



PROJECT MANUAL

FOR

SHELBY COUNTY EMA & IT BUILDING PROJECT

October 27, 2025

**SHELBY COUNTY EMA & IT BUILDING PROJECT
MANUAL TABLE OF CONTENTS**

SECTION 00-0010 – Page 1 of 5

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 0010	Project Manual Table of Contents
00 0020	Index of Bid Documents
00 0030	Legal Advertisement
00 0040	General Conditions
00 0050	Supplementary Conditions
00 0200	Invitation to Bid
00 0201	Instructions to Bidders
00 0202	Bid Requirements
00 0300	Proposal Form and Bid Bond
00 1010	Project Summary
00 1020	Project Notes
00 1025	Cost Reporting and Payments
00 1026	Measurement and Payment
00 1028	Change Order Procedures
00 1200	Project Meetings
00 1310	Construction Schedules
00 1340	Shop Drawings, Product Data, Samples
00 1620	Storage and Protection
00 1700	Contract Closeout
00 1720	Project Record Documents
00 1740	Warranties and Bonds

Contract Documents and Forms

00 2000	Public Works Contract
00 2010	Debarment, Suspension and Other Responsibility Matters Certificate
00 2015	Performance and Materials Bonds
00 2020	Certificate of Non-Segregated Facilities
00 2030	Notice of Award
00 2040	Notice to Proceed
00 2050	Change Order Form
00 2070	Sample Contractor Notice of Completion
00 2080	C-23 Affidavit for Payment of Debts Incurred on Construction Projects
00 2090	Alabama Department of Revenue Sales Tax Notice

DIVISION 01 – GENERAL REQUIREMENTS

01 1100	Summary of Work
01 1150	Construction Documents
01 2500	Substitution Procedures
01 2519	Substitution Request Form
01 3216	Construction Progress Schedules
01 3233	Photographic Documentation
01 3300	Submittal Procedures

**SHELBY COUNTY EMA & IT BUILDING PROJECT
MANUAL TABLE OF CONTENTS**

SECTION 00-0010 – Page 2 of 5

01 4000	Quality Requirements
01 4100	Structural Tests and Special Inspections
01 5000	Temporary Facilities and Controls
01 5713	Temporary Erosion and Sediment Control
01 6000	Product Requirements
01 7123	Field Engineering
01 7419	Construction Waste Management
01 7700	Closeout Procedures

DIVISION 02 – EXISTING CONDITIONS

02 4100	Demolition
---------	------------

DIVISION 03 – CONCRETE

03 3000	Cast-in-Place Concrete
---------	------------------------

DIVISION 04 – MASONRY

04 0513	Masonry Mortaring
04 2000	Unit Masonry

DIVISION 05 – METALS

05 1200	Structural Steel
05 2100	Steel Joist
05 3100	Steel Deck
05 4000	Cold-Formed Metal Framing
05 5000	Metal Fabrications

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

06 1643	Gypsum Sheathing
06 4100	Architectural Wood Casework
06 6116	Solid Surfacing Fabrications

**SHELBY COUNTY EMA & IT BUILDING PROJECT
MANUAL TABLE OF CONTENTS**

SECTION 00-0010 – Page 3 of 5

DIVISION 07 – THERMAL LAND MOISTURE PROTECTION

07 2115	Batt Insulation
07 2200	Roof Board Insulation
07 2800	Moisture Barriers
07 4213	Insulated Wall Panels
07 5419	PVC Roofing
07 6200	Sheet Metal Flashing and Trim
07 9200	Joint Sealers

DIVISION 08 - OPENINGS

08 1113	Hollow Metal Doors and Frames
08 1416	Flush Wood Doors
08 4113	Aluminum-Framed Entrances and Storefronts
08 7100	Door Hardware
08 8000	Glazing

DIVISION 09 - FINISHES

09 2200	Metal Support Assemblies
09 2900	Gypsum Board
09 3000	Tiling
09 5100	Acoustical Ceilings
09 6513	Resilient Base
09 6519	Resilient Tile Flooring
09 6813	Tile Carpeting
09 7200	Wall Coverings
09 9100	Painting

DIVISION 10 – SPECIALTIES

10 1423	Interior Panel Signs
10 2600	Wall and Door Protection
10 2813	Toilet Accessories
10 4413	Fire Extinguishers and Cabinets
10 5300	Sunshades / Solar Louvers

DIVISION 11 - EQUIPMENT

11 3100	Appliances and Equipment
---------	--------------------------

DIVISION 12 - FURNISHINGS

12 2413 Roller Window Shades

DIVISION 21 – FIRE SUPPRESSION

21 0500 General Provisions
21 1000 Materials and Methods
21 4000 Fire Suppression
21 4100 Clean Agent Fire Suppression
21 4150 Integrated Pre-Action Suppression System

DIVISION 22 – PLUMBING

22 0500 General Provisions
22 1000 Materials and Methods
22 1500 Thermal and Acoustical Insulation
22 2000 Plumbing Fixtures and Equipment

DIVISION 23 – HVAC

23 0500 General Provisions
23 1000 Materials and Methods
23 1500 Thermal and Acoustical Insulation
23 5000 Heating and Air Conditioning Equipment and Specialties
23 6000 Air Distribution
23 7000 HVAC Testing and Balancing
23 8000 Conventional Automatic Controls
23 8100 Building Automation Systems (BAS)

DIVISION 26 – ELECTRICAL

26 0500 Basic Electrical Materials and Methods
26 0519 Power Conductors and Cables
26 0526 Grounding
26 0533 Raceways
26 0534 Outlet Boxes, Junction Boxes, Wireways
26 0536 Cable Trays
26 0553 Electrical Identification
26 0573 Power Distribution System Electrical Studies
26 0943 Lighting Control System
26 0944 Distributed Digital Lighting Management System
26 2416 Power Panelboards – Circuit Breaker Type
26 2417 Lighting Panelboards
26 2726 Wiring Devices

**SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL
TABLE OF CONTENTS**

SECTION 00-0010 – Page 5 of 5

26 2816	Safety Switches and Fuses
26 3213	Generator Sets
26 3353	Uninterruptable Power Supply (UPS)
26 3623	Automated Transfer Switches
26 3633	Generator Load Bank Docking Station
26 4100	Lightning Protection System
26 4300	Surge Protective Devices
26 5000	Lighting Materials and Methods
27 0500	Auxiliary System Cables, 0-50V
27 1000	Structured Cabling Systems
27 4100	Television Distribution System
28 3100	Fire Alarm System

DIVISION 31 – EARTHWORK

31 1000	Site Clearing
31 2200	Grading
31 2316	Excavation
31 2316.13	Trenching
31 2316.26	Rock Removal
31 2323	Fill
31 3700	Riprap

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 1123	Aggregate Base Courses
32 1216	Asphalt Paving
32 1313	Concrete Paving
32 1723.13	Painted Pavement Markings
32 1723.20	Site Regulatory Signs
32 9219	Seeding
32 9223	Sodding

DIVISION 33 - UTILITIES

33 0110.58	Disinfection of Water Utility Piping Systems
33 1416	Site Water Distribution Piping
33 3113	Site Sanitary Sewerage Gravity Piping
33 4211	Stormwater Gravity Piping

SECTION 00-0020 – Page 1 of 1

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SHELBY COUNTY EMA & IT BUILDING PROJECT
LEGAL ADVERTISEMENT

SECTION 00-0102 – Page 1 of 1

STATE OF ALABAMA

COUNTY OF SHELBY

LEGAL NOTICE

NOTICE TO CONTRACTORS

Sealed bids will be received at the office of the Shelby County Chief Financial Officer at 200 West College St. Room 125, Columbiana, AL 35051 for the Shelby County EMA & IT Building Project until November 25, 2025 at 2:00 p.m. and at that time publicly opened.

Plans and specifications will be available at the Shelby County Facilities & General Services Office, 280 McDow Road Columbiana, AL 35051 after 12:00 noon on October 27, 2025.

Fee is \$100.00 which includes the cost of plans and specifications when picked up at the above office. No refunds will be made. Electronic copies of bid documents may be obtained by email at no charge. To obtain electronic copies, send request to rlcroy@shelbyal.com.

A mandatory pre-bid conference will be held at 10:00 a.m. on November 17, 2025 at the Shelby County Administration Building, 200 West College Street, Columbiana, AL 35051. **Attendance at the Pre-Bid Conference IS REQUIRED for all General Contractor Bidders** intending to submit a Proposal, and is highly recommended for Subcontractors. Bids from General Contractors not attending the Pre-Bid Conference will be rejected.

Please contact the Project Manager, Trey Gauntt, PE at trey@shelbyal.com with any questions regarding this project.

November 2
November 9
November 16

GENERAL CONDITIONS of the CONTRACT

CONTENTS

1. Definitions
2. Intent and Interpretation of the Contract Documents
3. Contractor's Representation
4. Supervision, Superintendent, & Employees
5. Review of Contract Documents and Field Conditions by Contractor
6. Submittals
7. Documents and Samples at the Site
8. "As-built" Documents
9. Progress Schedule
10. Equipment, Materials, & Substitutions
11. Safety & Protection of Persons & Property
12. Hazardous Materials
13. Inspection of the Work
14. Correction of Defective Work
15. Deductions for Uncorrected Work
16. Changes in the Work
17. Claims for Extra Cost or Extra Work
18. Differing Site Conditions
19. Claims for Damages
20. Delays
21. Owner's Right to Correct Defective Work
22. Progress Payments
23. Certification & Approvals for Payments
24. Payments Withheld
25. Substantial Completion
26. Occupancy or Use Prior to Completion
27. Final Payment
28. Contractor's Warranty
29. Insurance
30. Performance and Payment Bonds
31. Assignment
32. Construction by Owner or Separate Contracts
33. Subcontracts
34. Architect's Status
35. Cash Allowances
36. Permits, Laws and Regulations
37. Royalties, Patents and Copyrights
38. Use of the Site
39. Cutting and Patching
40. In-progress and Final Cleanup
41. Liquidated Damages

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 2 of 49

**ARTICLE 1
DEFINITIONS**

Whenever the following terms, or pronouns in place of them, are used in the Contract Documents, the intent and meaning shall be interpreted as follows:

ARCHITECT: The Architect is the person or entity lawfully licensed to practice architecture in the State of Alabama, who is under contract with the Owner as the primary design professional for the Project and identified as the Architect in the Construction Contract. The term “Architect” means the Architect or the Architect’s authorized representative. If the employment of the Architect is terminated, the Owner shall employ a new Architect whose status under the Contract Documents shall be that of the former Architect

CONTRACT: The Contract is the embodiment of the Contract Documents. The Contract represents the entire and integrated agreement between the Owner and Contractor and supersedes any prior written or oral negotiations, representations or agreements that are not incorporated into the Contract Documents. The Contract may be amended only by a Contract Change Order or a Modification to the Construction Contract. The contractual relationship which the Contract creates between the Owner and the Contractor extends to no other persons or entities.

DEFECTIVE WORK: The term “Defective Work” shall apply to: **(1)** any product, material, system, equipment, or service, or its installation or performance, which does not conform to the requirements of the Contract Documents, **(2)** in-progress or completed Work the workmanship of which does not conform to the quality specified or, if not specified, to the quality produced by skilled workers performing work of a similar nature on similar projects in the state, **(3)** substitutions and deviations not properly submitted and approved or otherwise authorized, **(4)** temporary supports, structures, or construction which will not produce the results required by the Contract Documents, and **(5)** materials or equipment rendered unsuitable for incorporation into the Work due to improper storage or protection.

DRAWINGS: The Drawings are the portions of the Contract Documents showing graphically the design, location, layout, and dimensions of the Work, in the form of plans, elevations, sections, details, schedules, and diagrams.

NOTICE TO PROCEED: A proceed order issued by the Owner or Director, as applicable, fixing the date on which the Contractor shall begin the prosecution of the Work, which is also the date on which the Contract Time shall begin.

OWNER: The Owner is the entity or entities identified as such in the Construction Contract and is referred to throughout the Contract Documents as if singular in number. The term “Owner” means the Owner or the Owner’s authorized representative. The term “Owner” as used herein shall be synonymous with the term “Awarding Authority” as defined and used in Title 39 - Public Works, Code of Alabama, 1975, as amended.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 3 of 49

THE PROJECT: The Project is the total construction of which the Work required by these Contract Documents may be the entirety or only a part with other portions to be constructed by the Owner or separate contractors.

PROJECT MANUAL: The Project Manual is the volume usually assembled for the Work which may include the Advertisement for Bids, Instructions to Bidders, sample forms, General Conditions of the Contract, Supplementary Conditions, and Specifications of the Work.

SPECIFICATIONS: The Specifications are that portion of the Contract Documents which set forth in writing the standards of quality and performance of products, equipment, materials, systems, and services and workmanship required for acceptable performance of the Work.

SUBCONTRACTOR: A Subcontractor is a person or entity who is undertaking the performance of any part of the Work by virtue of a contract with the Contractor. The term "Subcontractor" means a Subcontractor or its authorized representatives.

THE WORK: The Work is the construction and services required by the Contract Documents and includes all labor, materials, supplies, equipment, and other items and services as are necessary to produce the required construction and to fulfill the Contractor's obligations under the Contract. The Work may constitute the entire Project or only a portion of it.

