) Static water level and pumping water level
   h) Time pumped before sampled
   i) Name of Contractor
   j) Field pH
   k) Field Fe
   l) Field temperature
   m) Odor, if any
3. Required physical, chemical and mineral analyses on the water from the test well are as follows:
   a) Color
   b) pH
   c) Alkalinity (P) as $CaCO_3$
   d) Alkalinity (T) as $CaCO_3$
   e) Chloride
   f) Sulfate
   g) Fluoride
   h) Free Carbon Dioxide
   i) Iron
   j) Magnesium
   k) Manganese
   l) Calcium

m) Sodium
n) Potassium
o) Total Dissolved Residue
p) Total Hardness as $CaCO_3$

4. THE ENGINEER SHALL BE GIVEN AT LEAST TWENTY-FOUR (24) HOURS NOTICE PRIOR TO SAMPLING THE TEST WELL. THIS WORK SHALL ONLY BE CONDUCTED IN THE PRESENCE OF, OR WITH THE AUTHORIZATION OF THE ENGINEER.

J. Contractor's Report and Evaluation

1. On completion of the test well requirements, the Contractor's Hydrologist shall submit a written report to the Engineer giving his evaluation of the site for the satisfactory completion of the permanent well.
2. The Contractor's report shall also contain a copy of the following information:
   a) Driller's log
   b) All geophysical logs
   c) Sand formation sieve analysis
   d) Water sample analysis from the State Department of Health
   e) Complete Test Well Hydraulics including an estimate of transmissivity from both drawdown and recovery curves and an estimate of the permanent well specific capacity
   f) Recommended screen slot size and sieve analysis of gravel pack for the permanent well

K. Removal of Materials and Abandonment

1. Should the Contractor fail in his attempt to retrieve the test well casing and screen, the test well shall be abandoned in accordance with current State Regulations governing abandoned holes. This work shall be done at the Contractor's own expense.
2. In addition, had the Contractor planned to use this abandoned hole as a pilot hole for the permanent well, he shall, at his own expense, drill another hole at the site to replace the hole lost as a result of the loss of these materials.
3. If the Contractor successfully removes all test well materials, he may use the test well hole as a pilot hole for the permanent well.
4. Additional samples, from different strata, if required, shall be considered as one unit of work for each sample and shall be compensated at the Contractor Lump Sum Price for Additional Water Samples.

2.03 PERMANENT WELL

A. Depth: The well shall be drilled to the depth necessary to adequately penetrate the desired aquifer which has been selected based on data obtained from the test hole and test well.

B. Diameter: The Contractor shall drill a plumb hole which shall be insured by successive reamings of a smaller diameter hole to a larger diameter hole and the correct use and application of properly-sized drill collars and stabilizers. The diameter of the finished hole ready for the installation of the permanent well casing shall be enough to leave an annular space of not less than two and one-half (22) inches outside the outer casing.

C. Surface Casing: The Contractor may elect to use surface casing. If so, he may use whatever he wishes but no payment by the Owner will be made. It shall be the Contractor's option to remove or allow the surface casing to remain in place.

D. Permanent Well Casing:

1. Depth: The permanent well outer casing shall be installed as one continuous unit from two feet (2') above the surface of the ground to the top of the selected water-bearing formation from which the water is to be extracted.
2. Quality: The permanent well outer casing shall be new steel pipe conforming to API 5L-Grade A or Grade B specifications. This pipe shall be supplied with plain ends which have been machine beveled for welding or threaded for coupling. The Contractor shall submit to the Engineer five (5) copies of mill certificates on the pipe with heat numbers the same as stenciled on the pipe.
3. Casing Strength: Casing strength shall be calculated using standard methods and such calculations supplied by the Contractor shall prove casing has required collapse strength to withstand anticipated depth setting pressures.
4. Welding: If the welding method of joining the casing is chosen, such welding shall be done in accordance with the American Welding Society Specifications and the American Petroleum Institute Specifications. All welding shall be done by a qualified welder, using adequate equipment, rods compatible with casing materials. Proof of the welder's qualifications may be requested by the Engineer prior to any welding.
5. Casing coating: The inside wall of the outer casing shall be coated with two (2) coats of Induron Ruff Stuff 3300 HMW Epoxy and applied according to manufacturer's written instructions. Alternative coating materials and methods shall require approval of the Engineer. The coating shall be applied to a SSPC-SP-10 near white sandblasted surface and shall be done by a professional, commercial firm specializing in pipe coating. Coating company shall provide written and signed certification of compliance with the blasting and coating requirements.
6. Casing alignment: Extreme care shall be taken as each casing joint is welded to the other to assure proper and consistent alignment. So-called "dog leg" joints or sections are not acceptable and will be rejected. The casing shall be installed sufficiently straight to insure satisfactory operation of the reaming bits, graveling devices and permanent pump.
    a) The casing shall be installed with centering guides to center the casing in the drilled hole.
    b) Prior to cementing, the casing shall be rotated 360 degrees in the presence of the Engineer.

E. Cementing: The permanent well outer casing shall be cemented in place with a minimum two and one-half (22) inch cement grout around the outside of the casing, using the Halliburton Method or approved equal. After the mud around the casing has been flushed out with clear water, the annular space around the entire casing length shall be filled with high-early strength cement grout weighing no less than 14 pounds per gallon. After the cement grout is in place it shall be allowed to set and harden for at least 48 (forty-eight) hours before drilling operations are continued. Each bidder shall supply with his bid a description of the method of cementing proposed.

F. Underreaming Hole Below the Outer Casing: The hole below the outer casing shall be underreamed. The outer diameter of the underreamed hole shall be 16" (sixteen inches) larger than the diameter of the well screen. The underream shall extend the entire length of the anticipated screen setting.

G. Inner Casing or Lap Pipe:

1. General: The Contractor shall attach to the screen a length of inner casing of the length and dimension shown in the well summary section.
2. Coating (required): As specified for outer casing, except inner casing shall be coated inside and outside.

3. Centering guides: The Contractor shall provide centering guides near the top of the lap pipe to hold the lap pipe in the center of the outer casing. These guides shall not be of such spacing or dimension as to interfere with the gravel pack operation.

H. Permanent Well Screen: After the sand strata has been underreamed, the Contractor shall install a well screen equal in length and diameter to that shown on the well data sheet using centering guides as necessary. The screen shall be made of AISI, type 304, all 18-8 stainless steel wire wrap construction, and of sufficient strength to resist collapse from the pressures to be encountered at the depth installed and the forces exerted during pumping operations. Slot opening size shall be determined from analysis of the sand from the water bearing formation, but in no case shall the size used allow for Entrance velocity to exceed 0.1 (one tenth) feet per second. This slot opening shall have sharp outer edges, widening inwardly so as to be resistant to clogging. The bottom of the screen shall be fitted with a properly sized non-corrosive metal back pressure valve to permit washing and prevent inflow of sand.

I. Gravel Pack: The entire annular space between the well screen and the wall of the underreamed hole shall be filled with clean graded and well rounded gravel of proper size as determined by the sand analysis to permit the free flow of water to and through the screen without well clogging or well sanding. The Contractor shall submit to the Engineer, before graveling, the gradation and type of gravel to be used. The Contractor shall also show the uniformity coefficient of the gravel in relation to the uniformity coefficient of the water bearing formation. The type of gravel used shall be acceptable to both the Contractor and Engineer. The gravel may be placed in the well by any method, at the option of the Contractor, which will assure a complete fill in the underreamed area with no voids or cavities. The gravel pack material shall be disinfected with 100 mg/l (one hundred milligrams per liter) chlorine solution as it is placed in the well. The Contractor shall notify the Engineer at least twenty-four (24) hours prior to placing the gravel pack. This work shall only be conducted in the presence of, or with the authorization of the Engineer.

J. Permanent Well Development:

1. General: The permanent well shall be developed by such methods as to effectively remove from the formation the borehole wall mud cake and surrounding fine formation materials. Development may be done with compressed air, surge blocks, high velocity jetting tools or combination of these methods or any other method which may effectively develop the well and is done in such a manner that it does not affect the integrity of the screen or well casing.
2. Well Efficiency: During development, the Contractor shall provide the Engineer with reasonable yield estimates and water level drawdown measurements in order to determine the increase in specific capacity. Development shall continue until the specific capacity cannot be reasonably increased by additional development or the well is determined to be at least seventy-five (75) percent efficient by standard hydraulic methods and calculations. Should the Engineer and Contractor be unable to agree upon the well efficiency, an independent Hydrogeologist shall be consulted who shall determine well efficiency. Should the well prove less than seventy-five (75) percent efficient, the Contractor shall make all reasonable efforts to increase the well efficiency. Should the Contractor fail in his effort, the Owner may not accept the well or may, at his option, negotiate with the Contractor for the less efficient well.
3. Development Time: Development shall continue until the water produced is free from turbidity, cloudiness, drilling mud and sand.
4. Equipment: Any pump equipment used in the development of the well shall not be installed as permanent equipment. Contractor shall furnish all power or make arrangements for all power to operate temporary development pumps.

K. Permanent Well Hydraulic Testing

1. General: When the well is completed and thoroughly developed, the Contractor shall furnished, install and operate a test pump complete with prime mover, water-level measuring device and pipe orifices for accurately measuring the pumping rate. A twenty-four (24)-hour aquifer test with continuous pumping shall be conducted at a constant rate of one hundred ten (110) percent of the specified well design capacity. Measurements at the following designated intervals:
   a) Every minute for first ten minutes (0-10)
   b) Every two minutes for second ten minutes (10-20)
   c) Every five minutes for first hour (20-60)
   d) Every ten minutes for second hour (60-120)
   e) Every twenty minutes for third hour (120-180)
   f) Every thirty minutes for remainder of test

   After the pumping portion of the test has been completed and the pump stopped, measurements of the recovery of the water level shall be made at these same time intervals for an eight (8)-hour period or until the water level recovers to near or at the original static water level, whichever occurs first. The pump shall not be removed during this recovery period.

2. Report: The Contractor shall submit to the Engineer immediately following the completed hydraulic testing, two (2) signed copies of the field water-level data on a form which shows the water level, time measurement taken and flow rate. Along with this data, within thirty-six (36) hours, the Contractor's hydrologist shall submit a written report to the Engineer with his recommendations and including the following data:
   a) Well specific capacity
   b) Well efficiency
   c) Coefficient of transmissivity of formation
   d) Recommend capacity for permanent pump
   e) Recommend pump bowl setting depth
   f) Recommend pump bowl size
3. Inspection: The Contractor shall notify the Engineer at least twenty-four (24) hours prior to the start of pumping for the hydraulic testing. This work shall only be conducted in the presence of, or with the authorization of the Engineer.

L. Capping: After development, testing and test pump has been removed, the well shall be capped by welding on a 1/4 inch steel plate. Before capping, it shall be disinfected by adding a minimum volume equal to two (2) times the volume of water in the casing and screen. This volume of water shall contain enough chlorine to equal a one hundred milligrams per liter (100 mg/l) chlorine solution.

M. Installation of Pump Foundation:

1. The Contractor shall furnish all labor, materials, tools and equipment required for installation of the pump foundation and seal. The pump head shall be connected to the outer casing by a watertight seal, or by the outside casing projecting not less than one inch (1") above the pump foundation and into the pump head. Before setting the pump head casting the Contractor shall pour cement grout over the pump foundation to provide a seal between the pump head casting to prevent water entering the well when a partial vacuum is created.
2. The pump foundation shall be not less than forty inches (40") square at top, chamfered, and extending not less than 18" (eighteen inches) above finish grade and extending not less than 18" (eighteen inches) into solid ground.

3. A 2" (two inch) steel vent pipe, with cap shall be connected to the casing and extended through the foundation as shown on plans.

2.04 PERMANENT WELL VERTICAL TURBINE PUMP

A. General: The pump herein specified shall produce the guaranteed capacity of the well at the pressure contained in the data well summary. The pump shall be placed at an elevation to insure 50 foot minimum submergence at maximum discharge to allow for future drop in water level. The pump shall operate at a maximum of 1,800 revolutions per minute.

B. Materials:

1. Discharge Head: A suitable pump head, heavy duty type manufactured of ASTM A48 Class 30 cast iron designed for the above ground discharge of sufficient strength and rigidity to support the motor mounted on it and carry the weight of the column and bowls suspended from it. The discharge flange shall be faced to match ANSI Class 125 cast iron connections. The design shall permit the motor drive to be coupled above the stuffing box. The bottom face of the discharge head shall be fully finished. A separate, fully finished, cast iron base plate shall be furnished so designed to permit the extension of the well casing up into the base plate at least one inch (1"). The discharge head shall be shrouded so that relief water from the stuffing box and around the packing gland can be collected and piped away from the well site. The top of the discharge head shall be of the same diameter as the base of the motor. The discharge head shall be designed to withstand the pressure produced by the pump at shut off as the pump may be operated against a closed valve.
2. Column Assembly: Column assembly shall be flanged connected to the discharge head. Column pipe shall be of ASTM A53, Grade A steel pipe, and coated inside and outside as specified for outer casing. Ends shall be machined with 8 threads per inch and faced parallel to butt against machined shoulders in the column couplings. Intermediate sections of columns shall not exceed ten feet (10'). Top and bottom sections of the column pipe shall not exceed five feet (5'). The upper end of bottom and intermediate column pipe shall be fitted with a coupling of ASTM A48 Class 30 cast iron. The coupling shall have an integrally cast hub to hold and accurately align the line shaft bearing. The line shaft bearings shall be of synthetic rubber. The external shape of the bearing shall be such as to retain it in the coupling hub without use of auxiliary collars or rings. The shape of the bearings shall be a polygon to provide minimum friction contact to the shaft sleeves. Replacement bearings shall be capable of being installed by hand without special tools.
3. Packed Type Stuffing Box: The cast iron stuffing box shall be of the deep bore type with a minimum of six (6) rings of packing and a seal cage. Connections for grease inlet and pressure relief shall be provided. The packing gland shall be of the bronze split type and secured in place with ASTM A193, Grade B8 stainless steel studs and silicon bronze nuts. A bronze grease cup shall be furnished with each stuffing box. The bottom of the stuffing box casting shall be provided with a bronze bearing of adequate length to prevent shaft deflection through the box and to serve as a throttle bushing. The stuffing box will be designed to withstand pressure produced by the pump at shutoff head as the pump may operate against a closed valve.
4. Line Shaft: The line shaft shall be of 410 stainless steel, and of ample size to operate the pump without distortion or vibration and shall be capable of carrying the maximum horsepower generated by the motor. The butting ends shall be machined, faced and recessed square to the axis of the shaft. The ends of the shaft shall be accurately machine threaded for connection. The shaft couplings shall be 410 stainless steel and designed with a safety factor of one and one-half (12) of the shaft. The threads shall be left hand to tighten during pump operation. The length of the shaft shall match properly the length of the discharge column.

5. Pump Bowl: Pump bowl, suction and discharge case shall be of close grained cast iron equivalent to ASTM A48, Class 30, without imperfections. The bowl water passages shall be porcelain enamel coated to provide optimum performance and consistency of output. The suction case and intermediate bowls shall be fitted with replaceable wear rings of bronze, ASTM B505 Alloy 836. Wear rings shall have the minimum practical clearance to the mating cylindrical surface of the impeller to provide adequate sealing independent of vertical positioning of the impellers. Bowls and cases shall have bronze sleeve type bushings to support and guide the shaft. Bushing material shall be bronze, ASTM B505 Alloy 836. The suction case bearing shall be grease packed with provision for grease circulation from the reservoir in the suction case hub. A sand collar of rubber or bronze, ASTM B505 Alloy 836 shall be provided to protect the suction case bearing from abrasives in the liquid pumped. The discharge case shall have vanes to deliver the flow of water with minimum turbulence. The intermediate stages shall be selected to provide the maximum efficiency with least number of stages. Impeller shall be the enclosed type, cast of bronze, ASTM B584 Alloy 836, accurately cast, machined, balanced and filed for optimum performance and minimum vibration. The design shall be non-overloading for the capacity of the motor selected. The impeller shall be securely fastened to the bowl shaft with taper collets of ASTM A582, Grade 416 stainless steel. Bowl shaft shall be of sufficient diameter to transmit the pump horsepower with a liberal safety factor and rigidly support the impellers between the bowl or case bearings. The bowl shaft material shall be high chrome stainless steel of ASTM A276, Grade 410. The pump bowl shall have a minimum operating efficiency of eighty percent (80%) at the guaranteed capacity operating at the pressure contained in the Well Data Summary.
6. Pump Motor: The motor shall be 3 phase, 60 cycle, 460 volt, 1,800 rpm electric motor having a 40EC ambient temperature and a 1.15 service factor. The motor shall be vertical hollow shaft, weather-proof type suitable for unprotected outdoor use, and shall be equipped with a nonreverse ratchet. The motor shall be sized so that no load on the pump curve exceeds the nameplate rating. The motor mounting dimensions shall comply with NEMA interchangeability standards.
7. Suction Pipe: The Contractor shall furnish with the pumping unit, a minimum 10 foot section of black steel, ASTM A53, Grade B suction pipe threaded for attaching to the pump. The diameter of the suction pipe will be nominal size of the column pipe and the wall thickness shall be API Standard. The suction pipe shall be coated inside and outside as specified for outer casing.
8. Air Line: A copper air line will be furnished from the pump bowl to the pump head together with valve and gauge to enable water level readings in the well. The air line shall be attached to the pump column with stainless steel bands or straps at intervals not to exceed ten feet. The gauge shall be four inch (4") diameter and shall read in both feet and psi.