ARTICLE 2

INTENT and INTERPRETATION of the CONTRACT DOCUMENTS

INTENT

It is the intent of the Contract Documents that the Contractor shall properly execute and complete the Work described by the Contract Documents, and unless otherwise provided in the Contract, the Contractor shall provide all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work, in full accordance with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

COMPLEMENTARY DOCUMENTS

The Contract Documents are complementary. If Work is required by one Contract Document, the Contractor shall perform the Work as if it were required by all of the Contract Documents. However, the Contractor shall be required to perform Work only to the extent that is consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

ORDER of PRECEDENCE

Should any discrepancy arise between the various elements of the Contract Documents, Precedence shall be given to them in the following order unless to do so would contravene the apparent Intent of the Contract Documents stated in preceding Paragraph Titled INTENT:

(1) The Construction Contract.

(2) Addenda, with those of later date having precedence over those of earlier date.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 4 of 49

- (3)** Supplementary Conditions (or other Conditions which modify the General Conditions of the Contract).
- (4)** General Conditions of the Contract.
- (5)** The Specifications.
- (6)** Details appearing on the Drawings; large scale details shall take precedence over smaller scale details.
- (7)** The Drawings; large scale drawings shall take precedence over smaller scale drawings.

INTERPRETATION

(1) The Contract Documents shall be interpreted collectively, each part complementing the others and consistent with the Intent of the Contract Documents stated in preceding Paragraph Titled INTENT. Unless an item shown or described in the Contract Documents is specifically identified to be furnished or installed by the Owner or others or is identified as “Not In Contract” (“N.I.C.”), the Contractor’s obligation relative to that item shall be interpreted to include furnishing, assembling, installing, finishing, and/or connecting the item at the Contractor’s expense to produce a product or system that is complete, appropriately tested, and inoperative condition ready for use or subsequent construction or operation of the Owner or separate contractors. The omission of words or phrases for brevity of the Contract Documents, the inadvertent omission of words or phrases, or obvious typographical or written errors shall not defeat such interpretation as long as it is reasonably inferable from the Contract Documents as a whole.

(2) Words or phrases used in the Contract Documents which have well-known technical or construction industry meanings are to be interpreted consistent with such recognized meanings unless otherwise indicated.

(3) Except as noted otherwise, references to standard specifications or publications of associations, bureaus, or organizations shall mean the latest edition of the referenced standard specification or publication as of the date of the Advertisement for Bids.

(4) In the case of inconsistency between Drawings and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect’s interpretation.

(5) Generally, portions of the Contract Documents written in longhand take precedence over typed portions, and typed portions take precedence over printed portions.

(6) Any doubt as to the meaning of the Contract Documents or any obscurity as to the wording of them, shall be promptly submitted in writing to the Architect for written interpretation, explanation, or clarification.

SEVERABILITY

The partial or complete invalidity of any one or more provision of this Contract shall not affect the validity or continuing force and effect of any other provision.

ARTICLE 3 CONTRACTOR'S REPRESENTATIONS

By executing the Construction Contract the Contractor represents to the Owner:

- A.** The Contractor has visited the site of the Work to become familiar with local conditions under which the Work is to be performed and to evaluate reasonably observable conditions as compared with requirements of the Contract Documents.
- B.** The Contractor shall use its best skill and attention to perform the Work in an expeditious manner consistent with the Contract Documents.
- C.** The Contractor is an independent contractor and in performance of the Contract remains and shall act as an independent contractor having no authority to represent or obligate the Owner in any manner unless authorized by the Owner in writing.

ARTICLE 4 SUPERVISION, SUPERINTENDENT, and EMPLOYEES

A. SUPERVISION and CONSTRUCTION METHODS

- (1)** The term "Construction Methods" means the construction means, methods, techniques, sequences, and procedures utilized by the Contractor in performing the Work. The Contractor is solely responsible for supervising and coordinating the performance of the Work, including the selection of Construction Methods, unless the Contract Documents give other specific instructions concerning these matters.
- (2)** The Contractor is solely and completely responsible for job site safety, including the protection of persons and property.
- (3)** The Contractor shall be responsible to the Owner for acts and omissions of not only the Contractor and its agents and employees, but all persons and entities, and their agents and employees, who are performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.
- (4)** The Contractor shall be responsible to inspect the in-progress and completed Work to verify its compliance with the Contract Documents and to insure that any element or portion of the Work upon which subsequent Work is to be applied or performed is in proper condition to receive the subsequent Work.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 6 of 49

B.SUPERINTENDENT

(1) The Contractor shall employ and maintain a competent level of supervision for the performance of the Work at the Project site, including a superintendent who shall: **(a)** have full authority to receive instructions from the Architect or Owner and to act on those instructions and **(b)** be present at the Project site at all times during which Work is being performed.

(2) Before beginning performance of the Work, the Contractor shall notify the Architect in writing of the name and qualifications of its proposed superintendent so that the Owner may review the individual's qualifications. If, for reasonable cause, the Owner refuses to approve the individual, or withdraws its approval after once giving it, the Contractor shall name a different superintendent for the Owner's review and approval. Any disapproved superintendent will not perform in that capacity thereafter at the Project site.

C. EMPLOYEES

The Contractor shall permit only fit and skilled persons to perform the Work. The Contractor shall enforce safety procedures, strict discipline, and good order among persons performing the Work. The Contractor will remove from its employment on the Project any person who deliberately or persistently produces non-conforming Work or who fails or refuses to conform to reasonable rules of personal conduct contained in the Contract Documents or implemented by the Owner and delivered to the Contractor in writing during the course of the Work.

ARTICLE 5

REVIEW of CONTRACT DOCUMENTS and FIELD CONDITIONS by CONTRACTOR

A. In order to facilitate assembly and installation of the Work in accordance with the Contract Documents, before starting each portion of the Work, the Contractor shall examine and compare the relevant Contract Documents, and compare them to relevant field measurements made by the Contractor and any conditions at the site affecting that portion of the Work.

B. If the Contractor discovers any errors, omissions, or inconsistencies in the Contract Documents, the Contractor shall promptly report them to the Architect as a written request for information that includes a detailed statement identifying the specific Drawings or Specifications that are in need of clarification and the error, omission, or inconsistency discovered in them.

(1) The Contractor shall not be expected to act as a licensed design professional and ascertain whether the Contract Documents comply with applicable laws, statutes, ordinances, building codes, and rules and regulations, but the Contractor shall be obligated to promptly notify the Architect of any such noncompliance discovered by or made known to the Contractor. If the Contractor performs Work without fulfilling this notification obligation, the Contractor shall pay the resulting costs and damages that would have been avoided by such notification.

(2) The Contractor shall not be liable to the Owner for errors, omissions, or inconsistencies that may exist in the Contract Documents, or between the Contract Documents

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 7 of 49

and conditions at the site, unless the Contractor knowingly fails to report a discovered error, omission, or inconsistency to the Architect, in which case the Contractor shall pay the resulting costs and damages that would have been avoided by such notification.

C. If the Contractor considers the Architect's response to a request for information to constitute a change to the Contract Documents involving additional costs and/or time, the Contractor shall follow the procedures prescribed herein.

D. If, with undue frequency, the Contractor requests information that is obtainable through reasonable examination and comparison of the Contract Documents, site conditions, and previous correspondence, interpretations, or clarifications, the Contractor shall be liable to the Owner for reasonable charges from the Architect for the additional services required to review, research, and respond to such requests for information.

**ARTICLE 6
SUBMITTALS**

A. Where required by the Contract Documents, the Contractor shall submit shop drawings, product data, samples and other information (hereinafter referred to as Submittals) to the Architect for the purpose of demonstrating the way by which the Contractor proposes to conform to the requirements of the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect without action.

B. The Contractor shall be responsible to the Owner for the accuracy of its Submittals and the conformity of its submitted information to the requirements of the Contract Documents. Each Submittal shall bear the Contractor's approval, evidencing that the Contractor has reviewed and found the information to be in compliance with the requirements of the Contract Documents. Submittals which are not marked as reviewed and approved by the Contractor may be returned by the Architect without action.

C. The Contractor shall prepare and deliver its submittals to the Architect sufficiently in advance of construction requirements and in a sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. In coordinating the Submittal process with its construction schedule, the Contractor shall allow sufficient time to permit adequate review by the Architect.

D. By approving a Submittal the Contractor represents not only that the element of Work presented in the Submittal complies with the requirements of the Contract Documents, but also that the Contractor has:

- (1) found the layout and/or dimensions in the Submittal to be comparable with those in the Contract Documents and other relevant Submittals and has made field measurements as necessary to verify their accuracy, and

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 8 of 49

determined that products, materials, systems, equipment and/or procedures presented in the Submittal are compatible with those presented, or being presented, in other relevant Submittals and with the Contractor's intended Construction Methods.

E. The Contractor shall not fabricate or perform any portion of the Work for which the Contract Documents require Submittals until the respective Submittals have been approved by the Architect.

F. In the case of a resubmission, the Contractor shall direct specific attention to all revisions in a Submittal. The Architect's approval of a resubmission shall not apply to any revisions that were not brought to the Architect's attention.

G. If the Contract Documents specify that a Submittal is to be prepared and sealed by a registered architect or licensed engineer retained by the Contractor, all drawings, calculations, specifications, and certifications of the Submittal shall bear the Alabama seal of registration and signature of the registered/licensed design professional who prepared them or under whose supervision they were prepared. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of such a Submittal, provided that all performance and design criteria that such Submittal must satisfy are sufficiently specified in the Contract Documents. The Architect will review, approve or take other appropriate action on such a Submittal 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 or design criteria specified in the Contract Documents.

H. DEVIATIONS

(1) The Architect is authorized by the Owner to approve "minor" deviations from the requirements of the Contract Documents. "Minor" deviations are defined as those which are in the interest of the Owner, do not materially alter the quality or performance of the finished Work, and do not affect the cost or time of performance of the Work. Deviations which are not "minor" may be authorized only by the Owner through the Change Order procedures.

(2) Any deviation from the requirements of the Contract Documents contained in a Submittal shall be clearly identified as a "Deviation from Contract Requirements" (or by similar language) within the Submittal and, in a letter transmitting the Submittal to the Architect, the Contractor shall direct the Architect's attention to, and request specific approval of, the deviation. Otherwise, the Architect's approval of a Submittal does not constitute approval of deviations from the requirements of the Contract Documents contained in the Submittal.

(3) The Contractor shall bear all costs and expenses of any changes to the Work, changes to work performed by the Owner or separate contractors, or additional services by the Architect required to accommodate an approved deviation unless the Contractor has specifically informed the Architect in writing of the required changes and a Change Order has been issued authorizing the deviation and accounting for such resulting changes and costs.

I. ARCHITECT'S REVIEW and APPROVAL

(1) The Architect will review the Contractor's Submittals for conformance with requirements of, and the design concept expressed in, the Contract Documents and will approve or take other appropriate action upon them. This review is not intended to verify the accuracy and completeness of details such as dimensions and quantities nor to substantiate installation instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor. However, the Architect shall advise the Contractor of any errors or omissions which the Architect may detect during this review. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

(2) The Architect will review and respond to all Submittals with reasonable promptness to avoid delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time to permit adequate review.

(3) No corrections or changes to Submittals indicated by the Architect will be considered as authorizations to perform Extra Work. If the Contractor considers such correction or change of a Submittal to require Work which differs from the requirements of the Contract Documents, the Contractor shall promptly notify the Architect in writing in accordance with Article, Claims for Extra Cost or Extra Work.

J. CONFORMANCE with SUBMITTALS

The Work shall be constructed in accordance with approved Submittals.

ARTICLE 7 DOCUMENTS and SAMPLES at the SITE

A. "AS ISSUED" SET

The Contractor shall maintain at the Project site, in good order, at least one copy of all Addenda, Change Orders, supplemental drawings, written directives and clarifications, and approved Submittals intact as issued, and an updated construction schedule.

B. "POSTED" SET

The Contractor shall maintain at the Project site, in good order, at least one set of the Drawings and Project Manual into which the Contractor has "posted"(incorporated) all Addenda, Change Orders, supplemental drawings, clarifications, and other information pertinent to the proper

performance of the Work. The Contractor shall assure that all sets of the Drawings and Project Manuals being used by the Contractor, Subcontractors, and suppliers are “posted” with the current information to insure that updated Contract Documents are used for performance of the Work.

C. RECORD SET

One set of the Drawings and Project Manual described in Paragraph B shall be the Contractor’s record set in which the Contractor shall record all field changes, corrections, selections, final locations, and other information as will be duplicated on the “As-built” documents. The Contractor shall record such “as-built” information in its record set as it becomes available through progress of the Work. The Contractor’s performance of this requirement shall be subject to confirmation by the Architect at any time as a prerequisite to approval of Progress Payments.

D. The documents and samples required by this Article to be maintained at the Project site shall be readily available to the Architect, Owner, and their representatives.

**ARTICLE 8
“AS-BUILT” DOCUMENTS**

A. Unless otherwise provided in the Contract Documents, the Contractor shall deliver two (2) sets of “As-built” documents, as described herein, to the Architect for submission to the Owner upon completion of the Work. Each set of “As-built” documents shall consist of a copy of the Drawings and Project Manual, in like-new condition, into which the Contractor has neatly incorporated all Addenda, Change Orders, supplemental drawings, clarifications, field changes, corrections, selections, actual locations of underground utilities, and other information as required herein or specified elsewhere in the Contract Documents.

B. The Contractor shall use the following methods for incorporating information into the “As-built” documents:

1. Drawings

(a) To the greatest extent practicable, information shall be carefully drawn and lettered, in ink, on the Drawings in the form of sketches, details, plans, notes, and dimensions as required to provide a fully dimensioned record of the Work. When required for clarity, sketches, details, or partial plans shall be drawn on supplemental sheets and bound into the Drawings and referenced on the drawing being revised.

(b) Where a revised drawing has been furnished by the Architect, the drawing of latest date shall be bound into the Drawings in the place of the superseded drawing.

(c) Where a supplemental drawing has been furnished by the Architect, the supplemental drawing shall be bound into the Drawings in an appropriate location and referred to by note added to the drawing being supplemented.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 11 of 49

(d) Where the Architect has furnished details, partial plans, or lengthy notes of which it would be impractical for the Contractor to redraw or letter on a drawing, such information may be affixed to the appropriate drawing with transparent tape if space is available on the drawing.

(e) Any entry of information made in the Drawings that is the result of an Addendum or Change Order, shall identify the Addendum or Change Order from which it originated.

2. Project Manual

(a) A copy of all Addenda and Change Orders, excluding drawings thereof, shall be bound in the front of the Project Manual.

(b) Where a document, form, or entire specification section is revised, the latest issue shall be bound into the Project Manual in the place of the superseded issue.

(c) Where information within a specification section is revised, the deleted or revised information shall be drawn through in ink and an adjacent note added identifying the Addendum or Change Order containing the revised information.

C. Within ten days after the Date of Substantial Completion of the Work, or the last completed portion of the Work, the Contractor shall submit the “As-built” documents to the Architect for approval. If the Architect requires that any corrections be made, the documents will be returned in a reasonable time for correction and resubmission.

**ARTICLE 9
PROGRESS SCHEDULE**

A. The Contractor shall within fifteen days after the date of commencement stated in the Notice to Proceed, or such other time as may be provided in the Contract Documents, prepare and submit to the Architect for review and approval a practicable construction schedule informing the Architect and Owner of the order in which the Contractor plans to carry on the Work within the Contract Time. The Architect’s review and approval of the Contractor’s construction schedule shall be only for compliance with the specified format, Contract Time, and suitability for monitoring progress of the Work and shall not be construed as a representation that the Architect has analyzed the schedule to form opinions of sequences or durations of time represented in the schedule.

B. At the end of each month the Contractor shall enter the actual percentage of completion on the construction schedule submit two copies to the Architect, and attach one copy to each copy of the monthly Application for Payment. The construction schedule shall be revised to reflect any agreed extensions of the Contract Time or as required by conditions of the Work.

C. The Contractor’s construction schedule shall be used by the Contractor, Architect, and Owner to determine the adequacy of the Contractor’s progress. The Contractor shall be responsible for maintaining progress in accordance with the currently approved construction schedule and shall increase the number of shifts, and/or overtime operations, days of work,

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 12 of 49

and/or the amount of construction plant and equipment as may be necessary to do so. If the Contractor's progress falls materially behind the currently approved construction schedule and, in the opinion of the Architect or Owner, the Contractor is not taking sufficient steps to regain schedule, the Architect may, with the Owner's concurrence, issue a Contractor a Notice to Cure. In such a Notice to Cure the Architect may require the Contractor to submit such supplementary or revised construction schedules as may be deemed necessary to demonstrate the manner in which schedule will be regained.

**ARTICLE 10
EQUIPMENT, MATERIALS, and SUBSTITUTIONS**

A. Every part of the Work shall be executed in a workmanlike manner in accordance with the Contract Documents and approved Submittals. All materials used in the Work shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Work and shall be new except such materials as may be expressly provided or allowed in the Contract Documents to be otherwise.

B. Whenever a product, material, system, item of equipment, or service is identified in the Contract Documents by reference to a trade name, manufacturer's name, model number, etc.(hereinafter referred to as "source"), and only one or two sources are listed, or three or more sources are listed and followed by "or approved equal" or similar wording, it is intended to establish a required standard of performance, design, and quality, and the Contractor may submit, for the Architect's approval, products, materials, systems, equipment, or services of other sources which the Contractor can prove to the Architect's satisfaction are equal to, or exceed, the standard of performance, design and quality specified, unless the provisions of Paragraph D below apply. Such proposed substitutions are not to be purchased or installed without the Architect's written approval of the substitution.

C. If the Contract Documents identify three or more sources for a product, material, system, item of equipment or service to be used and the list of sources is not followed by "or approved equal" or similar wording, the Contractor may make substitution only after evaluation by the Architect and execution of an appropriate Contract Change Order.

D. If the Contract Documents identify only one source and expressly provide that it is an approved sole source for the product, material, system, item of equipment, or service, the Contractor must furnish the identified sole source.

**ARTICLE 11
SAFETY and PROTECTION of PERSONS and PROPERTY**

A. The Contractor shall be solely and completely responsible for conditions at the Project site, including safety of all persons (including employees) and property. The Contractor shall create, maintain, and supervise conditions and programs to facilitate and promote safe execution of the Work, and shall supervise the Work with the attention and skill required to assure its safe performance. Safety provisions shall conform to OSHA requirements and all other federal, state,

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 13 of 49

county, and local laws, ordinances, codes, and regulations. Where any of these are in conflict, the more stringent requirement shall be followed. Nothing contained in this Contract shall be construed to mean that the Owner has employed the Architect nor has the Architect employed its consultants to administer, supervise, inspect, or take action regarding safety programs or conditions at the Project site.

B. The Contractor shall employ Construction Methods, safety precautions, and protective measures that will reasonably prevent damage, injury or loss to:

(1) workers and other persons on the Project site and in adjacent and other areas that may be affected by the Contractor's operations;

(2) the Work and materials and equipment to be incorporated into the Work and stored by the Contractor on or off the Project site; and

(3) other property on, or adjacent to, the Project site, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and other improvements not designated in the Contract Documents to be removed, relocated, or replaced.

C. The Contractor shall be responsible for the prompt remedy of damage and loss to property, including the filing of appropriate insurance claims, caused in whole or in part by the fault or negligence of the Contractor, a Subcontractor, or anyone for whose acts they may be liable.

D. The Contractor shall comply with and give notices required by applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety and protection of persons or property, including without limitation notices to adjoining property owners of excavation or other construction activities that potentially could cause damage or injury to adjoining property or persons thereon.

E. The Contractor shall erect and maintain barriers, danger signs, and any other reasonable safeguards and warnings against hazards as may be required for safety and protection during performance of the Contract and shall notify owners and users of adjacent sites and utilities of conditions that may exist or arise which may jeopardize their safety.

F. If use or storage of explosives or other hazardous materials or equipment or unusual Construction Methods are necessary for execution of the Work, the Contractor shall exercise commensurate care and employ supervisors and workers properly qualified to perform such activity.

G. The Contractor shall furnish a qualified safety representative at the Project site whose duties shall include the prevention of accidents. The safety representative shall be the Contractor's superintendent, unless the Contractor assigns this duty to another responsible member of its on-site staff and notifies the Owner and Architect in writing of such assignment.

H. The Contractor shall not permit a load to be applied, or forces introduced, to any part of the construction or site that may cause damage to the construction or site or endanger safety of the construction, site, or persons on or near the site.

I. The Contractor shall have the right to act as it deems appropriate in emergency situations jeopardizing life or property. The Contractor shall be entitled to equitable adjustment of the Contract Sum or Contract Time for its efforts expended for the sole benefit of the Owner in an Emergency.

J. The duty of the Architect and the Architect's consultants to visit the Project site to conduct periodic inspections of the Work or for other purposes shall not give rise to a duty to review or approve the adequacy of the Contractor's safety program, safety supervisor, or any safety measure which Contractor takes or fails to take in, on, or near the Project site.

ARTICLE 12 HAZARDOUS MATERIALS

A. A Hazardous Material is any substance or material identified as hazardous under any federal, state, or local law or regulation, or any other substance or material which may be considered hazardous or otherwise subject to statutory or regulatory requirements governing its handling, disposal, and/or clean-up. Existing Hazardous Materials are Hazardous Materials discovered at the Project site and not introduced to the Project site by the Contractor, a Subcontractor, or anyone for whose acts they may be liable.

B. If, during the performance of the Work, the Contractor encounters a suspected Existing Hazardous Material, the Contractor shall immediately stop work in the affected area, take measures appropriate to the condition to keep people away from the suspected Existing Hazardous Material, and immediately notify the Architect and Owner of the condition in writing.

C. The Owner shall obtain the services of an independent laboratory or professional consultant, appropriately licensed and qualified, to determine whether the suspected material is a Hazardous Material requiring abatement and, if so, to certify after its abatement that it has been rendered harmless. Any abatement of Existing Hazardous Materials will be the responsibility of the Owner. The Owner will advise the Contractor in writing of the persons or entities who will determine the nature of the suspected material and those who will, if necessary, perform the abatement. The Owner will not employ persons or entities to perform these services to whom the Contractor or Architect has reasonable objection.

D. After certification by the Owner's independent laboratory or professional consultant that the material is harmless or has been rendered harmless, work in the affected area shall resume upon written agreement between the Owner and Contractor. If the material is found to be an Existing Hazardous Material and the Contractor incurs additional cost or delay due to the presence and abatement of the material, the Contract Sum and/or Contract Time shall be appropriately adjusted by a Contract Change Order.

E. The Owner shall not be responsible for Hazardous Materials introduced to the Project site by the Contractor, a Subcontractor, or anyone for whose acts they may be liable unless such Hazardous Materials were required by the Contract Documents.

**ARTICLE 13
INSPECTION of the WORK**

A. GENERAL

(1) The Contractor is solely responsible for the Work's compliance with the Contract Documents; therefore, the Contractor shall be responsible to inspect in-progress and completed Work, and shall verify its compliance with the Contract Documents and that any element or portion of the Work upon which subsequent Work is to be applied or performed is in proper condition to receive the subsequent Work. Neither the presence nor absence of inspections by the Architect, Owner, any public authority having jurisdiction, or their representatives shall relieve the Contractor of responsibility to inspect the Work, for responsibility for Construction Methods and safety precautions and programs in connection with the Work, or from any other requirement of the Contract Documents.

(2) The Architect, Owner, Director, any public authority having jurisdiction, and their representatives shall have access at all times to the Work for inspection whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection. All materials, workmanship, processes of manufacture, and methods of construction, if not otherwise stipulated in the Contract Documents, shall be subject to inspection, examination, and test at any and all places where such manufacture and/or construction are being carried on. Such inspections will not unreasonably interfere with the Contractor's operations.

(3) The Architect will inspect the Work as a representative of the Owner.

(4) The Contractor may be charged by the Owner for any extra cost of inspection incurred by the Owner or Architect on account of material and workmanship not being ready at the time of inspection set by the Contractor.

B. TYPES of INSPECTIONS

(1) **SCHEDULED INSPECTIONS and CONFERENCES.** Scheduled Inspections and Conferences are conducted by the Architect, scheduled by the Architect in coordination with the Contractor and are attended by the Contractor and applicable Subcontractors, suppliers and manufacturers. Scheduled Inspections and Conferences of this Contract include:

(a) **Pre-construction Conference.**

(b) **Pre-roofing Conference** (not applicable if the Contract involves no roofing work)

(c) **Above Ceiling Inspection(s):** An above ceiling inspection of all spaces in the building is required before the ceiling material is installed. Above ceiling inspections are to be conducted at a time when all above ceiling systems are complete and tested to the greatest extent reasonable pending installation of the ceiling material. System identifications and

markings are to be complete. All fire-rated construction including fire-stopping of penetrations and specified identification above the ceiling shall be complete. Ceiling framing and suspension systems shall be complete with lights, grilles and diffusers, access panels, fire protection drops for sprinkler heads, etc., installed in their final locations to the greatest extent reasonable. Above ceiling framing to support ceiling mounted equipment shall be complete. The above ceiling construction shall be complete to the extent that after the inspection the ceiling material can be installed without disturbance.

(d) Final Inspection(s): A Final Inspection shall establish that the Work, or a designated portion of the Work, is Substantially Complete and is accepted by the Architect, and Owner, as being ready for the Owner's occupancy or use. At the conclusion of this inspection, items requiring correction or completion ("punch list" items) shall be minimal and require only a short period of time for accomplishment to establish Final Acceptance of the Work. If the Work, or designated portion of the Work, includes the installation, or modification, of a fire alarm system or other life safety systems essential to occupancy, such systems shall have been tested and appropriately certified before the Final Inspection.

(e) Year-end Inspection(s): An inspection of the Work, or each separately completed portion thereof, is required near the end of the Contractor's one year warranty period(s). The subsequent delivery of the Architect's report of this inspection will serve as confirmation that the Contractor was notified of Defective Work found within the warranty period.

(2) PERIODIC INSPECTIONS. Periodic Inspections are conducted throughout the course of the Work by the Architect, the Architect's consultants, and their representatives, jointly or independently, with or without advance notice to the Contractor.

(3) SPECIFIED INSPECTIONS and TESTS. Specified Inspections and Tests include inspections, tests, demonstrations, and approvals that are either specified in the Contract Documents or required by laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction, to be performed by the Contractor, one of its Subcontractors, or an independent testing laboratory or firm (whether paid for by the Contractor or Owner).

C. INSPECTIONS by the ARCHITECT

(1) The Architect is not authorized to revoke, alter, relax, or waive any requirements of the Contract Documents (other than "minor" deviations and "minor" changes) to finally approve or accept any portion of the Work or to issue instructions contrary to the Contract Documents without concurrence of the Owner.

(2) The Architect will visit the site at intervals appropriate to the stage of the Contractor's operations and as otherwise necessary to:

(a) become generally familiar with the in-progress and completed Work and the quality of the Work,

(b) determine whether the Work is progressing in general accordance with the Contractor's schedule and is likely to be completed within the Contract Time,

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 17 of 49

(c) visually compare readily accessible elements of the Work to the requirements of the Contract Documents to determine, in general, if the Contractor's performance of the Work indicates that the Work will conform to the requirements of the Contract Documents when completed,

(d) endeavor to guard the Owner against Defective Work,

(e) review and address with the Contractor any problems in implementing the requirements of the Contract Documents that the Contractor may have encountered, and

(f) keep the Owner fully informed about the Project.