C. Testing:

1. Pump Test: The Contractor shall conduct a continuous four hour pumping test of the permanent pump at the guaranteed capacity and specified pressure while recording the water level in the well at intervals specified under the well test section of these specifications. The capacity shall be measured by orifice plate and water level readings shall be measured by electric tape. The Contractor shall also conduct a graduated pressure test on the pump from closed valve (shut-in) to open discharge at ten pound increments.

2. Bacteriological Test: During or upon completion of the pumping test and disinfection the well shall be pumped and redisinfected as necessary until two consecutive chlorine free water samples are collected from the well which show no coliform bacteria and no confluent growth. The second sample shall be collected following at least two hours of pumping with no disinfectant applied between samples. The samples shall be collected, submitted and analyzed according to Mississippi State Department of Health requirements. The person collecting the sample must be a representative of the Mississippi State Department of Health or a certified operator.

2.05 ELECTRICAL

A. General: This work shall consist of all electrical necessary or incidental to the control, starting and operation of the electric motor for driving the well pump. All work shall be performed in accordance with the requirements of the National Electric Code (NEC) and by local ordinance where applicable.

B. Materials:

1. Starter: The starter shall be part wound or reduced voltage mounted in an appropriate NEMA enclosure. The Contractor shall install a weatherproof fused disconnect switch at the well site.
2. Lightning and Phase Protection: Provide suitable protection and install according to manufacturer's instructions.
3. Water Lube Solenoid Valve: Provide suitable valve to fail open.
4. Control Panel: Provide under Section 11230 - Controls.
5. Provide a line pressure system for pump controls.

2.06 PIPING

A. General: This work shall consist of the pipe, valves, fittings, and other items as shown on the Construction Drawings from the pump discharge head to and including the underground fitting as shown, and shall comply with Section 02667 - Sitewater Lines.

B. Materials:

1. Flow Meter: Flow meter shall be the propeller type, and shall conform to requirements of AWWA C704 with units in gallons.
2. Insulation: Above ground piping shall be insulated with one inch (1") of Pittsburg-Corning "Foam Glass" or approved equal covered with aluminum.
3. Air Release Valve: The air release valve shall be two inch (2") minimum, Crispin Model D20 or approved equal.
4. Coupling: Shall be Dresser or approved equal.

2.07 CONSTRUCTION REQUIREMENTS

A. Concrete support blocks and adjustable pipe jacks shall be installed as shown on the Construction Drawings. Concrete thrust blocks or restrained joints shall be used on fittings.

END OF SECTION

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-258-9 **CODE: (SP)**

DATE: 07/23/2009

SUBJECT: Miscellaneous Site Amenities

Section 907-258, Miscellaneous Site Amenities, is hereby added to and made a part of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction.

SECTION 907-258 -- MISCELLANEOUS SITE AMENITIES

907-258.01--Description. This item shall consist of constructing and installing concrete picnic tables and benches, wooden picnic tables and benches, charcoal grills, drinking fountains, trash receptacles, water hydrants, sewage dump station, cast stone benches, sign (masonry and stone), metal benches, bollards, pavilions, survey monument, car stops, cigarette receptacles, and picnic shelters , each complete in place, in accordance with these Specifications and in reasonably close conformity with the locations, lines, grades, configurations, dimensions and other requirements shown on the Drawings or established.

907-258.02--Materials. Unless otherwise stipulated, the materials used in this construction, in addition to the general requirements of these Specifications and the plans shall conform to the provisions and requirements prescribed in the sections of the Standard Specifications for the several items which constitute the complete structure.

All items will require approval by the Engineer from the manufacturer. Contractor shall submit eight (8) copies of brochures or shop drawings for approval prior to ordering manufactured items. Other items may require testing as directed by the Engineer.

A. Charcoal Grill. Charcoal Grill shall be the Model No. 100001085 Rotating Grill with post as manufactured by Iron Mountain Forge, Dumor Site Furnishings – Model No. 22-00, PW Athletic Manufacturing Co. – Model No. 1140-00, or approved equal. Post shall be set within a Class C concrete footing, size as recommended by manufacturer.

B. Drinking Fountain.

1. Waste Pipe. Waste pipe shall be of the size and type as shown on the Drawings and shall be standard PVC drain waste and vent piping.

2. Drain Pipe. Drain pipe shall be the size shown on the Drawings and shall conform to or exceed Commercial Standard CS 272-65 or CS 272.65.

3. Drinking Fountain. The drinking fountain shall be designed similar to the details shown on the Drawings, freeze-proof, and conforming to approved Handicapped Standards by the Engineer.

4. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk, and have an approved exposed aggregate finish to match the finish on the adjacent sidewalk.

5. Valves (Stop and Drain). The cut-off valve shall be a standard brass stop and drain cut-off valve of the proper size and type as shown on the plans.

C. Concrete Picnic Table and Benches.

1. Concrete. Concrete for table top, seat top, and end supports shall be Class "A" Concrete. Concrete for table slabs will be paid for as concrete sidewalks - Pay Item No. 608-B.

2. Reinforcing Steel. Reinforcing steel shall conform to Section 711.

3. Paint for Table top and Seats. Paint or coating for table top and seats shall be an approved HP Acrylic Latex paint conforming to or exceeding Master Paint Institute (MPI) numbers, primer MPI # 3 and topcoat MPI #141.

D. Wooden Picnic Tables and Benches. ADA Accessible Wooden Picnic Tables shall be the model number No.100000186, eight feet long with galvanized pipe frame and treated wood top and seats, as manufactured by Iron Mountain Forge, Picnic Table Source – Model No. M115-1061, All Picnic Tables – Model No. UPB158H-PT8, or approved equal.

Picnic tables shall be secured to the concrete with lead shields, anchors, or other means as approved by the Engineer.

E. Trash Receptacle.

1. Trash Receptacle. The trash receptacle shall be Upbeat Site Furnishings Model No. WR32AGBCT, 32-gallon Essence Receptacle Outdoor Trash Can with curved top, rounded corners and stone panels with leveling devices, rigid plastic liner, and hardware to secure the receptacle to the sidewalk, stone panel color shall be Golden Glo. United Receptacle, Inc. – Model No. R-38HT-202, Barco Products – Earth-Tone Panel Commercial Trash Cans, Model No. 38SQSTDMA, or approved equal.

2. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk, and have a finish to match the finish on the adjacent sidewalk.

F. Water Hydrant.

1. Water Hydrant. Steel body, self-closing, anti-freezing hydrant with heavy stainless operating springs, with 3/4-inch supply as the model M-175 hydrant as manufactured by Murdock-Super Secur, The Kupferle Foundry Company model Total Eclipse #1 Yard Hydrant, , or approved equal. Color shall be black.

2. Concrete. Concrete, unless otherwise specified, shall be paid for as sidewalk and have same finish as finish on adjacent sidewalk.

3. Valves (Stop and Drain). The cut-off valve shall be standard brass stop and drain cut-off valve of the proper size and type as shown on the Drawings.

G. Travel Trailer Sewage Dump Station (Modifications).

1. Sewage Dump Station. The sewage dump station shall be constructed similar to the details shown on the Drawings, with Schedule 40 galvanized steel pipe and fittings complete with vacuum breaker, and hose, in accordance with the Drawing details, and State Health Department minimum standards.

2. Concrete. Concrete unless otherwise specified shall be Class "B" conforming to Section 804 of the Standard Specifications and have an approved trowel finish.

3. Stand Pipe. Water stand pipe shall be standard galvanized Schedule 40 of the size shown on the Drawings.

4. Vent Pipe. Vent pipe shall be standard galvanized Schedule 40 of the size shown on the Drawings.

5. Signs. The signs shall be designed as shown on the details on the Drawings, constructed of 0.080-inch aluminum or 14 Ga. galvanized steel. The signs shall be manufactured by an approved sign company. The Contractor shall submit shop drawings.

H. Cast Stone Bench. Cast stone benches shall be constructed from the same material or an approved equal material as concrete picnic tables and benches.

I. Sign (Masonry and Stone).

1. Brick and Mortar. Brick and mortar shall be produced by the same manufacturer(s), and be the same type and kind, including bullnose and watertable units, and shall match the existing brick used on the Welcome Center Building, or approved equal.

2. Concrete Masonry Units. The concrete masonry units shall be hollow non-load bearing, light-weight aggregate, concrete masonry units conforming to ASTM Designation: C331-64T. Units shall be normal modular size for typical 3/8-inch mortar joint.

3. Concrete. Concrete, unless otherwise specified, shall be Class "B" conforming to Section 804 of the Standard Specifications.

4. Reinforcing Steel. Reinforcing steel shall conform to Section 711.

5. Precast Architectural Panel.

a. General.

Cement: Portland Cement shall conform to ASTM Designation: C-150, Type I or III.

Fine and coarse aggregate: Fine and coarse aggregate shall conform to ASTM Designation: C-33. Variations from aggregate gradations are permissible for the facing mix.

Reinforcement shall conform to ASTM Designation: C-185 for welded wire fabric.

Hot-dip galvanizing shall conform to ASTM Designation: A-153

Anchoring devices, inserts, etc., shall be either galvanized or corrosion resistant types approved by the Architect and as detailed on the Drawings.

b. Textures and Finishes. Precast architectural concrete shall be honed finish, lightly textured, approximating finish of limestone, with color as selected by the Engineer.

c. Fabrication. Precast architectural concrete shall be sufficiently reinforced to withstand conditions on the sign, including handling and erection stresses. Deformed bars with one inch (1") or less clearance to an exterior face shall be galvanized.

Units shall be fabricated straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.

Reglets, slots, holes, and other accessories shall be provided in units to receive cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

Arises, inscriptions and details shall be faithfully executed to the Engineer's design.

Each precast item shall be marked to correspond to identification mark on shop drawings.

Location of anchors, inserts and blockouts shall be plus or minus 3/8 inch from center line of location shown on drawings.

Rust-inhibitive coating shall be applied on damaged areas at welded connections, same as shop-applied material. Galvanizing repair coating shall be used on galvanized surfaces.

d. Mixes. Standard 6-inch by 12-inch cylinder strength of precast concrete shall not be less than 5,000 psi at 28 days when tested in accordance with ASTM Designation: C-39.

Absorption shall not be less than three percent (3%) and not more than seven percent (7%) when tested in accordance with ASTM Designation: C-97.

Minimum thickness of facing mix shall be 1½ inches thick. Backup concrete may be made with grey cement and aggregates conforming to requirements for cast-in-place concrete.

e. Joint Material. Joint material shall be as recommended by the precast architectural concrete manufacturer, and as approved by the Engineer.

6. Letters and Symbols. Letters, including custom letters, and symbols shall be brass, in the shapes and sizes noted on the drawings, as manufactured by Metal Arts, A. R. K. Ramos, Matthews, or approved equal.

The Engineer will provide camera ready art work of the symbols and custom letters to the Contractor for the manufacturer.

Method(s) of attaching letters and symbols to precast architectural concrete panel shall be approved by the Engineer.

J. Metal Bench. Garden – Style all – steel bench, six feet long, color – green, as Bench 118 series as manufactured by DuMor, Inc., Highland Products Group – 6-foot 'Sunshine' Thermoplastic-Coated expanded Metal Bench, Columbia Cascade Co. – Manor Bench No. 2824-6, or approved equal.

Metal Bench shall be secured to pavement. Method of securing shall be reviewed with and approved by the Engineer.

K. Bollard. Pipe shall be schedule 40 steel pipe, in the size as noted on the drawings. Finial shall be the Linn Park Ball Finial, as manufactured by Robinson Iron, Tennessee Fabricating Company, Reliance Foundry Co., Ltd., or approved equal. Pipe and finial shall be painted with 1 shop coat of a rust inhibitive primer and two (2) field coats of an oil base exterior paint, color selected by the Engineer. Class B concrete required for pipe infill.

L. Pavilion:

1. Masonry Components, Concrete, and Cast Stone. Masonry components, concrete, and cast stone shall conform to the specifications described in Sign (Masonry and Stone), above.

2. Steel. Steel shall be provided in the shapes, sizes, and fabricated as noted on the Drawings.

Steel shall receive the following paints/ coatings, all as manufactured by PPG, Sherwin Williams, Tnemec Company, Inc., or approved equal, and applied in strict accordance with the manufacturer's written instructions.

PPG Products		
First Shop Coat (primer)	UC65147 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Field Spot Primer (if necessary)	UC65147 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Second Field Coat	94-2800 pitthame*	3.0 – 6.0 Mils Dry Film Thickness
Third Field Coat	94-2800 pitthame*	3.0 – 6.0 Mils Dry Film Thickness

Sherwin Williams Products		
First Shop Coat (primer)	B65G10 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Field Spot Primer (if necessary)	B65G10 Zinc	3.0 – 4.0 Mils Dry Film Thickness
Polyurethane finish		
Second Field Coat	B65-600 Series*	3.0 – 6.0 Mils Dry Film Thickness
Third Field Coat	B65-600 Series*	3.0 – 6.0 Mils Dry Film Thickness
Tnemec Products		
First Shop Coat (primer)	90-97 Tneme Zinc	2.5 – 3.5 Mils Dry Film Thickness
Field Spot Primer (if necessary)	90-97 Tneme Zinc	2.5 – 3.5 Mils Dry Film Thickness
Second Field Coat	74 Endura-Shield*	2.0 – 2.5 Mils Dry Film Thickness
Third Field Coat	74 Endura-Shield*	2.0 – 2.5 Mils Dry Film Thickness

*Color of second and third field coat shall be selected by the Engineer.

3. Metal Roof. Metal roof shall be copper roofing sheet, 16 ounce per square foot, with 1½ inch standing seam "S" lock located 16 inches on center. Contractor shall design fabrication and fastening of the system for an I-60 wind uplift rating, using the purlins as noted on the drawings.

   Product data for materials, and fastening devices as well as shop drawings noting assembly and finished product appearance shall be submitted for review and approval of the Engineer. A minimum of eight (8) copies of each is required.

   Roof panel system shall be guaranteed by the manufacturer for a period of five (5) years.

4. Display Panel. The display panel shall be an exterior rated panel, with a top hinged impact resistant acrylic cover, cylinder lock and gas cylinder cover supports; baked on enamel finish, metal back with magnetic back (interior); for wall mounting, in a 40-inch high by 60-inch wide size, as the Module x Wide Profile as manufactured by ASI Sign Systems, Matthews International Corp., Mohawk Sign Systems, Inc., or approved equal.

   Color of panel shall be selected by the Engineer.

   Mounting of panel to metal work shall be reviewed with and approved by the Engineer.

M. Survey Monument.

1. Masonry Components and Concrete. Masonry components and concrete shall conform to the specifications described in Sign (Masonry and Stone), above.

2. Granite. Polished (finish) granite veneer, in the thickness as noted on the drawings. Color shall be selected by the Project Engineer. Method of attachment to masonry and devices for attachment shall be reviewed with and approved by the Engineer.

N. Car Stop. Car stops shall be six (6) foot long concrete curb (car) stops. Curb stops shall be secured to pavement with two (2) No. 3 reinforcing bars, 24 inches long.

O. Cigarette Receptacle. Cigarette Receptacles shall be Aladdin Smoker' Station – Model Number R1639E-HCHAR- steel smokers' station, 39 inches high by 16 inches diameter, color – Hammertone Charcoal, as manufactured by Gilmore-Kramer Company, Johnson Environmental Products –Smokers Outpost-black Model Number 710101 , Ashtrays And Urns – Smoker' Station Model Number LL144-1645 , or approved equal.

Cigarette Receptacle shall be secured to pavement with anchoring kit. Method of securing shall be reviewed with and approved by the Engineer.

P. Picnic Shelter:

1. Building Type. Building shall be Icon HIP 16 x 24T as manufactured by Icon Shelter Systems Inc., American Building Products "Navajo Shelters", Litchfield Industries "Pittsburg Hip End", or approved equal.