(3) The Architect shall have the authority to reject Defective Work or require its correction, but shall not be required to make exhaustive investigations or examinations of the in-progress or completed portions of the Work to expose the presence of Defective Work. However, it shall be an obligation of the Architect to report in writing, to the Owner, and Contractor any Defective Work recognized by the Architect.

(4) The Architect shall have the authority to require the Contractor to stop work only when, in the Architect's reasonable opinion, such stoppage is necessary to avoid Defective Work. The Architect shall not be liable to the Contractor or Owner for the consequences of any decisions made by the Architect in good faith either to exercise or not to exercise this authority.

(5) "Inspections by the Architect" includes appropriate inspections by the Architect's consultants as dictated by their respective disciplines of design and the stage of the Contractor's operations.

D. UNCOVERING WORK

(1) If the Contractor covers a portion of the Work before it is examined by the Architect and this is contrary to the Architect's request or specific requirements in the Contract Documents, then, upon written request of the Architect, the Work must be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

(2) Without a prior request or specific requirement that Work be examined by the Architect before it is covered, the Architect may request that Work be uncovered for examination and the Contractor shall uncover it. If the Work is in accordance with the Contract Documents, the Contract Sum shall be equitably adjusted to compensate the Contractor for the costs of uncovering and replacement. If the Work is not in accordance with the Contract Documents, uncovering, correction, and replacement 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.

E. SPECIFIED INSPECTIONS and TESTS

(1) The Contractor shall schedule and coordinate Specified Inspections and Tests to be made at appropriate times so as not to delay the progress of the Work or the work of the Owner or separate contractors. If the Contract Documents require that a Specified Inspection or Test be witnessed or attended by the Architect or Architect's consultant, the Contractor shall give the

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 18 of 49

Architect timely notice of the time and place of the Specified Inspection or Test. If a Specified Inspection or Test reveals that Work is not in compliance with requirements of the Contract Documents, the Contractor shall bear the costs of correction, repeating the Specified Inspection or Test, and any related costs incurred by the Owner, including reasonable charges, if any, by the Architect for additional services. Through appropriate Contract Change Order the Owner shall bear costs of tests, inspections or approvals which become Contract requirements subsequent to the receipt of bids.

(2) If the Architect, Owner, or public authority having jurisdiction determines that inspections, tests, demonstrations, or approvals in addition to Specified Inspections and Tests are required, the Contractor shall, upon written instruction from the Architect, arrange for their performance by an entity acceptable to the Owner, giving timely notice to the architect of the time and place of their performance. Related costs shall be borne by the Owner unless the procedures reveal that Work is not in compliance with requirements of the Contract Documents, in which case the Contractor shall bear the costs of correction, repeating the procedures, and any related costs incurred by the Owner, including reasonable charges, if any, by the Architect for additional services.

(3) Unless otherwise required by the Contract Documents, required certificates of Specified Inspections and Tests shall be secured by the Contractor and promptly delivered to the Architect.

(4) Failure of any materials to pass Specified Inspections and Tests will be sufficient cause for refusal to consider any further samples of the same brand or make of that material for use in the Work.

**ARTICLE 14
CORRECTION of DEFECTIVE WORK**

A. The Contractor shall, at the Contractor's expense, promptly correct Defective Work rejected by the Architect or which otherwise becomes known to the Contractor, removing the rejected or nonconforming materials and construction from the project site.

B. Correction of Defective Work shall be performed in such a timely manner as will avoid delay of completion, use, or occupancy of the Work and the work of the Owner and separate contractors.

C. The Contractor shall bear all expenses related to the correction of Defective Work, including but not limited to: **(1)** additional testing and inspections, including repeating Specified Inspections and Tests, **(2)** reasonable services and expenses of the Architect, and **(3)** the expense of making good all work of the Contractor, Owner, or separate contractors destroyed or damaged by the correction of Defective Work.

**ARTICLE 15
DEDUCTIONS for UNCORRECTED WORK**

If the Owner deems it advisable and in the Owner's interest to accept Defective Work, the Owner may allow part or all of such Work to remain in place, provided an equitable deduction from the Contract Sum, acceptable to the Owner, is offered by the Contractor.

**ARTICLE 16
CHANGES in the WORK**

A. GENERAL

(1) The Owner may at any time direct the Contractor to make changes in the Work which are within the general scope of the Contract, including changes in the Drawings, Specifications, or other portions of the Contract Documents to add, delete, or otherwise revise portions of the Work. The Architect is authorized by the Owner to direct "minor" changes in the Work by written order to the Contractor. "Minor" changes in the Work are defined as those which are in the interest of the Owner, do not materially alter the quality or performance of the finished Work, and do not affect the cost or time of performance of the Work. Changes in the Work which are not "minor" may be authorized only by the Owner.

(2) If the Owner directs a change in the Work, the change shall be incorporated into the Contract by a Contract Change Order prepared by the Architect and signed by the Contractor, Owner, and other signatories to the Construction Contract, stating their agreement upon the change or changes in the Work and the adjustments, if any, in the Contract Sum and the Contract Time.

(3) Subject to compliance with Alabama's Public Works Law, the Owner may, upon agreement by the Contractor, incorporate previously unawarded bid alternates into the Contract.

(4) In the event of a claim or dispute as to the appropriate adjustment to the Contract Sum or Contract Time due to a directive to make changes in the Work, the Work shall proceed as provided in this article subject to subsequent agreement of the parties or final resolution of the dispute.

(5) Consent of surety will be obtained for all Contract Change Orders involving an increase in the Contract Sum.

(6) Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly to perform changes in the Work, unless otherwise directed by the Owner through the Architect.

B. DETERMINATION of ADJUSTMENT of the CONTRACT SUM

The adjustment of the Contract Sum resulting from a change in the Work shall be determined by one of the following methods, or a combination thereof, as selected by the Owner:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 20 of 49

(1) Lump Sum. By mutual agreement to a lump sum based on or negotiated from an itemized cost proposal from the Contractor. Additions to the Contract Sum shall include the Contractor's direct costs plus a maximum 15% markup for overhead and profit. Where subcontract work is involved the total mark-up for the Contractor and a Subcontractor shall not exceed 25%. No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner. For the purposes of this method of determining an adjustment of the Contract Sum, "overhead" shall cover the Contractor's indirect costs of the change, such as the cost of bonds, superintendent and other job office personnel, watchman, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

(2) Unit Price. By application of Unit Prices included in the Contract or subsequently agreed to by the parties. However, if the character or quantity originally contemplated is materially changed so that application of such unit price to quantities of Work proposed will cause substantial inequity to either party, the applicable unit price shall be equitably adjusted.

(3) Force Account. By directing the Contractor to proceed with the change in the Work on a "force account" basis under which the Contractor shall be reimbursed for reasonable expenditures incurred by the Contractor and its Subcontractors in performing added Work and the Owner shall receive reasonable credit for any deleted Work. The Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting of the cost of the change together with sufficient supporting data. Unless otherwise stated in the directive, the adjustment of the Contract Sum shall be limited to the following:

- (a)** costs of labor and supervision, including employee benefits, social security, retirement, unemployment and workers' compensation insurance required by law, agreement, or under Contractor's or Subcontractor's standard personnel policy;
- (b)** cost of materials, supplies and equipment, including cost of delivery, whether incorporated or consumed;
- (c)** rental cost of machinery and equipment, not to exceed prevailing local rates if contractor owned;
- (d)** costs of premiums for insurance required by the Contract Documents, permit fees, and sales, use or similar taxes related to the change in the Work;
- (e)** reasonable credits to the Owner for the value of deleted Work, without Contractor or Subcontractor mark-ups; and
- (f)** for additions to the Contract Sum, mark-up of the Contractor's direct costs for overhead and profit not exceeding 15% on Contractor's work nor exceeding 25% for Contractor and Subcontractor on a Subcontractor's work. No allowance for overhead and profit shall be figured on a change which involves a net credit to the Owner. For the purposes of this method of determining an adjustment of the Contract Sum,

“overhead” shall cover the Contractor’s indirect costs of the change, such as the cost of insurance other than mentioned above, bonds, superintendent and other job office personnel, watchman, use and rental of small tools, job office, job office supplies and expenses, temporary facilities and utilities, and home office expenses.

C. ADJUSTMENT of the CONTRACT TIME due to CHANGES

(1) Unless otherwise provided in the Contract Documents, the Contract Time shall be equitably adjusted for the performance of a change provided that the Contractor notifies the Architect in writing that the change will increase the time required to complete the Work. Such notice shall be provided no later than:

(a) with the Contractor’s cost proposal stating the number of days of extension requested, or

(b) within ten days after the Contractor receives a directive to proceed with a change in advance of submitting a cost proposal, in which case the notice should provide an estimated number of days of extension to be requested, which may be subject to adjustment in the cost proposal.

(2) The Contract Time shall be extended only to the extent that the change affects the time required to complete the entire Work of the Contract, taking into account the concurrent performance of the changed and unchanged Work.

D. CHANGE ORDER PROCEDURES

(1) If the Owner proposes to make a change in the Work, the Architect will request that the Contractor provide a cost proposal for making the change to the Work. The request shall be in writing and shall adequately describe the proposed change using drawings, specifications, narrative, or a combination thereof. Within 21 days after receiving such a request, or such other time as may be stated in the request, the Contractor shall prepare and submit to the Architect a written proposal, properly itemized and supported by sufficient substantiating data to facilitate evaluation. The stated time within which the Contractor must submit a proposal may be extended if, within that time, the Contractor makes a written request with reasonable justification thereof.

(2) The Contractor may voluntarily offer a change proposal which, in the Contractor’s opinion, will reduce the cost of construction, maintenance, or operation or will improve the cost-effective performance of an element of the Project, in which case the Owner, through the Architect, will accept, reject, or respond otherwise within 21 days after receipt of the proposal, or such other reasonable time as the Contractor may state in the proposal.

(3) If the Contractor’s proposal is acceptable to the Owner, or is negotiated to the mutual agreement of the Contractor and Owner, the Architect will prepare an appropriate Contract

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 22 of 49

Change Order for execution. Upon receipt of the fully executed Contract Change Order, the Contractor shall proceed with the change.

(4) In advance of delivery of a fully executed Contract Change Order, the Architect may furnish to the Contractor a written authorization to proceed with an agreed change. However, such an authorization shall be effective only if it:

- (a)** identifies the Contractor's accepted or negotiated proposal for the change,
- (b)** states the agreed adjustments, if any, in Contract Sum and Contract Time,
- (c)** states that funds are available to pay for the change, and
- (d)** is signed by the Owner.

(5) If the Contractor and Owner cannot agree on the amount of the adjustment in the Contract Sum for a change, the Owner, through the Architect, may order the Contractor to proceed with the change on a Force Account basis, but the net cost to the Owner shall not exceed the amount quoted in the Contractor's proposal. Such order shall state that funds are available to pay for the change.

(6) If the Contractor does not promptly respond to a request for a proposal, or the Owner determines that the change is essential to the final product of the Work and that the change must be effected immediately to avoid delay of the Project, the Owner may:

- (a)** determine with the Contractor a sufficient maximum amount to be authorized for the change and
- (b)** direct the Contractor to proceed with the change on a Force Account basis pending delivery of the Contractor's proposal, stating the maximum increase in the Contract Sum that is authorized for the change.

(7) Pending agreement of the parties or final resolution of any dispute of the total amount due the Contractor for a change in the Work, amounts not in dispute for such changes in the Work may be included in Applications for Payment accompanied by an interim Change Order indicating the parties' agreement with part of all of such costs or time extension. Once a dispute is resolved, it shall be implemented by preparation and execution of an appropriate Change Order.

**ARTICLE 17
CLAIMS for EXTRA COST or EXTRA WORK**

A. If the Contractor considers any instructions by the Architect, Owner, or public authority having jurisdiction to be contrary to the requirements of the Contract Documents and will involve extra work and/or cost under the Contract, the Contractor shall give the Architect written notice thereof within ten days after receipt of such instructions, and in any event before proceeding to execute such work. As used in this Article, "instructions" shall include written or oral clarifications, directions, instructions, interpretations, or determinations.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 23 of 49

B. The Contractor's notification pursuant to Paragraph 17A shall state: (1) the date, circumstances, and source of the instructions, (2) that the Contractor considers the instructions to constitute a change to the Contract Documents and why, and (3) an estimate of extra cost and time that may be involved to the extent an estimate may be reasonably made at that time.

C. Except for claims relating to an emergency endangering life or property, no claim for extra cost or extra work shall be considered in the absence of prior notice required under Paragraph 17.A.

D. Within ten days of receipt of a notice pursuant to Paragraph 17.A, the Architect will respond in writing to the Contractor, stating one of the following:

- (1) The cited instruction is rescinded.
- (2) The cited instruction is a change in the Work and in which manner the Contractor is to proceed with procedures for Changes in the Work.
- (3) The cited instruction is reconfirmed, is not considered by the Architect to be a change in the Contract Documents, and the Contractor is to proceed with Work as instructed.