2. Concrete. Concrete shall conform to the specifications described in Sign (Masonry and Stone), above.

3. Description. Picnic shelter shall be 16 feet by 24 feet galvanized steel frame hipped rectangle shelter with standard 24 gage Multi-rib metal roof panels, overhead "Linear" ornaments and square stepped base columns.

4. Submittals. Product data for materials, color charts and fastening devices as well as shop drawings noting assembly and finished product appearance shall be submitted for review and approval of the Engineer.

5. Steel Framing and Finishes. Steel framing, columns, base covers and overhead ornaments shall receive hot-dipped zinc galvanizing prior to finish. A double coat of TGIC polyester powder coating shall be applied. Color shall be "Surrey Beige", unless another color is selected by the Engineer from manufacturer's standard 14 colors

6. Base Connection. Base connection shall be surfaced mounted with base covers.

7. Metal Roof Materials. Metal roof material shall be standard 24 gage Galvalume® Multi-rib roof panels with Kynar 500 finish. Color "Copper Penny", or other color selected by the Engineer. Design fabrication and fastening of system for an UL 90 wind uplift rating. Roof pitch shall be 4:12, unless noted otherwise on Drawings.

8. Warranty. Product shall carry a manufacturer's standard 10-year warranty

907-258.03--Construction Requirements. The method of construction, unless otherwise stipulated, shall conform to the provisions and requirements where applicable, prescribed in the standard specifications with the additions shown hereafter. All work shall be performed in a

good workmanlike manner, to the satisfaction of the Engineer.

A. Charcoal Grill. The charcoal grill with concrete footing shall be installed in accordance with the manufacturer's written instructions in the locations as noted on the Drawings.

B. Drinking Fountain. The drinking fountain shall be installed by skilled plumbers, concrete finishers, and workmen in an approved manner to the satisfaction of the Engineer, to the dimensions and details shown on the Drawings, or approved by the Engineer.

The fountain drain shall be located to drain to the existing drain field or an approved ditch as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The concrete will be paid for under separate pay item for that class of concrete.

C. Concrete Picnic Tables and Benches. Concrete picnic tables and benches shall be constructed to the detailed dimensions shown on the Drawings. The handling and placing of concrete shall conform to Subsection 804.10. The top and edge surfaces of the table and benches shall receive a slick smooth finish.

The concrete shall be free of honeycomb and air pockets and in no case have a slump greater than one and one-half inches.

The ground under the slab shall be graded or shaped and compacted when necessary to insure a smooth, firm foundation for the slab. The ground adjacent to the slab shall be sloped to drain away from the slab in a manner so as to preserve the natural shape of the terrain as close as possible.

The concrete slab shall be poured around the table and benches in place and correctly aligned. Care shall be taken to place the expansion joint material around the top and bench supports as shown on the plans in a neat, secure manner. The slab shall be sloped to drain and receive an approved exposed aggregate finish to match the finish on the sidewalk.

The placing and fastening of reinforcement shall conform to Subsection 805.05.

The table shall be located as shown on the Drawings and as directed by the Engineer.

D. Wooden Picnic Tables and Metal Benches. Wooden picnic tables and metal benches shall be located and secured in an approved manner as shown on the Drawings and as directed by the Engineer.

E. Trash Receptacle. The trash receptacle shall be installed on and secured to a square concrete pad four inches thick, with outside dimensions six inches greater than the width of the trash receptacle, in locations designated by the Engineer.

The excavation when required to place the trash receptacle into the ground shall be disposed of as directed by the Engineer.

The concrete shall be placed and finished to match the adjacent sidewalk. On locations adjacent to existing sidewalks, top of concrete pad for the receptacle shall meet flush with existing walk. Slope elevation of pads no more than 1/8 inch per foot in order that water will not stand.

The method to secure the trash receptacle to the concrete pad shall be submitted to the Engineer for approval.

F. Water Hydrant. Install water hydrant in accordance with the manufacturer's written instructions and the Drawings.

G. Travel Trailer Sewage Dump Station. The travel trailer sewage dump station shall be constructed by skilled plumbers, concrete finishers, and workmen in an approved manner to the satisfaction of the Engineer, to the details and dimensions shown on the Drawings.

H. Cast Stone Bench. The cast stone benches shall be a similar design and size as shown on the Drawings. Brochures or shop drawings shall be submitted.

The benches shall be secured to the sidewalk or bench pad in an approved manner with epoxy cement or other approved cement, to the satisfaction of the Engineer.

I. Sign (Masonry and Stone), Pavilion, and Survey Monument. The excavation required to place the sign and survey monument into the ground shall be disposed of as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The placing and fastening of reinforcement shall conform to Subsection 805.05.

Concrete Masonry Unit and Brick construction shall be in accordance with Section 611, and to the satisfaction of the Engineer.

Precast architectural concrete panels shall be set straight, plumb, level, and square. Exposed facings shall be cleaned to remove dirt and stains which may be on the units after erection and completion of joint treatments. Panels shall be washed and rinsed in accordance with precast manufacturer's recommendations. Other work shall be protected from damage due to cleaning operations. Do not use cleaning materials or processes which could change the character of exposed concrete finishes.

Letters and symbols shall be attached in accordance with the Drawings, approved shop drawings, and to the satisfaction of the Engineer.

Pavilion and survey monument shall be constructed straight, plumb, level, and square, in accordance with the drawings and to the satisfaction of the Engineer. Welds shall be grinded smooth prior to painting/ coatings application.

J. Metal Bench. Metal bench shall be located where noted on the Drawings. Metal bench shall

be secured to pavement as approved by the Engineer.

K. Bollard. Bollards shall be constructed plumb and in accordance with the drawings to the satisfaction of the Engineer. Welds shall be ground smooth prior to painting/ coatings application.

N. Car Stop. Drive reinforcing bars through holes in car stop and through new asphalt pavement. Top of reinforcing bar shall be driven to a point 1/4 inch below the top of the car stop.

O. Cigarette Receptacle. Cigarette receptacles shall be located where noted on the Drawings. Secure to pavement as approved by the Engineer.

P. Picnic Shelter. The excavation required to place the picnic shelter into the ground shall be disposed of as directed by the Engineer.

The concrete base shall be constructed as shown on the Drawings or as directed by the Engineer. The placing and fastening of reinforcement shall conform to Subsection 805.05

Picnic shelter shall be constructed straight, plumb, level, and square, in accordance with the drawings and to the satisfaction of the Engineer. Care shall be taken to protect paint finishes and touch up with matching paint and color to the satisfaction of the Engineer. Items that can not be successfully repaired in the field shall be replaced.

907-258.04--Method of Measurement. Miscellaneous Rest Area Facilities, constructed and complete in accordance with the requirements of the contract, and accepted, will be measured by the unit quantity per each unit.

A unit of concrete picnic tables and benches shall consist of one table, two benches, the concrete slab shall be as indicated on the Drawings.

A unit of wooden picnic tables shall consist of one table with benches, and the devices to secure the table when required.

A unit of charcoal grill shall consist of the grill complete with steel post and concrete footing.

A unit of drinking fountain shall consist of all concrete, steel, masonry elements, piping, plumbing elements, and drains as shown on the Drawings.

A unit of trash receptacle shall consist of the receptacle, complete, with leveling devices and approved devices to secure the trash receptacle to the pavement.

A unit of water hydrant shall consist of the hydrant complete with connection to water supply, piping, cut off valve, drain and drain line (where shown), and concrete footing, located where shown on the plans and installed in accordance with manufacturer's directions.

A unit of travel trailer sewage dump station shall consist of one tower, one drain, signs and

concrete as shown in the plan details.

A unit of cast stone bench shall consist of one bench seat and three bench supports.

A unit of sign (masonry and stone) shall consist of all concrete, steel, masonry elements, letters, as symbols shown on the plans.

A unit of bollard shall consist of steel pipe with finial, and concrete for footing and infill, as shown on the plans.

A unit of metal benches shall consist of one bench, and the devices to secure the bench when required.

A unit of pavilion and survey monument shall consist of concrete (not including sidewalk), steel (painted), metal roof, masonry elements, granite, re-location of survey monument, and display panel as applicable and as shown on the Drawings.

A unit of cigarette receptacle shall consist of one receptacle, and the devices to secure the receptacle when required.

A unit of picnic shelter shall consist of concrete (not including sidewalk), steel framing, metal roof, steel columns, and overhead ornaments, as shown on the Drawings.

Separate measurement for excavation and other individual items will not be made, it being understood that the cost thereof is included in one contract price bid per complete items.

907-258.05--Basis of Payment. Charcoal grills, drinking fountains, concrete picnic tables and benches, wooden picnic tables and benches, trash receptacles, water hydrants, travel trailer sewage dump station, cast stone benches, sign (masonry and stone), metal benches, bollards, pavilion, survey monument, car stops, cigarette receptacles, and picnic shelters each unit shall be paid for at the contract unit price bid per each, which price shall be full compensation for furnishing all materials and supplies; for performing all work necessary for each completed unit; and for all equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under:

907-258-A:	Charcoal Grill	- per each
907-258-B:	Drinking Fountain	- per each
907-258-C:	Concrete Picnic Table and Benches	- per each
907-258-D:	Wooden Picnic Table and Benches	- per each
907-258-E:	Trash Receptacle	- per each
907-258-F:	Water Hydrant	- per each

907-258-G: Travel Trailer Sewage Dump Station - per each

907-258-H: Cast Stone Bench - per each

907-258-I: Sign, Masonry and Stone - per each

907-258-J: Metal Bench - per each

907-258-K: Bollard - per each

907-258-L: Pavilion - per each

907-258-M: Survey Monument - per each

907-258-N: Car Stop - per each

907-258-O: Cigarette Receptacle - per each

907-258-P: Picnic Shelter - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-601-1 **CODE: (IS)**

DATE: 08/29/2007

SUBJECT: Structural Concrete

Division 600, Incidental Construction, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After the heading **DIVISION 600 - INCIDENTAL CONSTRUCTION**, add the following:

Unless otherwise specified, all testing of Portland cement concrete in Division 600 shall be in accordance with the requirements of Subsection 907-601.02.1.

907-601.02--Materials.

907-601.02.1--General. Delete the second and third sentence of the first paragraph of Subsection 601.02.1 on page 348, and substitute the following:

Sampling and testing will be in accordance with TMD-20-04-00-000 or TMD-20-05-00-000, as applicable.

907-601.03.6.3--Removal of Falsework, Forms, and Housing. Delete the first paragraph, the table and second paragraph of Subsection 601.03.6.3 on pages 349 and 350, and substitute the following:

The removal of falsework, forms, and the discontinuance of heating, shall be in accordance with the provisions and requirements of Subsection 907-804.03.15, except that the concrete shall conform to the following compressive strength requirements:

Wingwall and Wall Forms not Under Stress	1000 psi
Wall Forms under Stress	2200 psi
Backfill and Cover clear	2400 psi

In lieu of using concrete strength cylinders to determine when falsework, forms, and housings can be removed, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Subsection 907-804.03.15. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of Subsection 907-804.03.15. Technicians using the maturity meter or calculating strength/maturity graphs shall meet the requirements of Subsection 907-804.03.15.

907-601.05--Basis of Payment. Add the "907" prefix to the pay items listed on page 352.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-701-4 **CODE: (IS)**

DATE: 11/09/2010

SUBJECT: Hydraulic Cement

Section 701, Hydraulic Cement, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

Delete Subsection 701.01 on pages 595 & 596, and substitute the following:

907-701.01--General. The following requirements shall be applicable to hydraulic cement:

Only hydraulic cements conforming to Section 701 shall be used. Hydraulic cements shall not be listed or designated as meeting more than one AASHTO or Department type.

Different brands of hydraulic cement, or the same brand of hydraulic cement from different mills, shall not be mixed or used alternately in any one class of construction or structure, without written permission from the Engineer; except that this requirement will not be applicable to hydraulic cement treatment of design soils, or bases.

The Contractor shall provide suitable means for storing and protecting the hydraulic cement against dampness. Hydraulic cement, which for any reason, has become partially set or which contains lumps of caked hydraulic cement will be rejected. Hydraulic cement salvaged from discarded or used bags shall not be used.

The temperature of bulk hydraulic cement shall not be greater than l65°F at the time of incorporation in the mix.

Acceptance of hydraulic cement will be based on the certification program as described in the Department's Materials Division Inspection, Testing, and Certification Manual and job control sampling and testing as established by Department SOP.

Retests of hydraulic cement may be made for soundness and expansion within 28 days of test failure and, if the hydraulic cement passes, it may be accepted. Hydraulic cement shall not be rejected due to failure to meet the fineness requirements if upon retests after drying at 212°F for one hour, it meets such requirements.

Delete Subsection 701.02 on page 596, and substitute the following:

907-701.02--Portland Cement.

907-701.02.1--General.

907-701.02.1.1--Types of Portland Cement. Portland cement (cement) shall be either Type I or Type II conforming to AASHTO Designation: M85 or Type I(MS), as defined by the description below Table 1. Type III cement conforming to AASHTO Designation: M85 or Type III(MS), as defined by the description below Table 1, may be used for the production of precast or precast-prestressed concrete members.

907-701.02.1.2--Alkali Content. All cement types in this Subsection shall meet the Equivalent alkali content requirement for low-alkali cements listed in AASHTO Designation: M85, Table 2.

907-701.02.2--Replacement by Other Cementitious Materials. The maximum replacement of cement by weight is 25% for fly ash or 50% for ground granulated blast furnace slag (GGBFS). The minimum tolerance for replacement shall be 5% below the maximum replacement content. Replacement contents below this minimum tolerance by fly ash or GGBFS may be used, but shall not be given any special considerations, like the maximum acceptance temperature for Portland cement concrete containing pozzolans. Special considerations shall only apply for replacement of cement by fly ash or GGBFS.

907-701.02.2.1--Portland Cement Concrete Exposed to Soluble Sulfate Conditions or Seawater. When Portland cement concrete is exposed to moderate or severe soluble sulfate conditions, or to seawater, cement types and replacement of cement by Class F fly ash, GGBFS, or silica fume shall be as follows in Table 1.

Table 1- Cementitious Materials for Soluble Sulfate Conditions

Sulfate Exposure	Water-soluble sulfate (SO_4) in soil, % by mass	Sulfate (SO_4)in water, ppm	Cementitious material required*
Moderate and Seawater	0.10 - 0.20	150 - 1,500	Type II **, ***, **** cement, or Type I cement with one of the following replacements of cement by weight: 25% Class F fly ash, 50% GGBFS, or 8% silica fume
Severe	0.20 - 2.00	1,500 - 10,000	Type I cement with a replacement by weight of 50% GGBFS, or Type II ** cement with one of the following replacements of cement by weight: 25% Class F fly ash, 50% GGBFS, or 8% silica fume

* The values listed in this table for replacement of Portland cement by the cementitious materials listed are maximums and shall not be exceeded. The minimum tolerance for replacement shall be 0.5% below the maximum replacement content. Replacement contents below this minimum tolerance by the cementitious materials listed in this table do not meet the requirements for the exposure conditions listed and shall not be allowed.

** Type I cement conforming to AASHTO Designation: M85 with a maximum 8% tricalcium aluminate (C_3A) may be used in lieu of Type II cement; this cement is given the designation "Type I(MS)". Type III cement conforming to AASHTO Designation: M85 with a maximum 8% tricalcium aluminate (C_3A) may be used in lieu of Type II cement as allowed in Subsection 907-701.02.1; this cement is given the designation "Type III(MS)".

*** Blended cement meeting the sulfate resistance requirements of Subsection 907-701.04 may be used in lieu of Type II as allowed in Subsection 907-701.04. No additional cementitious materials shall be added to or as a replacement for blended cement.

**** Class F fly ash or GGBFS may be added as a replacement for cement as allowed in Subsection 907-701.02.2.

Class C fly ash shall not be used as a replacement for cement in any of the sulfate exposure conditions listed above.

907-701.02.2.2--Cement for Soil Stabilization Exposed to Soluble Sulfate Conditions or Seawater. When Portland cement for use in soil stabilization is exposed to moderate or severe soluble sulfate conditions, or to seawater, cement types and replacement of cement by Class F fly ash or GGBFS shall meet the requirements of Subsection 907-701.02.2.1. Neither metakaolin nor silica fume shall be used to bring the cementitious materials into compliance with the requirements of Table 1.

Delete Subsection 701.03 on page 596, and substitute the following:

907-701.03--Masonry Cement. Masonry cement shall conform to ASTM Designation: C 91 and shall only be used in masonry applications.

Delete Subsection 701.04 on page 596, and substitute the following:

907-701.04--Blended Hydraulic Cement.

907-701.04.1--General.

907-701.04.1.1--Types of Blended Cement. Blended hydraulic cements (blended cements) shall be of the following types and conform to AASHTO Designation: M 240:

Type I(SM) – Slag-modified Portland cement
Type IS – Portland blast-furnace slag cement
Type I(PM) – Pozzolan-modified Portland cement
Type IP – Portland-pozzolan cement

Blended cement for use in Portland cement concrete or soil stabilization exposed to the moderate soluble sulfate condition or exposure to seawater as defined in Table 1 shall meet the Sulfate resistance requirement listed in AASHTO Designation: M 240, Table 2 and the "(MS)" suffix shall be added to the type designation.

907-701.04.1.2--Alkali Content. All blended cement types in this Subsection shall meet the Mortar expansion requirements listed in AASHTO Designation: M 240, Table 2.

907-701.04.2--Replacement by Other Cementitious Materials. No additional cementitious materials, such as Portland cement, performance hydraulic cement, fly ash, GGBFS, metakaolin, or others, shall be added to or as a replacement for blended cement.

907-701.04.3--Exposure to Soluble Sulfate Conditions or Seawater. When Portland cement concrete or blended cement for soil stabilization is exposed to moderate soluble sulfate conditions or to seawater, where the moderate soluble sulfate condition is defined in Table 1, the blended cement shall meet the sulfate resistance requirement listed in AASHTO Designation: M 240, Table 2.

When Portland cement concrete or blended cement for soil stabilization is exposed to severe soluble sulfate conditions, where the severe soluble sulfate condition is defined in Table 1, blended cements shall not be used.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-711-4 **CODE: (IS)**

DATE: 06/26/2009

SUBJECT: Synthetic Structural Fiber Reinforcement

Section 711, Reinforcement and Wire Rope, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After Subsection 711.03.4.3 on page 665, add the following:

907-711.04--Synthetic Structural Fiber. The synthetic structural fibers shall be approved for listing in the Department's "Approved Sources of Materials" prior to use. The synthetic structural fibers shall be added to the concrete and mixed in accordance with the manufacturer's recommended methods.

907-711.04.1--Material Properties. The fibers shall meet the requirements of ASTM Designation: C 1116, Section 4.1.3. The fibers shall be made of polypropylene, polypropylene/polyethylene blend, nylon, or polyvinyl alcohol (PVA).

907-711.04.2--Minimum Dosage Rate. The dosage rate shall be such that the average residual strength ratio ($R_{150,3.0}$) of fiber reinforced concrete beams is a minimum of 20.0 percent when the beams are tested in accordance with ASTM Designation: C 1609. The dosage rate for fibers shall be determined by the following.

The fiber manufacturer shall have the fibers tested by an acceptable, independent laboratory acceptable to the Department and regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology and approved to perform ASTM Designations: C 39, C 78, and C192.

The laboratory shall test the fibers following the requirements of ASTM Designation: C 1609 in a minimum of three (3) test specimens cast from the same batch of concrete, molded in 6 x 6 x 20-inch standard beam molds meeting the requirements of ASTM Designation: C 31. The beams shall be tested on an 18-inch span. The tests for $R_{150,3.0}$ shall be performed when the average compressive strength of concrete used to cast the beams is between 3500 and 4500 psi. The tests for compressive strength shall follow the requirements of ASTM Designation: C 39. The average compressive strength shall be determined from a minimum of two (2) compressive strength cylinders.

The value for $R_{150,3}$ shall be determined using the following equation:

$$R_{150,3.0} = \frac{f_{150,3.0}}{f_1} \times 100$$

The residual flexural strength ($f_{150,3.0}$) shall be determined using the following equation:

$$f_{150,3.0} = \frac{P_{150,3.0} \times L}{b \times d^2}$$

where:

$f_{150,3.0}$ is the residual flexural strength at the midspan deflection of $L/150$, (psi),

$P_{150,3.0}$ is the residual load capacity at the midspan deflection of $L/150$, (lbf),

L is the span, (in),

b is the width of the specimen at the fracture, (in), and

d is the depth of the specimen at the fracture, (in).

For a 6 x 6 x 20-inch beam, the $P_{150,3.0}$ shall be measured at a midspan deflection of 0.12 inch.

Additionally, $R_{150,3.0}$, $f_{150,3.0}$, and $P_{150,3.0}$ may also be referred to as R_{150}^{150}, f_{150}^{150}, and P_{150}^{150} respectively.

At the dosage rate required to achieve the minimum $R_{150,3}$, the mixture shall both be workable and the fibers shall not form clumps.

The manufacturer shall submit to the State Materials Engineer certified test reports from the independent laboratory showing the test results of each test specimen.

907-711.04.3--Job Control Requirements. The synthetic structural fibers shall be one from the Department's "Approved Sources of Materials."

At the required dosage rate, the mixture shall both be workable and the fibers shall not form clumps to the satisfaction of the Engineer. If the mixture is determined by the Engineer to not be workable or have clumps of fibers, the mixture may be rejected.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-713-2

DATE: 04/04/2012

SUBJECT: Admixtures for Concrete

After the last sentence of the first paragraph of Subsection 907-713.02 on page 1, add the following.

Admixtures providing a specific performance characteristic(s) other than those of water reduction or set retardation shall meet the minimum requirements for Type S. For admixtures meeting the requirements for Type S, the manufacturer shall provide data to substantiate the specific performance characteristic(s) to the satisfaction of the State Materials Engineer.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-713-2 **CODE: (IS)**

DATE: 11/09/2010

SUBJECT: Admixtures for Concrete

Section 713, Concrete Curing Materials and Admixtures, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

After the second paragraph of Subsection 713.01.2 on page 676, add the following.

Type 1-D compound may be used on bridge rails, median barriers, and other structures requiring a spray finish. When Type 1-D compound is used, it will be the Contractor's responsibility to assure that the compound has dissipated from the structure prior to applying the spray finish and that the spray finish adheres soundly to the structure.

Delete Subsection 713.02 on pages 676 & 677, and substitute the following:

907-713.02--Admixtures for Concrete. Air-entraining admixtures used in Portland cement concrete shall comply with AASHTO Designation: M 154. Set-retarding, accelerating, and/or water-reducing admixtures shall comply with AASHTO Designation: M 194. Water-reducing admixture shall meet the minimum requirements for Type A. Set-retarding admixtures shall meet the minimum requirements for Type D.

In order to obtain approval of an admixture, the State Materials Engineer shall have been furnished certified test reports, made by an acceptable independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the admixture meets all the requirements of the applicable AASHTO Standard Specification.

The Department reserves the right to sample, for check tests, any shipment or lot of admixture delivered to a project.

The Department reserves the right to require tests of the material to be furnished, using the specific cement and aggregates proposed for use on the project, as suggested in AASHTO Designation: M 154 and outlined in AASHTO Designation: M 194.

After an admixture has been approved, the Contractor shall submit to the State Materials Engineer, with each new lot of material shipped, a certification from the manufacturer in accordance with the requirements of Subsection 700.05.1 and stating the material is of the same composition as originally approved and has not been changed or altered in any way. The requirement in Subsection 700.05.1(b) is not required on the certification from the manufacturer.

Admixtures containing chlorides will not be permitted.

Failure to maintain compliance with any requirement of these specifications shall be cause for rejection of any previously approved source or brand of admixture.

Admixtures shall only be used in accordance with the manufacturer's recommended dosage range as set forth in the manufacturer's approval request correspondence. When an admixture is used in Portland cement concrete, it shall be the responsibility of the Contractor to produce satisfactory results.

907-713.02.1--Source Approval. In order to obtain approval of an admixture, the Producer/Suppliers shall submit to the State Materials Engineer the following for review: certified test reports, made by an acceptable independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the admixture meets all the requirements of the applicable AASHTO or Department Specification for the specific type and the dosage range for the specific type of admixture.

907-713.02.2--Specific Requirements. Admixtures containing chlorides will not be permitted.

907-713.02.3--Acceptance. The Department reserves the right to sample, for check tests, any shipment or lot of admixture delivered to a project.

The Department reserves the right to require tests of the material to be furnished, using the specific cement and aggregates proposed for use on the project, as suggested in AASHTO Designation: M 154 and outlined in AASHTO Designation: M 194.

Failure to maintain compliance with any requirement of these specifications shall be cause for rejection of any previously approved source or brand of admixture.

With each new lot of material shipped the Contractor shall submit to the State Materials Engineer, a notarized certification from the manufacturer showing that the material complies with the requirements of the applicable AASHTO or Department Specification.

When an admixture is used, it shall be the responsibility of the Contractor to produce satisfactory results.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-714-6 **CODE: (IS)**

DATE: 11/09/2010

SUBJECT: Miscellaneous Materials

Section 714, Miscellaneous Materials, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-714.05--Fly Ash. Delete Subsections 714.05.1 & 714.05.2 on pages 680 & 681, and substitute the following:

907-714.05.1--General. The fly ash source must be approved for listing in the Department's "Approved Sources of Materials" prior to use. The acceptance of fly ash shall be based on certified test reports, certification of shipment from the supplier, and tests performed on samples obtained after delivery in accordance with the Department's Materials Division Inspection, Testing, and Certification Manual and Department SOP.

Different classes of fly ash or different sources of the same class shall not be mixed or used in the construction of a structure or unit of a structure without written permission from the Engineer.

The Contractor shall provide suitable means for storing and protecting the fly ash from dampness. Separate storage silos, bins, or containers shall be provided for fly ash. Fly ash which has become partially set or contains lumps of caked fly ash shall not be used.

The temperature of the bulk fly ash shall not be greater than 165°F at the time of incorporation into the work.

All classes of fly ash shall meet the supplementary option chemical requirement for available alkalies listed in AASHTO Designation: M 295, Table 2. Class F fly ash shall have a calcium oxide (CaO) content of less than 6.0%. Class C fly ash shall have a CaO content of greater than or equal to 6.0%.

The replacement of Portland cement with fly ash shall be in accordance with the applicable replacement content specified in Subsection 907-701.02.2.

In addition to these requirements, fly ash shall meet the following specific requirements for the intended use.

907-714.05.2--Fly Ash for Use in Concrete. When used with Portland cement in the production of concrete or grout, the fly ash shall meet the requirements of AASHTO Designation: M 295, Class C or F, with the following exception:

The loss on ignition shall not exceed 6.0 percent.

No additional cementitious materials, such as blended hydraulic cement, GGBFS, metakaolin, or others, shall be added to or as a replacement for Portland cement when used with fly ash.

907-714.06--Ground Granulated Blast Furnace Slag (GGBFS). Delete Subsection 714.06.1 on page 681, and substitute the following:

907-714.06.1--General. The GGBFS source must be approved for listing in the Department's "Approved Sources of Materials" prior to use. The acceptance of GGBFS shall be based on certified test reports, certification of shipment from the supplier, and tests performed on samples obtained after delivery in accordance with the Department's Materials Division Inspection, Testing, and Certification Manual and Department SOP.

The Contractor shall provide suitable means for storing and protecting the GGBFS against dampness and contamination. Separate storage silos, bins, or containers shall be provided for GGBFS. GGBFS which has become partially set, caked or contains lumps shall not be used.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing or other additions made to the GGBFS during production.

GGBFS from different mills shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer; except that this requirement will not be applicable to cement treatment of design soils or bases.

No additional cementitious materials, such as blended hydraulic cement, fly ash, metakaolin, or others, shall be added to or as a replacement for Portland cement when used with GGBFS in the production of concrete. The replacement of Portland cement with GGBFS shall be in accordance with the applicable replacement content specified in Subsection 907-701.02.2.

Delete Subsection 714.07 on page 682, and substitute the following:

907-714.07--Additional Cementitious Materials.

907-714.07.1--Metakaolin.

907-714.07.1.1--General. Metakaolin shall only be used as a supplementary cementitious material in Portland cement concrete for compliance with the requirements for cementitious materials exposed to soluble sulfate conditions. Metakaolin from different sources shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer. No additional cementitious materials, such as blended hydraulic cement, fly ash, GGBFS, or others, shall be added to or as a replacement for Portland cement when used with metakaolin in the production of concrete.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing, or other additions made to the metakaolin during production.

907-714.07.1.2--Source Approval. The approval of each metakaolin source shall be on a case by case basis as determined by the State Materials Engineer. In order to obtain approval of a metakaolin source, the Producer/Suppliers shall submit to the State Materials Engineer the

following for review: certified test reports, made by an acceptable, independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the metakaolin meets all the requirements of AASHTO Designation: M295, including the Effectiveness in contributing to sulfate resistance, Procedure A, listed in AASHTO Designation: M295, Table 4 for Supplementary Optional Physical Requirements, and other requirements listed herein.

In order to demonstrate effectiveness in contributing to sulfate resistance, included in this test data shall be results of metakaolin from the proposed source tested in accordance with ASTM Designation: C 1012. There shall be two sets of test specimens per the following:

a. One set of test specimens shall be prepared using a Type I Portland cement meeting the requirements of AASHTO Designation: M85 and having a tricalcium aluminate (C_3A) content of more than 8.0%,

b. One set of test specimens shall be prepared using a Type II Portland cement meeting the requirements of AASHTO Designation: M85.

c. The proposed metakaolin shall be incorporated at the rate of 10% cement replacement in each set of test specimens and shall meet both of the acceptance criteria listed below for source approval.

The requirement for acceptance of the test sample using Type I Portland cement is an expansion of 0.10% or less at the end of six months. The requirement for acceptance of the test sample using Type II Portland cement is an expansion of 0.05% or less at the end of six months.

907-714.07.1.3--Storage. The Contractor shall provide suitable means for storing and protecting the metakaolin against dampness and contamination. Metakaolin which has become partially set, caked, or contains lumps shall not be used.

907-714.07.1.4--Specific Requirements. Metakaolin shall meet the requirements of AASHTO Designation: M 295, Class N with the following modifications:

1. The sum of SiO_2 + Al_2O_3 + Fe_2O_3 shall be at least 85%. The Material Safety Data Sheet shall indicate that the amount of crystalline silica, as measured by National Institute of Occupation Safety and Health (NIOSH) 7500 method, after removal of the mica interference, is less than 1.0%.
2. The loss on ignition shall be less than 3.0%.
3. The available alkalies, as equivalent Na_2O, shall not exceed 1.0%.
4. The amount of material retained on a No. 325 mesh sieve shall not exceed 1.0%.
5. The strength activity index at seven (7) days shall be at least 85%.

907-714.07.1.5--Acceptance. With each new lot of material shipped the Contractor shall submit to the State Materials Engineer a certified test report from the manufacturer showing that the material meets the requirements AASHTO Designation: M295, Class N and the requirements of this Subsection.

The Department reserves the right to sample, for check tests, any shipment or lot of metakaolin delivered to a project.

907-714.07.2--Silica Fume.

907-714.07.2.1--General. Silica fume shall only be used as a supplementary cementitious material in Portland cement concrete for compliance with the requirements for cementitious materials exposed to soluble sulfate conditions. Silica fume from different sources shall not be mixed or used alternately in any one class of construction or structure without written permission from the Engineer. No additional cementitious materials, such as blended hydraulic cement, performance hydraulic cement, fly ash, GGBFS, or others, shall be added to or as a replacement for Portland cement when used with silica fume in the production of concrete.

The State Materials Engineer shall be notified in writing of the nature, amount and identity of any processing, or other additions made to the silica fume during production.

907-714.07.2.2--Source Approval. The approval of each silica fume source shall be on a case by case basis as determined by the State Materials Engineer. In order to obtain approval of a silica fume source, the Producer/Suppliers shall submit to the State Materials Engineer the following for review: certified test reports, made by an acceptable, independent laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institutes of Standards and Technology, which show that the silica fume meets all the requirements of AASHTO Designation: M307, Table 3, including the Sulfate resistance expansion, listed in the table for Optional Physical Requirements, and other requirements listed herein.

In order to demonstrate effectiveness in contributing to sulfate resistance, included in this test data shall be results of silica fume from the proposed source tested in accordance with ASTM Designation: C 1012. There shall be two sets of test specimens per the following:

a. One set of test specimens shall be prepared using a Type I Portland cement meeting the requirements of AASHTO Designation: M85 and having a tricalcium aluminate (C_3A) content of more than 8.0%,

b. One set of test specimens shall be prepared using a Type II Portland cement meeting the requirements of AASHTO Designation: M85.

c. The proposed silica fume shall be incorporated at the rate of 8% cement replacement in each set of test specimens and shall meet both of the acceptance criteria listed below for source approval.

The requirement for acceptance of the test sample using Type I Portland cement is an expansion of 0.10% or less at the end of six months. The requirement for acceptance of the test sample using Type II Portland cement is an expansion of 0.05% or less at the end of six months.