E. If the Architect's response to the Contractor is as in Paragraph 17.D(3), the Contractor shall proceed with the Work as instructed. If the Contractor continues to consider the instructions to constitute a change in the Contract Documents, the Contractor shall, within ten days after receiving the Architect's response, notify the Architect in writing that the Contractor intends to submit a claim pursuant to, Resolution of Claims and Disputes

**ARTICLE 18
DIFFERING SITE CONDITIONS**

A. DEFINITION

"Differing Site Conditions" are:

- (1) subsurface or otherwise concealed physical conditions at the Project site which differ materially from those indicated in the Contract Documents, or
- (2) unknown physical conditions at the Project site which are of an unusual nature, differing materially from conditions ordinarily encountered and generally recognized as inherent in construction activities of the character required by the Contract Documents.

B. PROCEDURES

If Differing Site Conditions are encountered, then the party discovering the condition shall promptly notify the other party before the condition is disturbed and in no event later than ten days after discovering the condition. Upon such notice and verification that a Differing Site Condition exists, the Architect will, with reasonable promptness and with the Owner's concurrence, make changes in the Drawings and/or Specifications as are deemed necessary to conform to the Differing Site Condition. Any increase or decrease in the Contract Sum or Contract Time that is warranted by the changes will be made as provided under Changes in the

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 24 of 49

Work. If the Architect determines a Differing Site Condition has not been encountered, the Architect shall notify the Owner and Contractor in writing, stating the reason for that determination.

**ARTICLE 19
CLAIMS for DAMAGES**

If either party to the Contract 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 after the discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**ARTICLE 20
DELAYS**

A. A delay beyond the Contractor's control at any time in the commencement or progress of Work by an act or omission of the Owner, Architect, or any separate contractor or by labor disputes, unusual delay in deliveries, unavoidable casualties, fires, abnormal floods, tornadoes, or other cataclysmic events of nature, may entitle the Contractor to an extension of the Contract Time provided, however, that the Contractor shall, within ten days after the delay first occurs, give written notice to the Architect of the cause of the delay and its probable effect on progress of the entire Work.

B. Adverse weather conditions that are more severe than anticipated for the locality of the Work during any given month may entitle the Contractor to an extension of Contract Time provided, however;

(1) the weather conditions had an adverse effect on construction scheduled to be performed during the period in which the adverse weather occurred, which in reasonable sequence would have an effect on completion of the entire Work,

(2) the Contractor shall, within twenty-one days after the end of the month in which the delay occurs, give the Architect written notice of the delay that occurred during that month and its probable effect on progress of the Work, and

(3) within a reasonable time after giving notice of the delay, the Contractor provides the Architect with sufficient data to document that the weather conditions experienced were unusually severe for the locality of the Work during the month in question. Unless otherwise provided in the Contract Documents, data documenting unusually severe weather conditions shall compare actual weather conditions to the average weather conditions for the month in question during the previous five years as recorded by the National Oceanic and Atmospheric Administration (NOAA) or similar record-keeping entities.

C. Adjustments, if any, of the Contract Time pursuant to this Article shall be incorporated into the Contract by a Contract Change Order prepared by the Architect and signed by the Contractor, Owner, and other signatories to the Construction Contract or, at closeout of the Contract, by mutual written agreement between the Contractor and Owner. The adjustment of the Contract Time shall not exceed the extent to which the delay extends the time required to complete the entire Work of the Contract.

D. The Contractor shall not be entitled to any adjustment of the Contract Sum for damage due to delays claimed pursuant to this Article.

ARTICLE 21 OWNER'S RIGHT to CORRECT DEFECTIVE WORK

If the Contractor fails or refuses to correct Defective Work in a timely manner that will avoid delay of completion, use, or occupancy of the Work or work by the Owner or separate contractors, the Architect may give the Contractor written Notice to Cure the Defective Work within a reasonable, stated time. If within ten days after receipt of the Notice to Cure the Contractor has not proceeded and satisfactorily continued to cure the Defective Work or provided the Architect with written verification that satisfactory positive action is in process to cure the Defective Work, the Owner may, without prejudice to any other remedy available to the Owner, correct the Defective Work and deduct the actual cost of the correction from payment then or thereafter due to the Contractor.

ARTICLE 22 PROGRESS PAYMENTS

A. FREQUENCY of PROGRESS PAYMENTS

Unless otherwise provided in the Contract Documents, the Owner will make payments to the Contractor as the Work progresses based on monthly estimates prepared and certified by the Contractor, approved and certified by the Architect, and approved by the Owner and other authorities whose approval is required.

B. SCHEDULE of VALUES

Within ten days after receiving the Notice to Proceed the Contractor shall submit to the Architect a Schedule of Values, which is a breakdown of the Contract Sum showing the value of the various parts of the Work for billing purposes. The Schedule of Values shall be prepared on 8 1/2" x 11" paper in a format that is acceptable to the Architect and Owner and shall divide the Contract Sum into as many parts ("line items") as the Architect and Owner determine necessary to permit evaluation and to show amounts attributable to Subcontractors. The Contractor's overhead and profit are to be proportionately distributed throughout the line items of the Schedule of Values. Upon approval, the Schedule of Values shall be used as a basis for monthly Applications for

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 26 of 49

Payment, unless it is later found to be in error. Approved change order amounts shall be added to or incorporated into the Schedule of Values as mutually agreed by the Contractor and Architect.

A. APPLICATIONS for PAYMENTS

(1) Based on the approved Schedule of Values, each monthly Application for Payment shall show the Contractor's estimate of the value of Work performed in each line item as of the end of the billing period. The Contractor's cost of materials and equipment not yet incorporated into the Work, but delivered and suitably stored on the site, may be considered in monthly Applications for Payment.

(2) The Contractor's estimate of the value of Work performed and stored materials must represent such reasonableness as to warrant certification by the Architect to the Owner in accordance with Article 23. Each monthly Application for Payment shall be supported by such data as will substantiate the Contractor's right to payment, including without limitation copies of requisitions from subcontractors and material suppliers.

(3) If no other date is stated in the Contract Documents or agreed upon by the parties, each monthly Application for Payment shall be submitted to the Architect on or about the first day of each month and payment shall be issued to the Contractor within thirty days after an Application for Payment is Certified pursuant to Article 23 and delivered to the Owner.

D. MATERIALS STORED OFF SITE

Unless otherwise provided in the Contract Documents, the Contractor's cost of materials and equipment to be incorporated into the Work, which are stored off the site, may also be considered in monthly Applications for Payment under the following conditions:

(1) the contractor has received written approval from the Architect and Owner to store the materials or equipment off site in advance of delivering the materials to the off site location;

(2) a Certificate of Insurance is furnished to the Architect evidencing that a special insurance policy, or rider to an existing policy, has been obtained by the Contractor providing all-risk property insurance coverage, specifically naming the materials or equipment stored, and naming the Owner as an additionally insured party;

(3) the Architect is provided with a detailed inventory of the stored materials or equipment and the materials or equipment are clearly marked in correlation to the inventory to facilitate inspection and verification of the presence of the materials or equipment by the Architect or Owner;

(4) the materials or equipment are properly and safely stored in a bonded warehouse, or a facility otherwise approved in advance by the Architect and Owner; and

(5) 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.

C. RETAINAGE

(1) "Retainage" is defined as the money earned and, therefore, belonging to the Contractor (subject to final settlement of the Contract) which has been retained by the Owner conditioned on final completion and acceptance of all Work required by the Contract Documents. Retainage shall not be relied upon by Contractor (or Surety) to cover or off-set unearned monies attributable to uncompleted or uncorrected Work.

(2) In making progress payments the Owner shall retain five percent of the estimated value of Work performed and the value of the materials stored for the Work; but after retainage has been held upon fifty percent of the Contract Sum, no additional retainage will be withheld.

D. CONTRACTOR'S CERTIFICATION

(1) Each Application for Payment shall bear the Contractor's notarized certification that, to the best of the Contractor's knowledge, information, and belief, the Work covered by the Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payments were issued and payments received from the Owner and that the current payment shown in the Application for Payment has not yet been received.

(2) By making this certification the Contractor represents to the Architect and Owner that, upon receipt of previous progress payments from the Owner, the Contractor has promptly paid each Subcontractor, in accordance with the terms of its agreement with the Subcontractor, the amount due the Subcontractor from the amount included in the progress payment on account of the Subcontractor's Work and stored materials. The Architect and Owner may advise Subcontractors and suppliers regarding percentages of completion or amounts requested and/or approved in an Application for Payment on account of the Subcontractor's Work and stored materials.

E. PAYMENT ESTABLISHES OWNERSHIP

All material and Work covered by progress payments shall become the sole property of the Owner, but the Contractor shall not be relieved from the sole responsibility for the care and protection of material and Work upon which payments have been made and for the restoration of any damaged material and Work.

**ARTICLE 23
CERTIFICATION and APPROVALS for PAYMENT**

A. The Architect's review, approval, and certification of Applications for Payment shall be based on the Architect's general knowledge of the Work obtained through site visits and the information provided by the Contractor with the Application. The Architect shall not be required to perform exhaustive examinations, evaluations, or estimates of the cost of completed or uncompleted Work or stored materials to verify the accuracy of amounts requested by the Contractor, but the Architect shall have the authority to adjust the Contractor's estimate when, in the Architect's reasonable opinion, such estimates are overstated or understated.

B. Within seven days after receiving the Contractor's monthly Application for Payment, or such other time as may be stated in the Contract Documents, the Architect will take one of the following actions:

(1) The Architect will approve and certify the Application as submitted and forward it as a Certification for Payment for approval by the Owner (and other approving authorities, if any) and payment.

(2) If the Architect takes exception to any amounts claimed by the Contractor and the Contractor and Architect cannot agree on revised amounts, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to certify to the Owner, transmitting a copy of same to the Contractor.

(3) To the extent the Architect determines may be necessary to protect the Owner from loss on account of any of the causes stated in Article 24, the Architect may subtract from the Contractor's estimates and will issue a Certificate for Payment to the Owner, with a copy to the Contractor, for such amount as the Architect determines is properly due and notify the Contractor and Owner in writing of the Architect's reasons for withholding payment in whole or in part.

C. Neither the Architect's issuance of a Certificate for Payment nor the Owner's resulting progress payment shall be a representation to the Contractor that the Work in progress or completed at that time is accepted or deemed to be in conformance with the Contract Documents.

D. The Architect shall not be required to determine that the Contractor has promptly or fully paid Subcontractors and suppliers or how or for what purpose the Contractor has used monies paid under the Construction Contract. However, the Architect may, upon request and if practical, inform any Subcontractor or supplier of the amount, or percentage of completion, approved or paid to the Contractor on account of the materials supplied or the Work performed by the Subcontractor.

**ARTICLE 24
PAYMENTS WITHHELD**

A. The Architect may nullify or revise a previously issued Certificate for Payment prior to Owner's payment thereunder to the extent as may be necessary in the Architect's opinion to protect the Owner from loss on account of any of the following causes not discovered or fully accounted for at the time of the certification or approval of the Application for Payment:

- (1) Defective Work;
- (2) filed, or reasonable evidence indicating probable filing of, claims arising out of the Contract by other parties against the Contractor;
- (3) the Contractor's failure to pay for labor, materials or equipment or to pay Subcontractors;
- (4) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- (5) damage suffered by the Owner or another contractor caused by the Contractor, a Subcontractor, or anyone for whose acts they may be liable;
- (6) reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance is insufficient to cover applicable liquidated damages; or
- (7) the Contractor's persistent failure to conform to the requirements of the Contract Documents.

B. If the Owner deems it necessary to withhold payment pursuant to preceding Paragraph A, the Owner will notify the Contractor and Architect in writing of the amount to be withheld and the reason for same.

C. The Architect shall not be required to withhold payment for completed or partially completed Work for which compliance with the Contract Documents remains to be determined by Specified Inspections or Final Inspections to be performed in their proper sequence. However, if Work for which payment has been approved, certified, or made under an Application for Payment is subsequently determined to be Defective Work, the Architect shall determine an appropriate amount that will protect the Owner's interest against the Defective Work.

(1) If payment has not been made against the Application for Payment first including the Defective Work, the Architect will notify the Owner and Contractor of the amount to be withheld from the payment until the Defective Work is brought into compliance with the Contract Documents.

(2) If payment has been made against the Application for Payment first including the Defective Work, the Architect will withhold the appropriate amount from the next Application for

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 30 of 49

Payment submitted after the determination of noncompliance, such amount to then be withheld until the Defective Work is brought into compliance with the Contract Documents.

D. The amount withheld will be paid with the next Application for Payment certified and approved after the condition for which the Owner has withheld payment is removed or otherwise resolved to the Owner's satisfaction.

E. The Owner shall have the right to withhold from payments due the Contractor under this Contract an amount equal to any amount which the Contractor owes the Owner under another contract.

**ARTICLE 25
SUBSTANTIAL COMPLETION**

A. Substantial Completion is the stage in the progress of the Work when the Work or designated portion of the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use without disruption or interference by the Contractor in completing or correcting any remaining unfinished Work ("punch list" items). Substantial Completion of the Work, or a designated portion of the Work, is not achieved until so agreed in a Certificate of Substantial Completion signed by the Contractor, Architect, and Owner.

B. The Contractor shall notify the Architect in writing when it considers the Work, or a portion of the Work which the Owner has agreed to accept separately, to be substantially complete and ready for a Final Inspection. In this notification the Contractor shall identify any items remaining to be completed or corrected for Final Acceptance prior to final payment.

C. Substantial Completion is achieved and a Final Inspection is appropriate only when a minimal number of punch list items exists and only a short period of time will be required to correct or complete them. Upon receipt of the Contractor's notice for a Final Inspection, the Architect will advise the Contractor in writing of any conditions of the Work which the Architect or Owner is aware do not constitute Substantial Completion, otherwise, a Final Inspection will proceed within a reasonable time after the Contractor's notice is given. However, the Architect will not be required to prepare lengthy listings of punch list items; therefore, if the Final Inspection discloses that Substantial Completion has not been achieved, the Architect may discontinue or suspend the inspection until the Contractor does achieve Substantial Completion.