907-714.07.2.3--Storage. The Contractor shall provide suitable means for storing and protecting the silica fume against dampness and contamination. Silica fume which has become partially set, caked, or contains lumps shall not be used.

907-714.07.2.4--Acceptance. With each new lot of material shipped, the Contractor shall submit to the State Materials Engineer a certified test report from the manufacturer showing that the material meets the Chemical and Physical Requirements of AASHTO Designation: M307.

The Department reserves the right to sample, for check tests, any shipment or lot of silica fume

delivered to a project.

Delete Subsection 714.11.6 on pages 690 and 691, and substitute the following:

907-714.11.6--Rapid Setting Cementitious Patching Compounds for Concrete Repair. Rapid setting concrete patching compounds must be approved for listing in the Department's "Approved Sources of Materials" prior to use. Upon approval, a product must be recertified every four (4) years to remain on the "Approved Sources of Materials" list. Each product shall be pre-measured and packaged dry by the manufacturer. All liquid solutions included by the manufacturer as components of the packaged material shall be packaged in a watertight container. The manufacturer may include aggregates in the packaged material or recommend the addition of Contractor furnished aggregates.

The type, size and quantity of aggregates, if any, to be added at the job site shall be in accordance with the manufacturer's recommendations and shall meet the requirements of Subsection 703.02 for fine aggregate and Subsection 703.03 for coarse aggregate. Required mixing water to be added at the job site shall meet the requirements of Subsection 714.01.2.

Only those bonding agents, if any, recommended by the manufacturer of the grout or patching compounds may be used for increasing the bond to old concrete or mortar surfaces.

Patching compounds containing soluble chlorides will not be permitted when in contact with steel.

Site preparation, proportioning of materials, mixing, placing and curing shall be performed in accordance with the manufacturer's recommendation for the specific type of application, and the Contractor shall furnish a copy of these recommendations to the Engineer.

Rapid setting cementitious concrete patching compounds, including components to be added at the job site, shall conform to the following physical requirements:

Non-shrink cementitious grouts shall not be permitted for use.

Compressive strength shall equal or exceed 3000 psi in 24 hours in accordance with ASTM C 928 for Type R2 concrete or mortar.

Bond strength shall equal or exceed 1000 psi in 24 hours in accordance with ASTM C 928 for Type R2 concrete or mortar.

The material shall have a maximum length change of ±0.15% in accordance with ASTM C 928 for Type R2 concrete or mortar.

The Contractor shall furnish to the Engineer three copies of the manufacturer's certified test report(s) showing results of all required tests and certification that the material meets the specifications when mixed and place in accordance with the manufacturer's instructions. When the mixture is to be placed in contact with steel, the certification shall further state that the packaged material contains no chlorides. Certified test report(s) and certification shall be furnished for each lot in a shipment.

The proportioning of materials must be approved by the State Materials Engineer and any subsequent change in proportioning must also be approved. A sample of each component shall be submitted to the Engineer along with the quantity or percentage of each to be blended. At least 45 days must be allowed for initial approval.

The proportioning of materials for subsequent lots may be approved by the State Materials Engineer upon receipt of certification from the manufacturer that the new lot of material is the same composition as that originally approved by the Department and that the material has not been changed or altered in any way.

907-714.11.7--Commercial Grout for Anchoring Doweled Tie Bars in Concrete. Before Subsection 714.11.7.1 on page 691, add the following:

Approved Non-"Fast Set" Epoxy anchor systems as specified below may be used for the repair of concrete pavements that do not involve permanent sustained tension applications or overhead applications.

"***Fast Set Epoxy***" may not be used for any Adhesive Anchor Applications. Adhesive Anchor Systems (Fast Set epoxy or otherwise) shall not be used for permanent sustained tension applications or overhead applications. "Fast Set Epoxy" refers to an epoxy produced by the Sika Corporation called Sikadur AnchorFix-3 and repackaged for sale under a variety of names/companies listed at the Federal Highway Administration web site at the following link:

http://www.fhwa.dot.gov/Bridge/adhesives.cfm

907-714.11.7.4--Acceptance Procedure. After the last sentence of the first paragraph of Subsection 714.11.4 on page 691, add the following:

Upon approval, a product must be recertified every four (4) years to remain on the "Approved Sources of Materials" list.

907-714.11.8--Epoxy Joint Repair System.

907-714.11.8.1--General. After the last sentence of the first paragraph of Subsection 714.11.8.1 on page 692, add the following:

Upon approval, a product must be recertified every four (4) years to remain on the "Approved Sources of Materials" list.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPPLEMENT TO SPECIAL PROVISION NO. 907-804-13

DATE: **08/28/2012**

SUBJECT: **Concrete Bridges And Structures**

After the second paragraph of Subsection 907-804.02.10 on page 2, add the following.

After the first paragraph of Subsection 804.02.10 on page 850, add the following.

If the Contractor chooses to cure the concrete in accordance with the requirements listed under **Length of Time Defined by Development of Compressive Strength** in Subsection 907-804.03.17, the compressive strength/maturity relationship shall be developed for the mixture design for a minimum of 28 days following the requirements of Subsection 907-804.03.15. The compressive strength/maturity relationship information shall be submitted with the mixture design information.

In the ** Note of Subsection 907-804.02.10 on page 2, delete "metakaolin" from the list of other cementitious materials.

After the first sentence of the last paragraph of Subsection 907-804.02.10 on page 3, add the following.

Mixture designs containing accelerating admixtures will not be approved. Admixtures providing a specific performance characteristic other than those of water reduction or set retardation may be used in accordance with the manufacturer's recommended dosage range.

After Subsection 907-804.02.10.1.1 on page 3, add the following.

907-804.02.10.1.2--Proportioning on the Basis of Laboratory Trial Mixtures. Delete subparagraph d) of Subsection 804.02.10.1.2 on pages 852 & 853, and substitute the following.

d) For each proposed mixture, at least three compressive test cylinders shall be made and cured in accordance with AASHTO Designation: T 126. Each change of water-cementitious ratio shall be considered a new mixture. The cylinders shall be tested for strength in accordance with AASHTO Designation: T 22 and shall be tested at 28 days.

After Subsection 907-804.02.10.3 on page 4, add the following.

After Subsection 804.02.10.3 on page 853, add the following.

907-804.02.10.3.1--Slump Retention of Class DS Concrete Mixture Designs. Prior to concrete placement, the Contractor shall provide test results of a slump loss test using approved methods to demonstrate that the mixture meets the four hour requirement in Subsection 907-803.02.7.1. These tests shall be conducted successfully by an approved testing laboratory within

30 days prior to installation of the trial shaft, with personnel from the Department's Central Laboratory present. The slump loss test shall be conducted at temperatures and conditions similar to those expected at the job site at the time of the installation of the trial shaft. The sample for the slump loss test shall be from a minimum batch size of four cubic yards of concrete. If the time between the previous successful slump loss test and the installation of the trial shaft exceeds 30 days, another successful slump loss test shall be performed on the first truckload of concrete as part of the installation of the trial shaft. This requirement limiting the time between the previous slump loss test and an installation of the trial shaft also applies to Class DS concrete mixture designs being transferred from another project. During any shaft installation a slump loss test shall be conducted by the Contractor at the direction of the Engineer from the concrete at the site for verification of slump loss requirements using a sample from a minimum batch size of four cubic yards of concrete.

Before Subsection 907-804.02.12.3 on page 5, add the following.

907-804.02.12.1.1--Elements of Plan. After item 3) in Subsection 804.02.12.1.1 on page 855, add the following.

4) Job Site Batch Adjustments by Addition of Chemical Admixtures:

   The Plan shall address if the Contractor intends to adjust either the slump and/or total air content of a batch on the job site by adding chemical admixture(s) to a batch. The Contractor shall include the names of the personnel designated to perform this batch adjustment, the equipment used to add the chemical admixture(s), and the procedure by which the batch adjustment will be accomplished. Only the Contractor's designated personnel shall adjust a batch. Only calibrated dispensing equipment shall be used to add chemical admixture(s) to a batch. Only the procedure described in section of the Plan shall be utilized.

   If the maximum permitted slump or total air content is exceeded after the addition of admixtures at the job site, the concrete shall be rejected.

   If the Contractor elects to utilize Job Site Batch Adjustments by Addition of Chemical Admixture within Item 2, Procedures for Corrective Actions for Non Compliance of Specifications, to adjust batches which do not meet the minimum specification requirements for slump and/or total air content, no more than three batches on any one project shall be allowed to be adjusted.

5) Construction of Concrete Bridge Decks, including the following:

   - the description of the equipment used for placing concrete on the bridge deck in accordance with Subsection 907-804.03.6 and, as applicable, Subsections 907-804.03.7 and 907-804.03.8 including any accessories added to the pump to ensure the entrained air in the concrete mixture remains entrained during pumping and depositing of the concrete mixture,
   - the description of and the number of pieces of equipment used to consolidate the concrete in accordance with Subsection 907-804.03.6.2,

- the description of the equipment used to finish the bridge deck in accordance with Subsection 907-804.03.19.7,
- the plan for ensuring a continuous rate of finishing the bridge deck without delaying the application of curing materials within the time specified in Subsection 907-804.03.17, including ensuring a continuous supply of concrete throughout the placement with an adequate quantity of concrete to complete the deck and filling diaphragms and end walls in advance of deck placement,
- the plan for applying the curing materials within the time specified in Subsection 907-804.03.17,
- the description of the powered fogging equipment in accordance with Subsection 907-804.03.17,
- a sample of the documentation used as the daily inspection report for ensuring maintenance of the continuous wet curing in accordance with Subsection 907-804.03.17, as required,
- the description of the equipment used to apply the liquid membrane, including but not limited to, the nozzles, pumping/pressurization equipment, and liquid membrane tanks, in accordance with Subsection 907-804.03.17,
- the method for determining the rate of applied liquid membrane meets the application rate requirements in accordance with Subsection 907-804.03.17,
- a sample of the documentation used for the application rate verification of the liquid membrane in accordance with Subsection 907-804.03.17.

After Subsection 907-804.03.6.2 on page 7, add the following.

907-804.03.8--Pumping Concrete. Delete the second paragraph of Subsection 804.03.8 on page 866, and substitute the following.

Where concrete mixture is conveyed and placed by mechanically applied pressure (pumping), the equipment shall be suitable in kind and adequate in capacity for the work. The Contractor shall select concrete mixture proportions such that the concrete mixture is pumpable and placeable with the selected equipment.

The pumping equipment shall be thoroughly cleaned prior to concrete placement. Excess form release agent shall be removed from the concrete pump hopper. The Contractor shall prime the pump at no additional cost to the Department by pumping and discarding enough concrete mixture to produce a uniform mixture exiting the pump. At least 0.25 cubic yard of concrete mixture shall be pumped and discarded to prime the pump. This shall be accomplished by using the pump to fill a commercially-available six (6) cubic foot wheelbarrow to overflowing or filling a commercially-available eight (8) cubic foot wheel barrow to level. Only concrete mixture shall be added directly into the concrete pump hopper after placement has commenced. If anything other than concrete mixture is added to the concrete pump hopper, all concrete mixture in the concrete pump hopper and pump line shall be discarded and the pump re-primed at no additional cost to the Department.

The discharge end of the pump shall be of such a configuration that the concrete does not move in the pump line under its own weight. The intent of this requirement is to ensure that entrained air in the concrete mixture remains entrained during pumping and depositing the concrete mixture. This shall be accomplished with one or both of the following:

- a minimum 10-foot flexible hose attached to the discharge end of a steel reducer having a minimum length of three (3) feet and a minimum reduction in area of 20% which is attached to the discharge end of the pump line, or
- a flexible reducing hose to the discharge end of the pumpline with a minimum reduction in area of 20% over a minimum 10-foot hose length.

Regardless of the configuration chosen, the Contractor shall ensure that the concrete is pumped and does not free-fall more than five (5) feet within the entire length of pump line and after discharge from the end of pump line.

The Contractor shall not have any type of metal elbow, metal pipe, or other metal fitting within five (5) feet of any person during discharge of concrete mixture.

Boom pumps shall have a current Concrete Pump Manufacturers Association's ASME/ANSI B30.27 certification. Equipment added to the boom and pump line shall meet the pump manufacturer's specifications and shall not exceed the manufacturer's maximum recommended weight limit for equipment added to the boom and pump line.

The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipe line, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned.

Before Subsection 907-804.03.15 on page 7, add the following.

907-804.03.14.2--Stay-In-Place Metal Forms. Delete the sentence in Subsection 804.03.14.2 on page 871 and substitute the following.

Stay-in-place (SIP) metal forms are corrugated metal sheets permanently installed between the supporting superstructure members. After the concrete has cured, these forms shall remain in place as permanent, non-structural members of the bridge.

Pay quantities for bridge deck concrete will be computed from the dimensions shown in the Contract Plans with no allowance for changes in deflection and /or changes in dimensions necessary to accommodate the SIP metal forms.

There will be no direct payment for the cost of the forms and form supports, or any material, tools, equipment, or labor incidental thereto, but the cost shall be considered absorbed in the contract unit price for bridge deck concrete.

Before fabricating any material, three (3) complete sets of SIP metal form shop drawings and design calculations, bearing the Design Engineer's Seal, shall be submitted to the Director of Structures, State Bridge Engineer, through the Project Engineer, for review. The Contractor's SIP metal form Design Engineer shall be a MS Registered Professional Engineer who is knowledgeable in the field of structural design.

In no case shall additional dead load produced by the use of SIP metal forms overstress any bridge component. Design calculations shall indicate any additional dead load from SIP metal form self-weight, form support hangers, concrete in flutes, concrete due to form deflection, etc. not included in the Contract Plans. The additional dead loads shall be clearly labeled and tabulated on the shop drawings. Bridge Division will evaluate the additional load for overstress of the bridge components. In the event that the additional dead load produces an overstress in any bridge component, Bridge Division will reject the Contractor's design. Deflection and loads produced by deflection of the SIP metal forms shall be considered and indicated in the design calculations.

The cambers and deflections provided in the Contract Plans do not consider the effects of SIP metal forms. The Contractor's Engineer shall take into account the weight of the forms and any additional dead load when developing the "Bridge Superstructure Construction Plan".

For the purpose of reducing any additional dead load produced by the SIP metal forms, the flutes of SIP metal forms may be filled with polystyrene foam. When polystyrene foam is used to fill the forms, the form flutes shall be filled completely; no portion of the polystyrene foam shall extend beyond the limits of the flutes. The Contractor shall ensure that the polystyrene foam remains in its required position within flutes during the entire concrete placement process. The Contractor shall not use reinforcing steel supports or other accessories in such a manner as to cause damage to the polystyrene foam. All damaged polystyrene foam shall be replaced to the satisfaction of the Project Engineer. All welding of formwork shall be completed prior to placement of polystyrene foam.

For bridges not located in horizontal curves, the Contractor may reduce the additional dead load by matching the flute spacing with the transverse steel spacing of the bottom layer. The bottom longitudinal layer of steel shall have one (1) inch of minimum concrete cover measured from the bottom of the reinforcing to the top of the flute. The Contractor will not be allowed to vary the reinforcing steel spacing or size from the Contract Plans for the purpose of matching flute spacing.

907-804.03.14.2.1--Materials. SIP metal forms and supports shall meet the requirements of ASTM Designation: A653 having a coating designation G165. Form materials that are less than 0.03-inch uncoated thickness shall not be allowed.

907-804.03.14.2.2--Certification. The Contractor shall provide written certification from the manufacturer stating the product meets the requirements of this specification to the Project Engineer along with the delivery of the coated forms to the job site.

907-804.03.14.2.3--Polystyrene Foam. The polystyrene foam shall be comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation. The polystyrene foam shall be extruded to match the geometry of the flutes and provide a snug fit. The polystyrene foam shall have a density of not less than 0.8 pounds per cubic foot. The polystyrene foam shall have water absorption of less than 2.6% when tested according to ASTM Designation: C272. The Contractor shall provide written certification from the manufacturer stating the polystyrene foam product meets the requirements of this specification to the Project Engineer along with the delivery of the coated forms to the job site.

907-804.03.14.2.4--Design. The design of the SIP metal forms shall meet the following criteria.

1. The maximum self-weight of the stay in place metal forms, plus the weight of the concrete or expanded polystyrene required to fill the form flutes (where used), shall not exceed 20 psf.

2. The forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot for construction loads. The design shall use a unit working stress in the steel sheet of not more than 0.725 of the specified minimum yield strength of the material furnished, but not to exceed 36,000 psi.

3. Deflection under the weight of the forms, reinforcement, and plastic concrete shall not exceed 1/180 of the form span or 1/2 inch, whichever is less, for form spans of 10 feet or less, or 1/240 of the form span or 3/4 inch, whichever is less, for form spans greater than 10 feet.

4. The design span of the form shall equal the clear span of the form plus two (2) inches. The span shall be measure parallel to the form flutes.

5. Physical design properties shall be computed in accordance with requirements of the AISI Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.

6. The design concrete cover required by the plans shall be maintained for all reinforcement.

7. The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained.

8. The SIP metal form shall not be considered as lateral bracing for compression flanges of supporting structural members.

9. SIP metal forms shall not be used under closure pours or in bays where longitudinal slab construction joints are located. SIP metal forms shall not be used under cantilevered slabs such as the overhang outside of fascia members.

10. Forms shall be secured to the supporting members by means other than welding directly to the member. Welding to the top flanges of steel stringers and/or girders shall not be allowed. Alternate installation procedures shall be submitted addressing this condition.

907-804.03.14.2.5--Construction. SIP metal form sheets shall not rest directly on the top of the stringer of floor beam flanges. Sheets shall be fastened securely to form supports, and maintain a minimum bearing length of one (1) inch at each end for metal forms. Form supports shall be placed in direct contact with the flange of the stringer or floor beam. All attachments for coated metal forms shall be made by bolts, clips, screws, or other approved means.

907-804.03.14.2.6--Form Galvanizing Repairs. Where forms or their installation are unsatisfactory in the opinion of the Project Engineer, either before or during placement of the concrete, the Contractor shall correct the defects before proceeding with the construction work. The

cost of such corrective work shall be at the sole expense of the Contractor. Minor heat discoloration in areas of welds shall not be touched up.

907-804.03.14.2.7--Placing of Concrete. The Contractor shall insure that concrete placement does not damage the SIP metal forms. The concrete shall be vibrated to avoid honeycomb and voids, especially at construction joints, expansion joints, valleys and ends of form sheets. Approved pouring sequences shall be used. Calcium chloride or any other admixture containing chloride salts shall not be used in the concrete. The completed SIP metal form system shall be sufficiently tight to prevent leakage of mortar or concrete.

907-804.03.14.2.8--Inspection. The Project Engineer will observe the Contractor's method of construction during all phases of the construction of the bridge deck slab, including the installation of the SIP metal form system; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck. Should the Project Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, at least one section of the metal forms shall be removed in each span for this purpose. This shall be done as soon after placing the concrete as practical in order to provide visual evidence that the concrete mix and the procedures are obtaining the desired results. An additional section shall be removed in any span if the Project Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the Project Engineer's judgment, inspection is needed to check for defects in the bottom of the deck or to verify soundness, the SIP metal forms shall be sounded with a hammer after the deck concrete has been in place a minimum of two days. If sounding discloses areas of doubtful soundness to the Project Engineer, the SIP metal forms shall be removed from such areas for visual inspection after the concrete has attained adequate strength. The SIP metal bridge deck forms shall be removed at no expense to the State.

At locations where sections of the metal forms have been removed, the Project Engineer will not require the Contractor to replace the metal forms. The adjacent metal forms and supports shall be repaired to present a neat appearance and to ensure their satisfactory retention. As soon as the form is removed, the Project Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found and the Project Engineer determines that these irregularities do not justify rejection of the work, the concrete shall be repaired as directed by the Project Engineer. If the Project Engineer determines that the concrete where the form is removed is unsatisfactory, additional metal forms as necessary shall be removed to inspect and repair the slab, and the Contractor's method of construction shall be modified as required to obtain satisfactory concrete in the slab. All unsatisfactory concrete shall be removed and replaced as directed at no expense to the State.

If the method of construction and the results of the inspections as outlined above indicate that sound concrete has been obtained throughout the slabs, the amount of sounding and form removal may be reduced when approved by the Project Engineer.

The Contractor shall provide a safe and convenient means of conducting of the inspection.

Delete Table 6 of Subsection 907-804.03.15 on page 8, and substitute the following.

Table 6
Minimum Compressive Strength Requirements for Form Removal

Forms:	
Columns	1000 psi
Side of Beams	1000 psi
Walls not under pressure	1000 psi
Other Parts	1000 psi
Centering:	
Under Beams	2400 psi
Under Bent Caps	2000 psi
Limitation for Placing Beams on:	
Pile Bents, pile under beam	2000 psi
Frame Bents, two or more columns	2200 psi
Frame Bents, single column	2400 psi

Forms for bridge deck slabs overhead and bridge deck slabs between beams shall be removed with the approval of the Engineer, between two weeks and four weeks after the removal of the wet burlap applied in accordance with Subsection 907-804.03.17.1, or application of liquid membrane applied in accordance with Subsection 907-804.03.17.2.

Delete the second paragraph of Subsection 907-804.03.16.1 on page 9, and substitute the following.

At the option of the Contractor with the approval of the Engineer, when concrete is placed during cold weather and there is a probability that the ambient temperatures will be lower than 40°F, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. An approved insulating blanketing material shall be used to protect the work when ambient temperatures are less than 40°F and shall remain in place until the required concrete strength in Table 6 is achieved. Within 30 minutes of removal of the insulating blanketing material in any area, the Contractor shall have curing of the concrete established in accordance with the requirements in Subsection 907-804.03.17. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

Before Subsection 907-804.03.19 on page 9, add the following.

907-804.03.17--Curing Concrete. Delete Subsection 804.03.17 on pages 874 & 875, and substitute the following.

Curing is defined as all actions taken to ensure the moisture and temperature conditions of freshly placed concrete exist so the concrete may develop its potential properties. Curing shall take place from the time of placement until its potential properties have developed. The Contractor shall use the guidance in ACI 308R-01 to:

a) cure the concrete in such a manner as to prevent premature moisture loss from the concrete,
b) supply additional moisture to the concrete as required in order to ensure sufficient moisture within the concrete, and
c) maintain a concrete temperature beneficial to the concrete.

Curing in accordance with the requirements in either Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2 shall be completely established within 20 minutes after finishing, except as noted for bridge decks. Finishing is complete when the pan drag, burlap drag, or other is complete.

The length of time for curing shall be maintained in accordance with either of the following:

1. **Prescribed Length of Time:**
   a) Curing following the requirements of Subsection 804.03.17.1 shall continue uninterrupted for at least 14 days.
   b) Curing following the requirements of Subsection 804.03.17.2 shall continue uninterrupted for at least 10 days.

OR

2. **Length of Time Defined by Development of Compressive Strength:**
   Curing following the application requirements of Subsection 907-804.03.17.1 or Subsection 907-804.03.17.2 shall continue uninterrupted for each day's production until the compressive strength of the concrete exceeds 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1. Therefore, if an area is being cured in accordance with Subsection 907-804.03.17.1, the curing by wet burlap shall continue until the concrete in that area has attained a minimum of 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1. Likewise, if an area is being cured in accordance with Subsection 907-804.03.17.2, the curing by liquid membrane shall continue until the concrete in that area has attained a minimum of 75% of the 28-day compressive strength submitted as the Basis of Proportioning per Subsection 907-804.02.10.1.

   The compressive strength of the concrete may be determined by the use of maturity meter in accordance with Subsection 907-804.03.15.

907-804.03.17.1--Water With Waterproof Cover. All burlap shall be completely saturated and wet prior to placing it on the concrete. The burlap shall have been fully soaked in water for a minimum of 12 hours prior to placement on the concrete.

For bridge decks, the Contractor shall apply one (1) layer of saturated burlap within 20 minutes of the initial strike-off for bridges without a skew and 25 minutes of the initial strike-off for bridges

with a skew. For all other concrete, the Contractor shall apply one (1) layer of saturated burlap within 20 minutes of completing finishing.

Following the first layer of burlap, the Contractor shall apply a second layer of saturated burlap within five (5) minutes of applying the first layer. The concrete surface shall not be allowed to dry after strike-off or at any time during the curing period.

The Contractor shall maintain the burlap in a fully wet condition using powered fogging equipment capable of producing a fog spray of atomized droplets of water until the concrete has gained sufficient strength to allow foot traffic without the foot traffic marring the surface of the concrete. Burlap shall not be maintained in the fully wet condition using equipment which does not produce a fog spray of atomized droplets of water or by use of manually pressurized sprayers. For bridge decks, once the concrete has gained sufficient strength to allow foot traffic which does not mar the surface of the concrete, soaker hoses shall be placed on the burlap. The soaker hoses shall then be supplied with running water continuously to maintain continuous saturation of all burlap and the entire concrete surface.

If there is a delay in the placement of the first layer of saturated burlap outside the time limit, the struck-off and finished concrete shall be kept wet by use of the powered fogging equipment used to keep the burlap wet.

White polyethylene sheets shall be placed on top of the wet burlap and, as applicable, soaker hoses covering the entire concrete surface as soon as practical and not more than 12 hours after the placement of the concrete. White polyethylene sheets of the widest practical width shall be used, overlapping adjacent sheets a minimum of six inches (6") and tightly sealed with an adhesive like pressure sensitive tape, mastic, glue, or other approved methods to form a complete waterproof cover of the entire concrete surface. White polyethylene sheets which overlap a minimum of two feet (2') may be held in place using means other than an adhesive. The white polyethylene sheets shall be secured so that wind will not displace them. The Contractor shall immediately repair the broken or damaged portions or replace sections that have lost their waterproof qualities.

If burlap and/or white polyethylene sheets are temporarily removed for any reason during the curing period, the Contractor shall keep the entire exposed area continuously wet. The saturated burlap and white polyethylene sheets shall be replaced, resuming the specified curing conditions, as soon as possible.

The Contractor shall inspect the concrete surface once every 8 hours for the entirety of the curing period, so that all areas remain wet for the entire curing period and all curing requirements are satisfied and document the inspection in accordance with Subsection 907-804.03.17.1.1.

At the end of the curing period, one coating of liquid membrane shall be applied following the requirements of Subsection 907-804.03.17.1.2. The purpose of the coating of liquid membrane is to allow for slow drying of the concrete. The application of liquid membrane to any area shall be complete within 30 minutes of the beginning of removal of the white polyethylene sheets, soaker hoses, and burlap from this area.

907-804.03.17.1.1--Documentation. The Contractor shall provide the Engineer with a daily inspection report that includes:

- documentation that identifies any deficiencies found (including location of deficiency);
- documentation of corrective measures taken;
- a statement of certification that all areas are wet and all curing material is in place on the entire bridge deck;
- documentation showing the time and date of all inspections and the inspector's signature;
- documentation of any temporary removal of curing materials including location, date and time, length of time curing was removed, and means taken to ensure exposed area was kept continuously wet.

907-804.03.17.1.2--Liquid Membrane. At the end of the 14-day wet curing period the wet burlap and polyethylene sheets shall be removed and within 30 minutes, the Contractor shall apply white liquid membrane to the deck. The liquid membrane shall be thoroughly mixed within the time recommended by the liquid membrane producer but no more than an hour before use. If the use of liquid membrane results in a streaked or blotched appearance, the method shall be stopped and water curing applied until the cause of defective appearance is corrected.

The liquid membrane shall be applied when no free water remains on the surface but while the surface is still wet. The liquid membrane shall be applied according to the manufacturer's instructions with a minimum spreading rate per coat of one (1) gallon per 200 square feet of concrete surface. If the concrete is dry or becomes dry, the Contractor shall thoroughly wet it with water applied as a fog spray by means of approved equipment.

The application of liquid membrane shall be accomplished by the use of power applied spray equipment using nozzles and other equipment recommended by the liquid membrane producer. Manually pressurized or manual pump-up type sprayers shall not be used to apply the first application of liquid membrane.

As a visual guide, the color of concrete covered with the required amount of liquid membrane should be indistinguishable from a sheet of commercially available standard "letter" size white copier paper placed on top of it when viewed from a distance of about five feet (5') away horizontally if standing on the same grade as the concrete. The appearance of the concrete does not supersede applying the minimum spreading rate.

The coating shall be protected against marring for at least seven (7) days after the application of the curing compound. The coating on bridge decks shall receive extra attention and may require additional protection as required by the Engineer. All membrane marred or otherwise disturbed shall be given an additional coating. Manually pressurized or manual pump-up type sprayers may be used for giving marred areas the required additional application of liquid membrane. Should the surface coating be subjected repeatedly to injury, the Engineer may require that the water curing method be applied at once.

The 7-day period during which the liquid membrane is applied and protected shall not be reduced even if the period of wet curing is extended past the required 14 days.

907-804.03.17.1.2.1--Liquid Membrane Documentation. The Contractor shall make available to the Engineer an application rate verification method and any information necessary during application of the liquid membrane to verify that the rate of application meets the prescribed rate

for the various surfaces of the concrete, including, but not limited to, the top surface of the bridge deck and exposed sides of the bridge deck after any forms are removed. The Contractor shall submit this application verification method to the Engineer in accordance with Subsection 907-804.02.12.1.1.

One method of verifying the rate of application is as follows:

1. Determine the volume of liquid membrane in the container. For a container with a uniform cross-sectional area, for example a 55-gallon drum, determine the area of the cross-section. Determine the height of the surface of the liquid membrane from the bottom of the container. This may be accomplished by inserting a sufficiently long, clean dip-stick parallel with the axis of the container into the liquid membrane until the inserted end of the dip-stick contacts the bottom of the container. On removing the dip-stick, measure the length from the end which was inserted to the point on the dip-stick where the liquid membrane ceases to coat the dip-stick. Multiply the area of the cross-section by the height of the level of liquid membrane, maintaining consistent units, to determine the volume.
2. Perform step 1 prior to beginning applying the liquid membrane to establish the initial volume.
3. During the period of application, perform step 1 each 100 square feet of bridge deck.
4. In order to meet the required application rate of one (1) gallon per 200 square feet, the amount in the container shall be at least 0.5 gallon less than the previous volume in the previous 100 square feet. Other changes in volume may apply depending on the manufacturer's recommended application rate.
5. Additional applications to an area shall be applied until the required rate is satisfied. Areas which are not visually satisfactory to the Engineer shall have additional liquid membrane applied as directed by the Engineer.

The amount of liquid membrane applied shall be determined each day using the application verification method. This information shall be submitted to the Engineer within 24 hours of applying the liquid membrane.

907-804.03.17.2--Liquid Membrane Method. Surfaces on which curing is to be by liquid membrane shall be given the required surface finish prior to the application of liquid membrane. Concrete surfaces cured by liquid membrane shall receive two applications of white liquid membrane. Neither application shall be made from a position supported by or in contact with the freshly placed concrete. Both applications shall be applied perpendicularly to the surface of the concrete.

When using liquid membrane, the liquid membrane shall be thoroughly mixed within the time recommended by the liquid membrane producer but no more than an hour before use. If the use of liquid membrane results in a streaked or blotched appearance, the method shall be stopped and water curing applied until the cause of defective appearance is corrected.

The application of liquid membrane shall accomplished by the use of power applied spray equipment using nozzles and other equipment recommended by the liquid membrane producer. Manually pressurized or manual pump-up type sprayers shall not be used to apply the first two applications of liquid membrane.

The liquid membrane shall be applied when no free water remains on the surface but while the surface is still wet. The liquid membrane shall be applied according to the manufacturer's instructions with a minimum spreading rate per coat of one (1) gallon per 200 square feet of concrete surface. If the concrete is dry or becomes dry, the Contractor shall thoroughly wet it with water applied as a fog spray by means of approved equipment.

The first application of the liquid membrane shall be made as the work progresses. For bridge decks, the first application shall be completed in each area of the deck within 20 minutes of initial strike-off for bridges with no skew and within 25 minutes of initial strike-off for bridges with skew. For all other concrete, the first application of the liquid membrane shall be completed within 20 minutes of finishing.

The second application shall be applied within 30 minutes after the first application. The liquid membrane shall be uniformly applied to all exposed concrete surfaces.

As a visual guide, the color of concrete covered with the required amount of liquid membrane should be indistinguishable from a sheet of commercially available standard "letter" size white copier paper placed on top of it when viewed from a distance of about five feet (5') away horizontally if standing on the same grade as the concrete. The appearance of the concrete does not supersede applying the minimum spreading rate.

The Contractor shall make available to the Engineer an application rate verification in accordance with Subsection 907-804.03.17.1.2.1.

The coating shall be protected against marring for at least 10 days after the application of the curing compound. The coating on bridge decks shall receive extra attention and may require additional protection as required by the Engineer. All membrane marred or otherwise disturbed shall be given an additional coating. Manually pressurized or manual pump-up type sprayers may be used for giving marred areas the required additional application of liquid membrane. Should the surface coating be subjected repeatedly to injury, the Engineer may require that the water curing method be applied at once.

Delete Subsection 907-804.19.7 on page 9, and substitute the following.

907-804.03.19.7--Finishing Bridge Decks.