D. CERTIFICATE of SUBSTANTIAL COMPLETION

(1) When the Work or a designated portion of the Work is substantially complete, the Architect will prepare and sign a Certificate of Substantial Completion to be signed in order by the Contractor, and Owner.

(2) When signed by all parties, the Certificate of Substantial Completion shall establish the Date of Substantial Completion which is the date upon which:

(a) the Work, or designated portion of the Work, is accepted by the Architect, and Owner as being ready for occupancy,

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 31 of 49

- (b) the Contractor's one-year and special warranties for the Work covered by the Certificate commence, unless stated otherwise in the Certificate (the one-year warranty for punch list items completed or corrected after the period allowed in the Certificate shall commence on the date of their Final Acceptance) , and
- (c) Owner becomes responsible for building security, maintenance, utility services, and insurance, unless stated otherwise in the Certificate.
- (3) The Certificate of Substantial Completion shall set the time within which the Contractor shall finish all items on the "punch list" accompanying the Certificate. The completion of punch list items shall be a condition precedent to Final Payment.
- (4) If the Work or designated portion covered by a Certificate of Substantial Completion includes roofing work, the General Contractor's (5-year) Roofing Guarantee, ABC Form C-9, must be executed by the Contractor and attached to the Certificate of Substantial Completion. If the Contract Documents specify any other roofing warranties to be provided by the roofing manufacturer, Subcontractor, or Contractor, they must also be attached to the Certificate of Substantial Completion.

E. The Date of Substantial Completion of the Work, as set in the Certificate of Substantial Completion of the Work or of the last completed portion of the Work, establishes the extent to which the Contractor is liable for Liquidated Damages, if any; however, should the Contractor fail to complete all punch list items within thirty days, or such other time as may be stated in the respective Certificate of Substantial Completion, the Contractor shall bear any expenses, including additional Architectural services and expenses, incurred by the Owner as a result of such failure to complete punch list items in a timely manner.

**ARTICLE 26
OCCUPANCY or USE PRIOR to COMPLETION**

A. UPON SUBSTANTIAL COMPLETION

Prior to completion of the entire Work, the Owner may occupy or begin utilizing any designated portion of the Work on the agreed Date of Substantial Completion of that portion of the Work.

B. BEFORE SUBSTANTIAL COMPLETION

- (1) The Owner shall not occupy or utilize any portion of the Work before Substantial Completion of that portion has been achieved.
- (2) The Owner may deliver furniture and equipment and store, or install it in place ready for occupancy and use, in any designated portion of the Work before it is substantially completed under the following conditions:
 - (a) The Owner's storage or installation of furniture and equipment will not unreasonably disrupt or interfere with the Contractor's completion of the designated portion of the Work.
 - (b) The Contractor consents to the Owner's planned action (such consent shall not be unreasonably withheld).
 - (c) The Owner shall be responsible for insurance coverage of the Owner's furniture and equipment, and the Contractor's liability shall not be increased.
 - (d) The Contractor, Architect, and Owner will jointly inspect and record the condition of

the Work in the area before the Owner delivers and stores or installs furniture and equipment; the Owner will equitably compensate the Contractor for making any repairs to the Work that may subsequently be required due to the Owner's delivery and storage or installation of furniture and equipment.

- (e) The Owner's delivery and storage or installation of furniture and equipment shall not be deemed an acceptance of any Work not completed in accordance with the requirements of the Contract Documents.

ARTICLE 27

FINAL PAYMENT

A. PREREQUISITES to FINAL PAYMENT

The following conditions are prerequisites to Final Payment becoming due the Contractor:

(1) Full execution of a Certificate of Substantial Completion for the Work, or each designated portion of the Work

(2) Final Acceptance of the Work.

(3) The Contractor's completion, to the satisfaction of the Architect and Owner, of all documentary requirements of the Contract Documents; such as delivery of "as-built" documents, operating and maintenance manuals, warranties, etc.

(4) Delivery to the Owner of a final Application for Payment, prepared by the Contractor and approved and certified by the Architect.

(5) Completion of an Advertisement for Completion pursuant to Paragraph C below.

(6) Delivery by the Contractor to the Owner through the Architect of a Release of Claims and such other documents as may be required by Owner, satisfactory in form to the Owner pursuant to Paragraph D below.

(7) Consent of Surety, if any, to Final Payment to Contractor.

(8) Delivery by the Contractor to the Architect and Owner of other documents, if any, required by the Contract Documents as prerequisites to Final Payment.

B. FINAL ACCEPTANCE of the WORK

"Final Acceptance of the Work" shall be achieved when all "punch list" items recorded with the Certificate(s) of Substantial Completion are accounted for by their completion or correction by the Contractor and acceptance by the Architect, and Owner

C. ADVERTISEMENT for COMPLETION

(1) If the Contract Sum is less than \$50,000: The Owner, immediately after being notified by the Architect that all other requirements of the Contract have been completed, shall give public notice of completion of the Contract by having an Advertisement for Completion published one time in a newspaper of general circulation, published in the county in which the Owner is located and shall post notice of completion of the Contract on the Owner's bulletin board for one week, and shall require the Contractor to certify under oath that all bills have been paid in full. Final payment may be made at any time after the notice has been posted for one entire week.

(2) If the Contract Sum is more than \$50,000: The Contractor, immediately after being notified by the Architect that all other requirements of the Contract have been completed, shall give public notice of completion of the Contract by having an Advertisement for Completion, similar to the sample contained in the Project Manual, published for a period of four successive weeks in some newspaper of general circulation published within the city or county where the Work was performed. Proof of publication of the Advertisement for Completion, in duplicate, shall be made by the Contractor to the Architect by affidavit of the publisher and a printed copy of the Advertisement for Completion published, in duplicate. If no newspaper is published in the county where the work was done, the notice may be given by posting at the Court House for thirty days and proof of same made by Probate Judge or Sheriff and the Contractor. Final payment shall not be due until thirty days after this public notice is completed.

D. RELEASE of CLAIMS

The Release of Claims and other documents referenced in Paragraph A(6) above are as follows:

(1) A release executed by Contractor of all claims and claims of lien against the Owner arising under and by virtue of the Contract, other than such claims of the Contractor, if any, as may have been previously made in writing and as may be specifically excepted by the Contractor from the operation of the release in stated amounts to be set forth therein

(2) An affidavit under oath, if required, stating that so far as the Contractor has knowledge or information, there are no claims or claims of lien which have been or will be filed by any Subcontractor, Supplier or other party for labor or material for which a claim or claim of lien could be filed.

(3) A release, if required, of all claims and claims of lien made by any Subcontractor, Supplier or other party against the Owner or unpaid Contract funds held by the Owner arising under or related to the Work on the Project; provided, however, that if any Subcontractor, Supplier or others refuse to furnish a release of such claims or claims of lien, the Contractor may furnish a bond executed by Contractor and its Surety to the Owner to provide an unconditional obligation to defend, indemnify and hold harmless the Owner against any loss, cost or expense, including attorney's fees, arising out of or as a result of such claims, or claims of lien, in which event Owner may make Final Payment notwithstanding such claims or claims of lien. If Contractor and Surety fail to fulfill their obligations to Owner under the bond, the Owner shall be entitled to recover damages as a result of such failure, including all costs and reasonable attorney's fees incurred to recover such damages.

D. EFFECT of FINAL PAYMENT

(1) The making of Final Payment shall constitute a waiver of Claims by the Owner except those arising from:

- (a) liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- (b) failure of the Work to comply with the requirements of the Contract Documents;
- (c) terms of warranties or indemnities required by the Contract Documents, or
- (d) latent defects.

(2) Acceptance of Final Payment by the Contractor shall constitute a waiver of claims by Contractor except those previously made in writing, identified by Contractor as unsettled at the time of final Application for Payment, and specifically excepted from the release provided for in Paragraph D(1), above.

**ARTICLE 28
CONTRACTOR'S WARRANTY**

A. GENERAL WARRANTY

The Contractor warrants to the Owner and Architect that all materials and equipment furnished under the Contract will be of good quality and new, except such materials as may be expressly provided or allowed in the Contract Documents to be otherwise, and that none of the Work will be Defective Work.

B. ONE-YEAR WARRANTY

(1) If, within one year after the date of Substantial Completion of the Work or each

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 35 of 49

designated portion of the Work (or otherwise as agreed upon in a mutually-executed Certificate of Substantial Completion), any of the Work is found to be Defective Work, the Contractor shall promptly upon receipt of written notice from the Owner or Architect, and without expense to either, replace or correct the Defective Work to conform to the requirements of the Contract Documents, and repair all damage to the site, the building and its contents which is the result of Defective Work or its replacement or correction.

(2) The one-year warranty for punch list items shall begin on the Date of Substantial Completion if they are completed or corrected within the time period allowed in the Certificate of Substantial Completion in which they are recorded. The one-year warranty for punch list items that are not completed or corrected within the time period allowed in the Certificate of Substantial Completion, and other Work performed after Substantial Completion, shall begin on the date of Final Acceptance of the Work. The Contractor's correction of Work pursuant to this warranty does not extend the period of the warranty. The Contractor's one-year warranty does not apply to defects or damages due to improper or insufficient maintenance, improper operation, or wear and tear during normal usage.

(3) Upon recognizing a condition of Defective Work, the Owner shall promptly notify the Contractor of the condition. If the condition is causing damage to the building, its contents, equipment, or site, the Owner shall take reasonable actions to mitigate the damage or its continuation, if practical. If the Contractor fails to proceed promptly to comply with the terms of the warranty, or to provide the Owner with satisfactory written verification that positive action is in process, the Owner may have the Defective Work replaced or corrected and the Contractor and the Contractor's Surety shall be liable for all expense incurred.

(4) **Year-end Inspection(s):** An inspection of the Work, or each separately completed portion thereof, is required near the end of the Contractor's one-year warranty period(s). The subsequent delivery of the Architect's report of a Year-end Inspection will serve as confirmation that the Contractor was notified of Defective Work found within the warranty period.

(5) The Contractor's warranty of one year is in addition to, and not a limitation of, any other remedy stated herein or available to the Owner under applicable law.

C. GENERAL CONTRACTOR'S ROOFING GUARANTEE

(1) In addition to any other roof related warranties or guarantees that may be specified in the Contract Documents, the roof and associated work shall be guaranteed by the General Contractor against leaks and defects of materials and workmanship for a period of five (5) years, starting on the Date of Substantial Completion of the Project as stated in the Certificate of Substantial Completion. This guarantee for punch list items shall begin on the Date of Substantial Completion if they are completed or corrected within the time period allowed in the Certificate of Substantial Completion in which they are

recorded. The guarantee for punch list items that are not completed or corrected within the time period allowed in the Certificate of Substantial Completion shall begin on the date of Final Acceptance of the Work.

(2) The “General Contractor’s Roofing Guarantee” (ABC Form C-9), included in the Project Manual, shall be executed in triplicate, signed by the appropriate party and submitted to the Architect for submission with the Certificate of Substantial Completion to the Owner.

(3) This guarantee does not include costs which might be incurred by the General Contractor in making visits to the site requested by the Owner regarding roof problems that are due to lack of proper maintenance (keeping roof drains and/or gutters clear of debris that cause a stoppage of drainage which results in water ponding, overflowing of flashing, etc.), or damages caused by vandalism or misuse of roof areas. Should the contractor be required to return to the job to correct problems of this nature that are determined not to be related to faulty workmanship and materials in the installation of the roof, payment for actions taken by the Contractor in response to such request will be the responsibility of the Owner. A detailed written report shall be made by the General Contractor on each of these ‘Service Calls’ with copies to the Architect, and Owner

D. SPECIAL WARRANTIES

(1) The Contractor shall deliver to the Owner through the Architect all special or extended warranties required by the Contract Documents from the Contractor, Subcontractors, and suppliers.

(2) The Contractor and the Contractor’s Surety shall be liable to the Owner for such special warranties during the Contractor’s one-year warranty; thereafter, the Contractor’s obligations relative to such special warranties shall be to provide reasonable assistance to the Owner in their enforcement.

E. ASSUMPTION of GUARANTEES of OTHERS

If the Contractor disturbs, alters, or damages any work guaranteed under a separate contract, thereby voiding the guarantee of that work, the Contractor shall restore the work to a condition satisfactory to the Owner and shall also guarantee it to the same extent that it was guaranteed under the separate contract.

ARTICLE 29

CONTRACTOR’S and SUBCONTRACTORS’ INSURANCE

A. GENERAL

(1) RESPONSIBILITY. The Contractor shall be responsible to the Owner from the time of the signing of the Construction Contract or from the beginning of the first work,

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 37 of 49

whichever shall be earlier, for all injury or damage of any kind resulting from any negligent act or omission or breach, failure or other default regarding the work by the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of who may be the owner of the property.

(2) INSURANCE PROVIDERS. Each of the insurance coverages required below shall be issued by an insurer licensed by the Insurance Commissioner to transact the business of insurance in the State of Alabama for the applicable line of insurance, and such insurer (or, for qualified selfinsureds or group self-insureds, a specific excess insurer providing statutory limits) must have a Best Policyholders Rating of "A-" or better and a financial size rating of Class V or larger.

(3) NOTIFICATION ENDORSEMENT. Each policy shall be endorsed to provide that the insurance company agrees that the policy shall not be canceled, changed, allowed to lapse or allowed to expire for any reason until thirty days after the Owner has received written notice by certified mail as evidenced by return receipt or until such time as other insurance coverage providing protection equal to protection called for in the Contract Documents shall have been received, accepted and acknowledged by the Owner. Such notice shall be valid only as to the Project as shall have been designated by Project Name and Number in said notice.