907-804.03.19.7.1--General. Delete the third paragraph of Subsection 804.03.19.7.1 on page 884, and substitute the following.

Except when indicated otherwise on the plans, the finish of the bridge deck shall be either a belt finish, a broom finish, or one of the following drag methods: pan, double pan, burlap, or pan and burlap. Manual finishing of the bridge deck shall be performed only in areas inaccessible by the finishing equipment mounted to the strike-off screed, but shall not hinder the requirements for curing in accordance with Subsection 907-804.03.17.1. The surface texture specified and surface requirements shall be in accordance with the applicable requirements of Subsections 501.03.17 and 501.03.18 modified only as the Engineer deems necessary for bridge deck construction operations.

At no time shall water on the surface of the concrete from bleeding, fogging, curing, or other sources be worked into the concrete or used as an aid for finishing.

Regardless of the method of finishing selected, requirements for curing per Subsection 907-804.03.17 shall be completed within the specified time limits. If the requirements in Subsection 907-804.03.17 are not completed within the specific time limits, the Contractor shall cease operations, revise his operations up to and including acquiring new or additional equipment or additional personnel in order to satisfy the requirements in Subsection 907-804.03.17, and, on approval from the Engineer, resume operations

907-804.03.19.7.2--Longitudinal Method. Before the first paragraph of Subsection 804.03.19.7.2 on page 884, add the following.

The longitudinal method may be used for repairs to bridge decks or bridge widening projects. For bridge widening projects, the time for establishing curing in accordance with Subsections 907-804.03.17 shall be increased to within 30 minutes for bridges without skew and within 35 minutes for bridges with skew.

907-804.03.19.7.3--Transverse Method. Delete the first sentence of the second paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

The machine shall be so constructed and operated as to produce a bridge deck of uniform density with minimum manipulation of the fresh concrete and achieved in the shortest possible time.

Delete the fourth paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

At least one dry run shall be made the length of each pour with a "tell-tale" device attached to the screed carriage to assure the specified clearance to the reinforcing steel.

Delete the last sentence of the fifth paragraph of Subsection 804.03.19.7.3 on page 885, and substitute the following.

The screed shall be mechanically actuated to deliver the screeding action and for travel in a longitudinal direction at a uniform rate along the bridge deck.

Delete the last paragraph of Subsection 804.03.19.7.3 on page 886, and substitute the following.

Other finishing requirements shall be in accordance with the general requirements in Subsection 907-804.03.19.7.1 and as specified on the plans.

Regardless of the finish, the requirements for curing per Subsection 907-804.03.17 shall be completed within the specified time limits.

After Subsection 907-804.03.19.7.4 on page 9, add the following.

Delete the title of Subsection 804.03.19.7.4.1.3 on page 888, and substitute the following.

907-804.03.19.7.4.1.3--Final Surface Texture.

907-804.03.20--Opening Bridges.

907-804.03.20.2--Construction Traffic. Delete the paragraph in Subsection 804.03.20.2 on page 889, and substitute the following:

Unless otherwise specified, the concrete bridge decks shall be closed to construction traffic for the time required for curing in Subsection 907-804.03.17 and until the required compressive strength for the concrete is obtained.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-804-13 **CODE: (IS)**

DATE: 11/09/2010

SUBJECT: Concrete Bridges And Structures

Section 804, Concrete Bridges And Structures, of the 2004 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows:

907-804.02-- Materials.

907-804.02.1--General. Delete the third and fourth sentences of the first paragraph of Subsection 804.02.1 on page 846, and substitute the following:

For projects with 1000 cubic yards and more, quality control and acceptance shall be achieved through statistical evaluation of test results. For projects of more than 200 but less than 1000 cubic yards, quality control and acceptance shall be achieved by individual test results.

Add the following materials to the list of materials in Subsection 804.02.1 on page 847.

Blended Cement..... 907-701.01 and 907-701.04
Ground Granulated Blast Furnace Slag (GGBFS)..... 907-714.06
Silica Fume 907-714.07.2

907-804.02.8--Laboratory Accreditation. In Table 1 of Subsection 804.02.8 on page 849, substitute AASHTO: R 39 - Making and Curing Concrete Test Specimens in the Laboratory for AASHTO: T 126 - Making and Curing Concrete Test Specimens in the Laboratory.

907-804.02.9--Testing Personnel. Delete Table 2 in this subsection and replace it with the following.

Table 2

Concrete Technician's Tasks	Test Method Required	Certification Required**
Sampling or Testing of Plastic Concrete	AASHTO Designation:T 23, T 119, T 121, T 141, T 152, T 196, and ASTM Designation: C 1064	MDOT Class I certification
Compressive Strength Testing of Concrete Cylinders	AASHTO Designation: T 22 and T 231	MDOT Concrete Strength Testing Technician certification
Sampling of Aggregates	AASHTO Designation: T 2	Work under the supervision of an MDOT Class II certified technician

Testing of Aggregates	AASHTO Designation: T 19, T 27, T 84, T 85, T 248, and T 255	MDOT Class II certification
Proportioning of Concrete Mixtures*	AASHTO Designation: M 157 and R 39	MDOT Class III
Interpretation and Application of Maturity Meter Readings	AASHTO Designation: T 325 and ASTM Designation: C 1074	MDOT Class III or Two hours maturity method training

* Technicians making concrete test specimens for meeting the requirements of Subsection 804.02.10.1.2 shall be MDOT Class I certified and under the direct supervision of an MDOT Class III certified technician.

** MDOT Class I certification encompasses the same test procedures and specifications as ACI Concrete Field Testing Technician Grade I. MDOT Class II certification encompasses the same test procedures and specifications as ACI Aggregate Testing Technician - Level 1. MDOT Concrete Strength Testing Technician encompasses the same test procedures and specifications as ACI Concrete Strength Testing certification.

For specifics about the requirements for each level of certification, please refer to the latest edition of the Department's *Concrete Field Manual*. Technicians holding current MDOT Class I, MDOT Class II and/or MDOT Class III certifications shall be acceptable until those certifications expire. Upon a current certification expiration, recertification with the certifications listed in Table 2 shall be required. Technicians currently performing either specific gravity testing of aggregates or compressive strength tests shall be required to either:

- have the required MDOT certification listed in Table 2, or
- have a current MDOT Class III certification or work under the direct supervision of current MDOT Class III technician, and have demonstrated the specific gravity and/or compressive strength test during the inspection of laboratory equipment by the Materials Division, Concrete Section.

907-804.02.10--Portland Cement Concrete Mix Design. Delete the first sentence of the first paragraph of Subsection 804.02.10 on page 850 and substitute the following:

At least 30 days prior to production of concrete, the Contractor shall submit to the Engineer proposed concrete mixture designs complying with the Department's *Concrete Field Manual*.

Delete the Notes under Table 3 of Subsection 804.02.10 on pages 850 & 851, and substitute the following:

* Maximum size aggregate shall conform to the concrete mix design for the specified aggregate.

** The replacement limits of Portland cement by weight by other cementitious materials (such as fly ash, GGBFS, metakaolin, silica fume, or others) shall be in accordance with the values in Subsection 907-701.02. Other hydraulic cements may be used in accordance with the specifications listed in Section 701.

*** The slump may be increased up to eight (8) inches with :

- an approved water-reducing admixture,
- an approved water-reducing/set-retarding admixture, or
- a combination of an approved water-reducing admixture and an approved set-retarding admixture, in accordance with 907-713.02. Minus slump requirements shall meet those set forth in Table 3 of AASHTO Designation: M157.

**** Entrained air is not required except for concrete exposed to seawater. For concrete exposed to seawater, the total air content shall be 3.0 % to 6.0%. For concrete not exposed to seawater, the total air content shall not exceed 6.0%.

***** Class DS Concrete for drilled shafts shall have an 8±1-inch slump.

Delete the last paragraph of Subsection 804.02.10 on page 851 and substitute the following:

At least one water-reducing admixture shall be used in all classes of concrete in accordance with the manufacturer's recommended dosage range. Any combinations of admixtures shall be approved by the Engineer before their use.

907-804.02.10.1.1--Proportioning on the Basis of Previous Field Experience of Trial Mixtures. Delete the first sentence of the first paragraph of Subsection 804.02.10.1.1 on page 851, and substitute the following:

Where a concrete production facility has a record, based on at least 10 consecutive strength tests from at least 10 different batches within the past 12 months from a mixture not previously used on Department projects, the standard deviation shall be calculated.

907-804.02.10.3--Field Verification of Concrete Mix Design. Delete the first sentence of the third paragraph of Subsection 804.02.10.3 on page 853 and substitute the following:

For all Classes of concrete, the mixture shall be verified to yield within 2.0% of the correct volume when all the mix water is added to the batch.

For all Classes of concrete other than DS, F, and FX, the mixture shall produce a slump within a minus 1½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of three inches (3") or less or within a minus 2½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of greater than three inches (3"), and producing a total air content within a minus 1½ percent tolerance of the maximum allowable air content in Table 3.

For Class DS, the slump shall be within the requirements in Note ***** below Table 3. For Class DS exposed to seawater, the total air content shall be within a minus 1½ percent tolerance of the maximum allowable air content in Note **** below Table 3. For Class DS not exposed to seawater the total air content shall be within the requirements in Note **** below Table 3.

For Classes F and FX, the slump shall be within a minus 1½-inch tolerance of the maximum permitted for mixtures with a maximum permitted slump of three inches (3") or less or within a minus 2½-inch tolerance of the maximum permitted for mixtures with a maximum permitted

slump of greater than three inches (3"). For Classes F and FX exposed to seawater, the total air content shall be within a minus 1½ percent tolerance of the maximum allowable air content in Note **** below Table 3. For Classes F and FX not exposed to seawater the total air content shall be within the requirements in Note **** below Table 3.

Delete the third sentence of the third paragraph of Subsection 804.02.10.3 on page 853, and substitute the following:

If the requirements of yield, slump, or total air content are not met within three (3) production days after the first placement, subsequent field verification testing shall not be permitted on department projects, and the mix design shall not be used until the requirements listed above are met

907-804.02.10.4--Adjustments of Mixture Proportions. Delete the paragraph in Subsection 804.02.10.4 on page 854, and substitute the following:

The mixture may be adjusted by the Class III Certified Technician representing the Contractor in accordance with the allowable revisions listed in the Department's Concrete Field Manual, paragraph 5.7. Written notification shall be submitted to the Engineer a minimum of seven (7) days prior to any source or brand of material change, aggregate size change, allowable material type change, or decrease in any cementitious material content. Any adjustments of the concrete mixture design shall necessitate repeat of field verification procedure as described in Subsection 804.02.10.3 and approval by the Engineer.

907-804.02.11--Concrete Batch Plants. Delete the first three paragraphs of Subsection 804.02.11 on page 854, and substitute the following:

The concrete batch plant shall meet the requirements of the National Ready Mixed Concrete Association *Quality Control Manual, Section 3, Plant Certification Checklist* as outlined in the latest edition of the Department's *Concrete Field Manual*. The Contractor shall submit a copy of the approved checklist along with proof of calibration of batching equipment, i.e., scales, water meter, and admixture dispenser, to the Engineer 30 days prior to the production of concrete.

For projects with 1000 cubic yards and more, the concrete batch plant shall meet the requirements for an automatic system capable of recording batch weights. It shall also have automatic moisture compensation for the fine aggregate. For projects of more than 200 but less than 1000 cubic yards the plant can be equipped for manual batching with a fine aggregate moisture meter visible to the plant operator.

The concrete batch plant shall have available adequate facilities to cool concrete during hot weather.

Mixer trucks to be used on the project are to be listed in the checklist and shall meet the requirements of the checklist.

907-804.02.12--Contractor's Quality Control. Delete the fourth paragraph of Subsection 804.02.12 on page 854 & 855, and substitute the following:

The Contractor's Quality Control program shall encompass the requirements of AASHTO Designation: M 157 into concrete production and control, equipment requirements, testing, and batch ticket information. The requirement of AASHTO Designation: M 157, Section 11.7 shall be followed except, on arrival to the job site, a maximum of 1½ gallons per cubic yard is allowed to be added. Water shall not be added at a later time. If the maximum permitted slump is exceeded after the addition of water at the job site, the concrete shall be rejected.

907-804.02.12.3--Documentation. After the second sentence of the second paragraph of Subsection 804.02.12.3 on page 856, add the following:

Batch tickets and gradation data shall be documented in accordance with Department requirements. Batch tickets shall contain all the information in AASHTO Designation: M157, Section 16 including the additional information in Subsection 16.2 with the following exception: the information listed in paragraphs 16.2.7 and 16.2.8 is not required. Batch tickets shall also contain the concrete producer's permanent unique mix number assigned to the concrete mix design.

907-804.02.12.5--Non-Conforming Materials. In Table 4 of Subsection 804.02.12.5 on page 857, delete "/ FM" from the requirements on line B.3.a.

In Table 4 of Subsection 804.02.12.5 on page 857, replace "One set (two cylinders) for 0-100 yd^3 inclusive" with "A minimum of one set (two cylinders) for each 100 yd^3,"

907-804.02.13--Quality Assurance Sampling and Testing. Delete subparagraph c) in Subsection 804.02.13 on page 858 and substitute the following:

c) For concrete, the Contractor's QC and Department's QA testing of concrete compressive strengths compare when using the data comparison computer program with an alpha value of 0.01 for projects with 1000 cubic yards and more; or, strength comparisons are within 990 psi for projects of more than 200 but less than 1000 cubic yards.

In Table 5 of Subsection 804.02.13 on page 858, delete "and FM" from the requirements on line A.3.

Delete Subsection 907-804.02.13.1 beginning on page 859 and substitute the following:

907-804.02.13.1--Basis of Acceptance.

907-804.02.13.1.1--Sampling. Sampling of concrete mixture shall be performed in accordance with the latest edition of the Department's *Concrete Field Manual*.

907-804.02.13.1.2--Slump. Slump of plastic concrete shall meet the requirements of Table 3: MASTER PROPORTION TABLE FOR STRUCTURAL CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

907-804.02.13.1.3--Air. Total air content of concrete shall be within the specified range for the class of concrete listed in Table 3: MASTER PROPORTION TABLE FOR STRUCTURAL CONCRETE DESIGN. A check test shall be made on another portion of the sample before rejection of any load.

907-804.02.13.1.4--Yield. If the yield of the concrete mix design is more than plus or minus 3% of the designed volume, the mix shall be adjusted by a Class III Certified Technician representing the Contractor to yield the correct volume plus or minus three percent (±3%). If batching of the proportions of the mix design varies outside the batching tolerance range of the originally approved proportions by more than the tolerances allowed in Subsection 804.02.12.1, the new proportions shall be field verified per Subsection 804.02.10.3.

907-804.02.13.1.5--Temperature. Cold weather concreting shall follow the requirements of Subsection 907-804.03.16.1. Hot weather concreting shall follow the requirements of Subsection 804.03.16.2 with a maximum temperature of 95°F for Class DS concrete or for concrete mixes containing cementitious materials meeting the requirements of Subsection 907-701.02.2 as a replacement of Portland cement. For other concrete mixes, the maximum concrete temperature shall be 90°F. Concrete with a temperature more than the maximum allowable temperature shall be rejected and not used in Department work.

907-804.02.13.1.6--Compressive Strength. Laboratory cured concrete compressive strength tests shall conform to the specified strength (f'_c) listed in the specifications. Concrete represented by compressive strength test below the specified strength (f'_c) may be removed and replaced by the Contractor. If the Contractor elects not to remove the material, it will be evaluated by the Department as to the adequacy for the use intended. All concrete evaluated as unsatisfactory for the intended use shall be removed and replaced by the Contractor at no additional cost to the Department. For concrete allowed to remain in place, reduction in payment will be as follows:

Projects with 1000 Cubic Yards and More. When the evaluation indicates that the work may remain in place, a statistical analysis will be made of the QC and QA concrete test results. If this statistical analysis indicates at least 93% of the material would be expected to have a compressive strength equal to or greater than the specified strength (f'_c) and 99.87% of the material would be expected to have a compressive strength at least one standard deviation above the allowable design stress (f_c), the work will be accepted. If the statistical analysis indicates that either of the two criteria are not met, the Engineer will provide for an adjustment in pay as follows for the material represented by the test result.

Total Pay on Material in Question = Unit Price - (Unit Price x % Reduction)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c - (f_c + s)} \times 100$$

where:

f'_c = Specified 28-day compressive strength, psi

X = Individual compressive strength below f'_c, psi
s = standard deviation, psi*
f_c = allowable design stress, psi

* Standard deviation used in the above reduction of pay formula shall be calculated from the applicable preceding compressive strengths test results plus the individual compressive strength below f'_c. If below f'_c strengths occur during the project's first ten compressive strength tests, the standard deviation shall be calculated from the first ten compressive strength tests results.