(4) INSURANCE CERTIFICATES. The Contractor shall procure the insurance coverages identified below, or as otherwise required in the Contract Documents, at the Contractor's own expense, and to evidence that such insurance coverages are in effect, the Contractor shall furnish the Owner an insurance certificate(s) acceptable to the Owner and listing the Owner as the certificate holder. The insurance certificate(s) must be delivered to the Owner with the Construction Contract and Bonds for final approval and execution of the Construction Contract.

The insurance certificate must provide the following:

- (a) Name and address of authorized agent of the insurance company
- (b) Name and address of insured
- (c) Name of insurance company or companies
- (d) Description of policies
- (e) Policy Number(s)
- (f) Policy Period(s)
- (g) Limits of liability
- (h) Name and address of Owner as certificate holder
- (i) Project Name and Number, if any
- (j) Signature of authorized agent of the insurance company
- (k) Telephone number of authorized agent of the insurance company
- (l) Mandatory thirty day notice of cancellation / non-renewal / change

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 38 of 49

B. INSURANCE COVERAGES

Unless otherwise provided in the Contract Documents, the Contractor shall purchase the types of insurance coverages with liability limits not less than as follows:

(1) WORKERS' COMPENSATION and EMPLOYER'S LIABILITY INSURANCE

(a) Workers' Compensation coverage shall be provided in accordance with the statutory coverage required in Alabama. A group insurer must submit a certificate of authority from the Alabama Department of Industrial Relations approving the group insurance plan. A selfinsurer must submit a certificate from the Alabama Department of Industrial Relations stating the Contractor qualifies to pay its own workers' compensation claims.

(b) Employer's Liability Insurance limits shall be at least:

(1) Bodily Injury by Accident - \$1,000,000 each accident

(2) Bodily Injury by Disease - \$1,000,000 each employee

(2) COMMERCIAL GENERAL LIABILITY INSURANCE

(a) Commercial General Liability Insurance, written on an ISO Occurrence Form (current edition as of the date of Advertisement for Bids) or equivalent, shall include, but need not be limited to, coverage for bodily injury and property damage arising from premises and operations liability, products and completed operations liability, blasting and explosion, collapse of structures, underground damage, personal injury liability and contractual liability. The Commercial General Liability Insurance shall provide at minimum the following limits:

Coverage	Limit
(1) General Aggregate	\$ 2,000,000.00 per Project
(2) Products, Completed Operations Aggregate	\$ 2,000,000.00 per Project
(3) Personal and Advertising Injury	\$ 1,000,000.00 per Occurrence
(4) Each Occurrence	\$ 1,000,000.00

(b) Additional Requirements for Commercial General Liability Insurance:

(1) The policy shall name the Owner, Architect, and their agents, consultants and employees as additional insureds, state that this coverage shall be primary insurance for the additional insureds; and contain no exclusions of the additional insureds relative to job accidents.

(2) The policy must include separate per project aggregate limits.

(3) COMMERCIAL BUSINESS AUTOMOBILE LIABILITY INSURANCE

(a) Commercial Business Automobile Liability Insurance which shall include coverage for bodily injury and property damage arising from the operation of any owned, non-owned or hired automobile. The Commercial Business Automobile Liability Insurance Policy shall provide not less than \$1,000,000 Combined Single Limits for each occurrence.

(b) The policy shall name the Owner, Architect, and their agents, consultants, and employees as additional insureds.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 39 of 49

(4) COMMERCIAL UMBRELLA LIABILITY INSURANCE

(a) Commercial Umbrella Liability Insurance to provide excess coverage above the Commercial General Liability, Commercial Business Automobile Liability and the Workers' Compensation and Employer's Liability to satisfy the minimum limits set forth herein.

(b) Minimum Combined Primary Commercial General Liability and Commercial/Excess

Umbrella Limits of:

(1) \$ 5,000,000 per Occurrence

(2) \$ 5,000,000 Aggregate

(c) Additional Requirements for Commercial Umbrella Liability Insurance:

(1) The policy shall name the Owner, Architect, and their agents, consultants, and employees as additional insureds.

(2) The policy must be on an "occurrence" basis.

(5) BUILDER'S RISK INSURANCE

(a) The Builder's Risk Policy shall be made payable to the Owner and Contractor, as their interests may appear. The policy amount shall be equal to 100% of the Contract Sum, written on a Causes of Loss - Special Form (current edition as of the date of Advertisement for Bids), or its equivalent. All deductibles shall be the sole responsibility of the Contractor.

(b) The policy shall be endorsed as follows:

"The following may occur without diminishing, changing, altering or otherwise affecting the coverage and protection afforded the insured under this policy:

(i) Furniture and equipment may be delivered to the insured premises and installed in place ready for use; or

(ii) Partial or complete occupancy by Owner; or

(iii) Performance of work in connection with construction operations insured by the Owner, by agents or lessees or other contractors of the Owner, or by contractors of the lessee of the Owner."

C. SUBCONTRACTORS' INSURANCE

(1) **WORKERS' COMPENSATION and EMPLOYER'S LIABILITY INSURANCE.** The Contractor shall require each Subcontractor to obtain and maintain Workers' Compensation and Employer's Liability Insurance coverages as described in preceding Paragraph B, or to be covered by the Contractor's Workers' Compensation and Employer's Liability Insurance while performing Work under the Contract.

(2) **LIABILITY INSURANCE.** The Contractor shall require each Subcontractor to

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 40 of 49

obtain and maintain adequate General Liability, Automobile Liability, and Umbrella Liability Insurance coverages similar to those described in preceding Paragraph B. Such coverage shall be in effect at all times that a Subcontractor is performing Work under the Contract.

(3) ENFORCEMENT RESPONSIBILITY. The Contractor shall have responsibility to enforce its Subcontractors' compliance with these or similar insurance requirements; however, the Contractor shall, upon request, provide the Architect or Owner acceptable evidence of insurance for any Subcontractor.

D. TERMINATION of OBLIGATION to INSURE

Unless otherwise expressly provided in the Contract Documents, the obligation to insure as provided herein shall continue as follows:

(1) BUILDER'S RISK INSURANCE. The obligation to insure under Subparagraph B(5) shall remain in effect until the Date of Substantial Completion as shall be established in the Certificate of Substantial Completion. In the event that multiple Certificates of Substantial Completion covering designated portions of the Work are issued, Builder's Risk coverage shall remain in effect until the Date of Substantial Completion as shall be established in the last issued Certificate of Substantial Completion.

(2) PRODUCTS and COMPLETED OPERATIONS. The obligation to carry Products and Completed Operations coverage specified under Subparagraph B(2) shall remain in effect for two years after the Date(s) of Substantial Completion.

(3) ALL OTHER INSURANCE. The obligation to carry other insurance coverages specified under Subparagraphs B(1) through B(4) and Paragraph C shall remain in effect after the Date(s) of Substantial Completion until such time as all Work required by the Contract Documents is completed. Equal or similar insurance coverages shall remain in effect if, after completion of the Work, the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, returns to the Project to perform warranty or maintenance work pursuant to the terms of the Contract Documents.

E. 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 performing construction or operations related to the Project, if any, and any of their subcontractors, sub-subcontractors, agents and

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 41 of 49

employees, for damages caused by fire or other causes of loss to the extent covered by builder's risk insurance or other property insurance applicable to the Work or to other property located within or adjacent to the Project, except such rights as they may have to proceeds of such insurance held by the Owner or Contractor as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors, if any, and the subcontractor, sub-subcontractors, suppliers, 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 the 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. The waivers provided for in this paragraph shall survive final acceptance and continue to apply to insured losses to the Work or other property on or adjacent to the Project.

**ARTICLE 30
PERFORMANCE and PAYMENT BONDS**

A. GENERAL

Upon signing and returning the Construction Contract to the Owner for final approval and execution, the Contractor shall, at the Contractor's expense, furnish to the Owner a Performance Bond and a Payment Bond, each in a penal sum equal to 100% of the Contract Sum. Each bond shall be on the form contained in the Project Manual, shall be executed by a surety company (Surety) acceptable to the Owner and duly authorized and qualified to make such bonds in the State of Alabama in the required amounts, shall be countersigned by an authorized, Alabama resident agent of the Surety who is qualified to execute such instruments, and shall have attached thereto a power of attorney of the signing official. The provisions of this Article are not applicable to this Contract if the Contract Sum is less than \$50,000, unless bonds are required for this Contract in the Supplemental General Conditions.

B. PERFORMANCE BOND

Through the Performance Bond, the Surety's obligation to the Owner shall be to assure the prompt and faithful performance of the Contract and Contract Change Orders. The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. In case of default on the part of the Contractor, the Surety shall take charge of and complete the Work in accordance with the terms of the Performance Bond. Any reasonable expenses incurred by the Owner as a result of default on the part of the Contractor, including architectural, engineering, administrative, and legal services, shall be recoverable under the Performance Bond.

C. PAYMENT BOND

Through the Payment Bond the Surety's obligation to the Owner shall be to guarantee that the contractor and its Subcontractors shall promptly make payment to all persons supplying labor, materials, or supplies for, or in, the prosecution of the Work, including the payment of reasonable attorneys' fees incurred by successful claimants or plaintiffs in civil actions on the Bond. Any person or entity indicating that they have a claim of nonpayment under the Bond shall, upon written request, be promptly furnished a certified copy of the Bond and Construction Contract by the Contractor, Architect, Owner or whomever is recipient of the request.

D. CHANGE ORDERS

The Penal Sum shall remain equal to the Contract Sum as the Contract Sum is adjusted by Contract Change Orders. All Contract Change Orders involving an increase in the Contract Sum will require consent of Surety by endorsement of the Contract Change Order form. The Surety waives notification of any Contract Change Orders involving only extension of the Contract Time.

E. EXPIRATION

The obligations of the Contractor's performance bond surety shall be coextensive with the contractor's performance obligations under the Contract Documents; provided.

**ARTICLE 31
ASSIGNMENT**

The Contractor shall not assign the Contract or sublet it as a whole nor assign any moneys due or to become due to the Contractor thereunder without the previous written consent of the Owner (and of the Surety, in the case of a bonded Construction Contract). As prescribed by the Public Works Law, the Contract shall in no event be assigned to an unsuccessful bidder for the Contract whose bid was rejected because the bidder was not a responsible or responsive bidder.

**ARTICLE 32
CONSTRUCTION by OWNER or SEPARATE CONTRACTORS**

A. OWNER'S RESERVATION of RIGHT

(1) The Owner reserves the right to self-perform, or to award separate contracts for, other portions of the Project and other Project related construction and operations on the site. The contractual conditions of such separate contracts shall be substantially similar to those of this Contract, including insurance requirements and the provisions of this Article

(2) When separate contracts are awarded, the term "Contractor" in the separate Contract Documents shall mean the Contractor who executes the respective Construction Contract.

B. COORDINATION

Unless otherwise provided in the Contract Documents, the Owner shall be responsible for coordinating the activities of the Owner's forces and separate contractors with the Work of the Contractor. The Contractor shall cooperate with the Owner and separate contractors, shall participate in reviewing and comparing their construction schedules relative to that of the Contractor when directed to do so, and shall make and adhere to any revisions to the construction schedule resulting from a joint review and mutual agreement.

C. CONDITIONS APPLICABLE to WORK PERFORMED by OWNER

Unless otherwise provided in the Contract Documents, when the Owner self-performs construction or operations related to the Project, the Owner shall be subject to the same obligations to Contractor as Contractor would have to a separate contractor under the provision of this Article 32.

D. MUTUAL RESPONSIBILITY

(1) The Contractor shall reasonably accommodate the required introduction and storage of materials and equipment and performance of activities by the Owner and separate contractors and shall connect and coordinate the Contractor's Work with theirs as required by the Contract Documents.

(2) By proceeding with an element or portion of the Work that is applied to or performed on construction by the Owner or a separate contractor, or which relies upon their operations, the Contractor accepts the condition of such construction or operations as being suitable for the Contractor's Work, except for conditions that are not reasonably discoverable by the Contractor. If the Contractor discovers any condition in such construction or operations that is not suitable for the proper performance of the Work, the Contractor shall not proceed, but shall instead promptly notify the Architect in writing of the condition discovered.

(3) The Contractor shall reimburse the Owner for any costs incurred by a separate contractor and payable by the Owner because of acts or omissions of the Contractor. Likewise, the Owner shall be responsible to the Contractor for any costs incurred by the Contractor because of the acts or omissions of a separate contractor.

(4) The Contractor shall not cut or otherwise alter construction by the Owner or a separate contractor without the written consent of the Owner and separate contractor; such consent shall not be unreasonably withheld. Likewise, the Contractor shall not unreasonably withhold its consent allowing the Owner or a separate contractor to cut or otherwise alter the Work.

(5) The Contractor shall promptly remedy any damage caused by the Contractor to the construction or property of the Owner or separate contractors.

**ARTICLE 33
SUBCONTRACTS**

A. AWARD of SUBCONTRACTS and OTHER CONTRACTS for PORTIONS of the WORK

(1) Unless otherwise provided in the Contract Documents, when delivering the executed Construction Contract, bonds, and evidence of insurance to

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 44 of 49

the Architect, the Contractor shall also submit a listing of Subcontractors proposed for each principal portion of the Work and fabricators or suppliers proposed for furnishing materials or equipment fabricated to the design of the Contract Documents. This listing shall be in addition to any naming of Subcontractors, fabricators, or suppliers that may have been required in the bid process. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner, after due investigation, has reasonable objection to any Subcontractor, fabricator, or supplier proposed by the Contractor. The issuance of the Notice to Proceed in the absence of such objection by the Owner shall constitute notice that no reasonable objection to them is made.