Projects of More Than 200 but Less Than 1000 Cubic Yards. When the evaluation indicates that the work may remain in place, a percent reduction in pay will be assessed based on a comparison of the deficient 28-day test result to the specified strength. The Engineer will provide for an adjustment in pay as follows for the material represented by the test result.

Total Pay on Material in Question = Unit Price - (Unit Price x % Reduction)

$$\% \text{ Reduction} = \frac{(f'_c - X)}{f'_c} \times 100$$

where:

f'_c = Specified 28-day compressive strength, psi
X = Individual compressive strength below f'_c, psi

907-804.03--Construction Requirements.

907-804.03.6--Handling and Placing Concrete.

907-804.03.6.2--Consolidation. After the last sentence of Subsection 804.03.6.2 on page 864, add the following:

If the Department determines that there is an excessive number of projections, swells, ridges, depressions, waves, voids, holes, honeycombs or other defects in the completed structure, removal of the entire structure may be required as set out in Subsection 105.12.

907-804.03.15--Removal of Falsework, Forms, and Housing. Delete the first sentence of the second paragraph of Subsection 804.03.15 on page 871, and substitute the following:

Concrete in the last pour of a continuous superstructure shall have attained a compressive strength of 2,400 psi, as determined by cylinder tests or maturity meter probe, prior to striking any falsework.

Delete the first sentence of the third paragraph of Subsection 804.03.15 on page 871, and substitute the following:

At the Contractor's option and with the approval of the Engineer, the time for removal of forms may be determined by cylinder tests, in accordance with the requirements listed in Table 6, in which case the Contractor shall furnish facilities for testing the cylinders.

Delete the fourth and fifth paragraphs of Subsection 804.03.15 on pages 871 & 872, and substitute the following:

The cylinders shall be cured under conditions which are not more favorable than those existing for the portions of the structure which they represent.

Delete the table in Subsection 804.03.15 on page 872, and substitute the following:

Table 6
Minimum Compressive Strength Requirements for Form Removal

Forms:	
Columns	1000 psi
Side of Beams	1000 psi
Walls not under pressure	1000 psi
Floor Slabs, overhead	2000 psi
Floor Slabs, between beams	2000 psi
Slab Spans	2400 psi
Other Parts	1000 psi
Centering:	
Under Beams	2400 psi
Under Bent Caps	2000 psi
Limitation for Placing Beams on:	
Pile Bents, pile under beam	2000 psi
Frame Bents, two or more columns	2200 psi
Frame Bents, single column	2400 psi

In lieu of using concrete strength cylinders to determine when falsework, forms, and housings can be removed, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. Falsework, forms, and housings may be removed when maturity meter readings indicate that the required concrete strength is achieved. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

Table 7
Requirements for use of Maturity Meter Probes

Structure Component	Quantity of Concrete	No. of Probes
Slabs, beams, walls, & miscellaneous items	0 - 30 yd^3	2
	> 30 to 60 yd^3	3
	> 60 to 90 yd^3	4
	> 90 yd^3	5
Footings, Columns & Caps	0 - 13 yd^3	2
	> 13 yd^3	3
Pavement, Pavement Overlays	1200 yd^2	2
Pavement Repairs	Per repair or 900 yd^2 Whichever is smaller	2

907-804.03.16--Cold or Hot Weather Concreting.

907-804.03.16.1--Cold Weather Concreting. After the third paragraph of Subsection 804.03.16.1 on page 873, add the following:

In lieu of the protection and curing of concrete in cold weather, at the option of the Contractor with the approval of the Engineer, when concrete is placed during cold weather and there is a probability of ambient temperatures lower that 40°F, an approved maturity meter may be used to determine concrete strengths by inserting probes into concrete placed in a structure. The minimum number of maturity meter probes required for each structural component shall be in accordance with Table 7. An approved insulating blanketing material shall be used to protect the work when ambient temperatures are less than 40°F and shall remain in place until the required concrete strength in Table 6 is achieved. Procedures for using the maturity meter and developing the strength/maturity relationship shall follow the requirements of AASHTO Designation: T 325 and ASTM Designation: C 1074 specifications. Technicians using the maturity meter or calculating strength/maturity graphs shall be required to have at least two hours of training prior to using the maturity equipment.

Rename the Table in Subsection 804.03.16.1 on page 874 from "Table 6" to "Table 8".

907-804.03.19--Finishing Concrete Surfaces.

907-804.03.19.7--Finishing Bridge Floors.

907-804.03.19.7.4--Acceptance Procedure for Bridge Deck Smoothness. After the first sentence of the second paragraph of Subsection 804.03.19.7.4 on page 886, add the following:

Auxiliary lanes, tapers, shoulders and other areas that are not checked with the profilograph, shall meet a 1/8 inch in 10-foot straightedge check made transversely and longitudinally across the deck or slab.

907-804.05--Basis of Payment. Add the "907" prefix to the pay items listed on page 898.

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.

Attached hereto is a certified check, cashier's check or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law).

INSTRUCTION TO BIDDERS: Alternate and Optional Items on Bid Schedule.

1. Two or more items entered opposite a single unit quantity WITHOUT DEFINITE DESIGNATION AS "ALTERNATE ITEMS" are considered as "OPTIONAL ITEMS". Bidders may or may not indicate on bids the Optional Item proposed to be furnished or performed WITHOUT PREJUDICE IN REGARD TO IRREGULARITY OF BIDS.

2. Items classified on the bid schedule as "ALTERNATE ITEMS" and/or "ALTERNATE TYPES OF CONSTRUCTION" must be preselected and indicated on bids. However, "Alternate Types of Construction" may include Optional Items to be treated as set out in Paragraph 1, above.

3. Optional items not preselected and indicated on the bid schedule MUST be designated in accordance with Subsection 102.06 prior to or at the time of execution of the contract.

4. Optional and Alternate items designated must be used throughout the project.

I (We) further propose to perform all "force account or extra work" that may be required of me (us) on the basis provided in the Specifications and to give such work my (our) personal attention in order to see that it is economically performed.

S E C T I O N 9 0 5 -- P R O P O S A L (CONTINUED)

I (We) further propose to execute the attached contract agreement (Section 902) as soon as the work is awarded to me (us), and to begin and complete the work within the time limit(s) provided for in the Specifications and Advertisement. I (We) also propose to execute the attached contract bond (Section 903) in an amount not less than one hundred (100) percent of the total of my (our) part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted.

I (We) enclose a certified check, cashier's check or bid bond for **five percent (5%) of total bid** and hereby agree that in case of my (our) failure to execute the contract and furnish bond within Ten (10) days after notice of award, the amount of this check (bid bond) will be forfeited to the State of Mississippi as liquidated damages arising out of my (our) failure to execute the contract as proposed. It is understood that in case I am (we are) not awarded the work, the check will be returned as provided in the Specifications.

Respectfully Submitted,

DATE _____

_____
Contractor

BY _____
Signature

TITLE _____

ADDRESS _____

CITY, STATE, ZIP _____

PHONE _____

FAX _____

E-MAIL _____

(To be filled in if a corporation)

Our corporation is chartered under the Laws of the State of _____ and the names, titles and business addresses of the executives are as follows:

President	Address
Secretary	Address
Treasurer	Address

The following is my (our) itemized proposal.

Construction of Gulf Coast Regional Office/First Responders' Building, known as State Project Nos. BWO-6208-24(001) / 502085301 & 302 in Harrison County.

Line No.	Item Code	Adj Code	Quantity	Units	Description [Fixed Unit Price]
					Roadway Items
0010	201-A001		1	Lump Sum	Clearing and Grubbing
0020	203-A004	(E)	224	Cubic Yard	Unclassified Excavation, LVM, AH
0030	203-EX002	(E)	3,133	Cubic Yard	Borrow Excavation, AH, LVM, Class B1
0040	234-A001		629	Linear Feet	Temporary Silt Fence
0050	607-B043		113	Linear Feet	84" Type II Chain Link Fence, Class I
0060	607-G126		1	Each	Gate, 4' x 7' Chain Link
0070	607-G129		1	Each	Gate, 24' x 7' Double Chain Link
0080	607-P2007		7	Each	Brace Post, 7' x 2 1/2" Galvanized Steel
0090	607-P3021		2	Each	Gate Post, 7' x 2 1/2" Galvanized Steel
0100	607-P3022		2	Each	Gate Post, 7' x 3 1/2" Galvanized Steel
0110	609-D006	(S)	191	Linear Feet	Combination Concrete Curb and Gutter Type 1 Modified
0120	620-A001		1	Lump Sum	Mobilization
0130	907-237-A003		300	Linear Feet	Wattles, 20"
0140	907-242-A006		1	Lump Sum	Construction of Gulf Coast Regional Office /First Responders' Building BASE BID
0150	907-242-A006		1	Lump Sum	Construction of Gulf Coast Regional Office/First Responders' Building ALTERNATE BID
0160	907-242-PP001		1	Lump Sum	Water and Sewer Improvements, Per Plans
0170	907-258-N001		18	Each	Car Stop

CONDITIONS FOR COMBINATION BID

If a bidder elects to submit a combined bid for two or more of the contracts listed for this month's letting, the bidder must complete and execute these sheets of the proposal in each of the individual proposals to constitute a combination bid. In addition to this requirement, each individual contract shall be completed, executed and submitted in the usual specified manner.

Failure to execute this Combination Bid Proposal in each of the contracts combined will be just cause for each proposal to be received and evaluated as a separate bid.

* *

COMBINATION BID PROPOSAL

I. This proposal is tendered as one part of a Combination Bid Proposal utilizing option ___* of Subsection 102.11 on the following contracts:

* Option to be shown as either (a), (b), or (c).

	Project No.	County		Project No.	County
1.	______________	______________	6.	______________	______________
2.	______________	______________	7.	______________	______________
3.	______________	______________	8.	______________	______________
4.	______________	______________	9.	______________	______________
5.	______________	______________	10.	______________	______________

A. If option (a) has been selected, then go to II, and sign Combination Bid Proposal.

B. If option (b) has been selected, then complete the following, go to II, and sign Combination Bid Proposal.

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 option (c) has been selected, then initial and complete one of the following, go to II. and sign Combination Bid Proposal.

_____ I (We) desire to be awarded work not to exceed a total monetary value of $ _____.

_____ I (We) desire to be awarded work not to exceed _____ number of contracts.

II. It is understood that the Mississippi Transportation Commission not only reserves the right to reject any and all proposals, but also the right to award contracts upon the basis of lowest separate bids or combination bids most advantageous to the State.

It is further understood and agreed that the Combination Bid Proposal is for comparison of bids only and that each contract shall operate in every respect as a separate contract in accordance with its proposal and contract documents.

I (We), the undersigned, agree to complete each contract on or before its specified completion date.

SIGNED _____

_____

_____

TO: EXECUTIVE DIRECTOR, MISSISSIPPI DEPARTMENT OF TRANSPORTATION
JACKSON, MISSISSIPPI

CERTIFICATE

If awarded this contract, I (we) contemplate that portions of the contract will be sublet. I (we) certify that those subcontracts which are equal to or in excess of fifty thousand dollars ($50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

NOTE: Insert name and address of subcontractors. (Subcontracts equal to or in excess of fifty thousand dollars ($50,000.00) ONLY.)

(Individual or Firm)	(Address)
(Individual or Firm)	(Address)
(Individual or Firm)	(Address)
(Individual or Firm)	(Address)

NOTE: Failure to complete the above DOES NOT preclude subsequent subcontracts. Subsequent subcontracts, if any, equal to or in excess of fifty thousand dollars ($50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on January 13, 1999.

Contractor _____

By _____

Title _____

CERTIFICATE MUST BE EXECUTED

REV. 2/99

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION
(Execute in duplicate)

I,_____,
(Name of person signing certification)

individually, and in my capacity as _____ of
(Title)

_____ do hereby certify under
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that

_____, Bidder
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-6208-24(001) / 502085301 & 302**,

in **Harrison** County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here "_____" if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on _____ _____
Signature

(5/29/2008S)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

CERTIFICATION
(Execute in duplicate)

I,_____,
(Name of person signing certification)

individually, and in my capacity as _____ of
(Title)

_____ do hereby certify under
(Name of Firm, Partnership, or Corporation)

penalty of perjury under the laws of the United States and the State of Mississippi that

_____, Bidder
(Name of Firm, Partnership, or Corporation)

on Project No. **BWO-6208-24(001) / 502085301 & 302**,

in **Harrison** County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Initial here "_____" if exceptions are attached and made a part thereof. Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing and attachments (when indicated) is true and correct.

Executed on _____ _____
Signature

(5/29/2008S)

S E C T I O N 9 0 2

CONTRACT FOR **BWO-6208-24(001) / 502085301 & 302**

LOCATED IN THE COUNTY(IES) OF **Harrison**

STATE OF MISSISSIPPI,

COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the _____ day of _____, _____.

_____
Contractor (s)

By _____ MISSISSIPPI TRANSPORTATION COMMISSION

Title _____ By _____
Signed and sealed in the presence of: Executive Director
(names and addresses of witnesses)

_____ _____
Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ____ day of _____, _____, Minute Book No. _____, Page No. _____.

Revised 8/06/2003

S E C T I O N 9 0 3
PERFORMANCE AND PAYMENT BOND

CONTRACT BOND FOR: **BWO-6208-24(001) / 502085301 & 302**

LOCATED IN THE COUNTY(IES) OF: **Harrison**

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, are held and firmly bound unto the State of Mississippi in the sum of _____

_____

($_____) Dollars, lawful money of the United States of America, to be paid to it for which payment well and truly to be made, we bind ourselves, our heirs, administrators, successors, or assigns jointly and severally by these presents.

Signed and sealed this the _____ day of _____ A.D. _____.

The conditions of this bond are such, that whereas the said _____

_____

principal, has (have) entered into a contract with the Mississippi Transportation Commission, bearing the date of _____ day of _____ A.D. _____ hereto annexed, for the construction of certain projects(s) in the State of Mississippi as mentioned in said contract in accordance with the Contract Documents therefor, on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

Now therefore, if the above bounden _____

_____ in all things shall stand to and abide by and well and truly observe, do keep and perform all and singular the terms, covenants, conditions, guarantees and agreements in said contract, contained on his (their) part to be observed, done, kept and performed and each of them, at the time and in the manner and form and furnish all of the material and equipment specified in said contract in strict accordance with the terms of said contract which said plans, specifications and special provisions are included in and form a part of said contract and shall maintain the said work contemplated until its final completion and acceptance as specified in Subsection 109.11 of the approved specifications, and save harmless said Mississippi Transportation Commission from any loss or damage arising out of or occasioned by the negligence, wrongful or criminal act, overcharge, fraud, or any other loss or damage whatsoever, on the part of said principal (s), his (their) agents, servants, or employees in

the performance of said work or in any manner connected therewith, and shall be liable and responsible in a civil action instituted by the State at the instance of the Mississippi Transportation Commission or any officer of the State authorized in such cases, for double any amount in money or property, the State may lose or be overcharged or otherwise defrauded of, by reason of wrongful or criminal act, if any, of the Contractor(s), his (their) agents or employees, and shall promptly pay the said agents, servants and employees and all persons furnishing labor, material, equipment or supplies therefor, including premiums incurred, for Surety Bonds, Liability Insurance, and Workmen's Compensation Insurance; with the additional obligation that such Contractor shall promptly make payment of all taxes, licenses, assessments, contributions, damages, any liquidated damages which may arise prior to any termination of said principal's contract, any liquidated damages which may arise after termination of the said principal's contract due to default on the part of said principal, penalties and interest thereon, when and as the same may be due this state, or any county, municipality, board, department, commission or political subdivision: in the course of the performance of said work and in accordance with Sections 31-5-51 et seq. Mississippi Code of 1972, and other State statutes applicable thereto, and shall carry out to the letter and to the satisfaction of the Executive Director of the Mississippi Department of Transportation, all, each and every one of the stipulations, obligations, conditions, covenants and agreements and terms of said contract in accordance with the terms thereof and all of the expense and cost and attorney's fee that may be incurred in the enforcement of the performance of said contract, or in the enforcement of the conditions and obligations of this bond, then this obligation shall be null and void, otherwise to be and remain in full force and virtue.

Witness our signatures and seals this the _____ day of _____ A.D. _____.

_____	_____
(Contractors) Principal	Surety
By _____	By _____
	(Signature) Attorney in Fact
	Address _____
	_____
Title _____	_____
(Contractor's Seal)	(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 Gulf Coast Regional Office/First Responders' Building, known as State Project Nos. BWO-6208-24(001) / 502085301 & 302 in Harrison 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