(2) The Contractor shall not contract with a proposed Subcontractor, fabricator, or supplier to whom the Owner has made reasonable and timely objection. Except in accordance with prequalification procedures as may be contained in the Contract Documents, through specified qualifications, or on the grounds of reasonable objection, the Owner may not restrict the Contractor's selection of Subcontractors, fabricators, or suppliers.

(3) Upon the Owner's reasonable objection to a proposed Subcontractor, fabricator, or supplier, the Contractor shall promptly propose another to whom the Owner has no reasonable objection. If the proposed Subcontractor, fabricator, or supplier to whom the Owner made reasonable objection was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be equitably adjusted by Contract Change Order for any resulting difference if the Contractor has acted promptly and responsively in this procedure.

(4) The Contractor shall not change previously selected Subcontractors, fabricators, or suppliers without notifying the Architect and Owner in writing of proposed substitute Subcontractors, fabricators, or suppliers. If the Owner does not make a reasonable objection to a proposed substitute within three working days, the substitute shall be deemed approved.

B. SUBCONTRACTUAL RELATIONS

(1) The Contractor agrees to bind every Subcontractor and material supplier (and require every Subcontractor to so bind its subcontractors and material suppliers) to all the provisions of the Contract Documents as they apply to the Subcontractor's and material supplier's portion of the Work.

(2) Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner, nor to create a duty of the Architect, or Owner, to resolve disputes between or among the Contractor or its Subcontractors and suppliers or any other duty to such Subcontractors or suppliers.

**ARTICLE 34
ARCHITECT'S STATUS**

A. The Architect is an independent contractor performing, with respect to this Contract, pursuant to an agreement executed between the Owner and the Architect. The Architect has prepared the Drawings and Specifications and assembled the Contract Document and is, therefore, charged with their interpretation and clarification as described in the Contract Documents. As a representative of the Owner, the Architect will endeavor to guard the Owner against variances from the requirements of the Contract Documents by the Contractor. On behalf of the Owner, the Architect will administer the Contract as described in the Contract Documents during construction and the Contractor's one-year warranty.

B. So as to maintain continuity in administration of the Contract and performance of the Work, and to facilitate complete documentation of the project record, all communications between the Contractor and Owner regarding matters of or related to the Contract shall be directed through the Architect, unless direct communication is otherwise required to provide a legal notification. Unless otherwise authorized by the Architect, communications by and with the Architect's consultants shall be through the Architect. Unless otherwise authorized by the Contractor, communications by and with Subcontractors and material suppliers shall be through the Contractor.

C. ARCHITECT'S AUTHORITY

Subject to other provisions of the Contract Documents, the following summarizes some of the authority vested in the Architect by the Owner with respect to the Construction Contract and as further described or conditioned in other Articles of these General Conditions of the Contract.

(1) The Architect is authorized to:

- (a)** approve "minor" deviations as defined in Article 9, Submittals,
- (b)** make "minor" changes in the Work as defined in Article 19, Changes in the Work,
- (c)** reject or require the correction of Defective Work,
- (d)** require the Contractor to stop the performance of Defective Work,
- (e)** adjust an Application for Payment by the Contractor pursuant to Article 30, Certification and Approval of payments, and
- (f)** issue Notices to Cure.

(2) The Architect is not authorized to:

- (a)** revoke, alter, relax, or waive any requirements of the Contract Documents (other than "minor" deviations and changes) without concurrence of the Owner,
- (b)** finally approve or accept any portion of the Work without concurrence of the Owner,
- (c)** issue instructions contrary to the Contract Documents,
- (d)** issue Notice of Termination or otherwise terminate the Contract, or
- (e)** require the Contractor to stop the Work except only to avoid the performance of Defective Work.

D. LIMITATIONS of RESPONSIBILITIES

- (1)** The Architect shall not be responsible to Contractors or to others for supervising or coordinating the performance of the Work or for the Construction Methods or safety of the Work, unless the Contract Documents give other specific instructions concerning

these matters.

(2) The Architect will not be responsible to the Contractor (nor the Owner) for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents or for acts or omissions of the Contractor, a Subcontractor, or anyone for whose acts they may be liable. However, the Architect will report to the Owner and Contractor any Defective Work recognized by the Architect.

(3) The Architect will endeavor to secure faithful performance by Owner and Contractor, and the Architect will not show partiality to either or be liable to either for results of interpretations or decisions rendered in good faith.

E. ARCHITECT'S DECISIONS

Decisions by the Architect shall be in writing. The Architect's decisions on matters relating to aesthetic effect will be final and binding if consistent with the intent expressed in the Contract Documents. The Architect's decisions regarding disputes arising between the Contractor and Owner shall be advisory.

**ARTICLE 35
CASH ALLOWANCES**

A. All allowances stated in the Contract Documents shall be included in the Contract Sum. Items covered by allowances shall be supplied by the Contractor as directed by the Architect or Owner and the Contractor shall afford the Owner the economy of obtaining competitive pricing from responsible bidders for allowance items unless other purchasing procedures are specified in the Contract Documents.

B. Unless otherwise provided in the Contract Documents:

(1) allowances shall cover the cost to the Contractor of materials and equipment delivered to the Project site and all applicable taxes, less applicable trade discounts;

(2) the Contractor's costs for unloading, storing, protecting, and handling at the site, labor, installation, overhead, profit and other expenses related to materials or equipment covered by an allowance shall be included in the Contract Sum but not in the allowances;

(3) if required, the Contract Sum shall be adjusted by Change Order to reflect the actual costs of an allowance.

C. Any selections of materials or equipment required of the Architect or Owner under an allowance shall be made in sufficient time to avoid delay of the Work.

**ARTICLE 36
PERMITS, LAWS, and REGULATIONS**

A. PERMITS, FEES AND NOTICES

(1) Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work which are customarily secured after award of the

Construction Contract and which are in effect on the date of receipt of bids.

(2) The Contractor shall comply with and give notices required by all laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

B. TAXES

Unless stated otherwise in the Contract Documents, materials incorporated into the Work are exempt from sales and use tax pursuant to Section 40-9-33, Code of Alabama, 1975 as amended. The Contractor and its subcontractors shall be responsible for complying with rules and regulations of the Sales, Use, & Business Tax Division of the Alabama Department of Revenue regarding certificates and other qualifications necessary to claim such exemption when making qualifying purchases from vendors. The Contractor shall pay all applicable taxes that are not covered by the exemption of Section 40-9-33 and which are imposed as of the date of receipt of bids, including those imposed as of the date of receipt of bids but scheduled to go into effect after that date.

C. COMPENSATION for INCREASES

The Contractor shall be compensated for additional costs incurred because of increases in tax rates imposed after the date of receipt of bids.

ARTICLE 37

ROYALTIES, PATENTS, and COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend, indemnify and hold harmless the Owner, Architect, Architect's consultants and their agents, employees, and consultants from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of, related to, or resulting from all suits or claims for infringement of any patent rights or copyrights arising out of the inclusion of any patented or copyrighted materials, methods, or systems selected by the Contractor and used during the execution of or incorporated into the Work. This indemnification does not apply to any suits or claims of infringement of any patent rights or copyrights arising out of any patented or copyrighted materials, methods, or systems specified in the Contract Documents. However, if the Contractor has information that a specified material, method, or system is or may constitute an infringement of a patent or copyright, the Contractor shall be responsible for any resulting loss unless such information is promptly furnished to the Architect.

ARTICLE 38

USE of the SITE

- A.** The Contractor shall confine its operations at the Project site to areas permitted by the Owner and by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials, equipment, employees' vehicles, or debris. The Contractor's operations at the site shall be restricted to the sole purpose of

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERAL CONDITIONS**

SECTION 00-0040 – Page 48 of 49

constructing the Work, use of the site as a staging, assembly, or storage area for other business which the Contractor may undertake shall not be permitted.

- B.** Unless otherwise provided in the Contract Documents, temporary facilities, such as storage sheds, shops, and offices may be erected on the Project site with the approval of the Architect and Owner. Such temporary buildings and/or utilities shall remain the property of the Contractor, and be removed at the Contractor's expense upon completion of the Work, unless the Owner authorizes their abandonment without removal.

**ARTICLE 39
CUTTING and PATCHING**

- A.** The Contractor shall be responsible for all cutting, fitting, or patching that may be required to execute the Work to the results indicated in the Contract Documents or to make its parts fit together properly.
- B.** Any cutting, patching, or excavation by the Contractor shall be supervised and performed in a manner that will not endanger persons nor damage or endanger the Work or any fully or partially completed construction of the Owner or separate contractors.

**ARTICLE 40
IN-PROGRESS and FINAL CLEANUP**

A. IN-PROGRESS CLEAN-UP

(1) The Contractor shall at all times during the progress of the Work keep the premises and surrounding area free from rubbish, scrap materials and debris resulting from the Work. Trash and combustible materials shall not be allowed to accumulate inside buildings or elsewhere on the premises. At no time shall any rubbish be thrown from window openings. Burning of trash and debris on site is not permitted.

(2) The Contractor shall make provisions to minimize and confine dust and debris resulting from construction activities.

B. FINAL CLEAN-UP

(1) Before Substantial Completion or Final Acceptance is achieved, the Contractor shall have removed from the Owner's property all construction equipment, tools, and machinery; temporary structures and/or utilities including the foundations thereof (except such as the Owner permits in writing to remain); rubbish, debris, and waste materials; and all surplus materials, leaving the site clean and true to line and grade, and the Work in a safe and clean condition, ready for use and operation.

(2) In addition to the above, and unless otherwise provided in the Contract Documents, the Contractor shall be responsible for the following special cleaning for all trades as the Work is completed:

(a) Cleaning of all painted, enameled, stained, or baked enamel work: Removal of all marks, stains, finger prints and splatters from such surfaces.

(b) Cleaning of all glass: Cleaning and removing of all stickers, labels, stains, and paint

from all glass, and the washing and polishing of same on interior and exterior.

(c) Cleaning or polishing of all hardware: Cleaning and polishing of all hardware.

(d) Cleaning all tile, floor finish of all kinds: Removal of all splatters, stains, paint, dirt, and dust, the washing and polishing of all floors as recommended by the manufacturer or required by the Architect.

(e) Cleaning of all manufactured articles, materials, fixtures, appliances, and equipment: Removal of all stickers, rust stains, labels, and temporary covers, and cleaning and conditioning of all manufactured articles, material, fixtures, appliances, and electrical, heating, and air conditioning equipment as recommended or directed by the manufacturers, unless otherwise required by the Architect; blowing out or flushing out of all foreign matter from all equipment, piping, tanks, pumps, fans, motors, devices, switches, panels, fixtures, boilers, sanitizing potable water systems; and freeing identification plates on all equipment of excess paint and the polishing thereof.

C. OWNER'S RIGHT to CLEAN-UP

If the Contractor fails to comply with these clean-up requirements and then fails to comply with a written directive by the Architect to clean-up the premises within a specified time, the Architect or Owner may implement appropriate clean-up measures and the cost thereof shall be deducted from any amounts due or to become due the Contractor

**ARTICLE 41
LIQUIDATED DAMAGES**

- A.** Time is the essence of the Contract. Any delay in the completion of the Work required by the Contract Documents may cause inconvenience to the public and loss and damage to the Owner including but not limited to interest and additional administrative, architectural, inspection and supervision charges. By executing the Construction Contract, the Contractor agrees that the Contract Time is sufficient for the achievement of Substantial Completion.
- B.** The Contract Documents may provide in the Construction Contract or elsewhere for a certain dollar amount for which the Contractor and its Surety (if any) will be liable to the Owner as liquidated damages for each calendar day after expiration of the Contract Time that the Contractor fails to achieve Substantial Completion of the Work. If such daily liquidated damages are provided for, Owner and Contractor, and its Surety, agree that such amount is reasonable and agree to be bound thereby.
- C.** The amount of liquidated damages due under either paragraph B or C, above, may be deducted by the Owner from the moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, or the amount may be recovered from Contractor or its Surety. If part of the Work is substantially completed within the Contract Time and part is not, the stated charge for liquidated damages shall be equitably prorated to that portion of the Work that the Contractor fails to substantially complete within the Contract Time. It is mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUPPLEMENTARY CONDITIONS**

SECTION 00-0050 – Page 1 of 2

1.1 SUMMARY

- A. Related Documents:
 - 1. Document 00 7200 - General Conditions.
 - 2. Division 01 - General Requirements.

1.2 GENERAL

- A. The following supplements modify, delete from, or add to the General Conditions referenced above.
- B. Where provisions of the General Conditions are modified, unaltered provisions remain in effect.

1.3 SUPPLEMENTS

1.4 ADDITIONAL REQUIREMENTS

A. Preliminary Drawings and Specifications – Prior to beginning construction, Contractor shall mark all preliminary drawings as VOID and insure no preliminary drawings will be used during construction. Contractor shall further direct his subcontractors, vendors, and trades to do likewise. At execution of the construction contract, the Contractor and his subcontractors shall certify that all contracts reflect the provisions of the current and official drawing revision that will be used to obtain permits and licenses from the Authorities Having Jurisdiction (AHJ)

B. Drawings and Specifications for Permitting – Contractor will be furnished computer .pdf files for bidding, building permits, and construction transmitted by email. These drawings and specifications will be labeled *Drawings and Project Manual For Construction* and will contain the Architect's Alabama registration seal. The Contractor is authorized to make sufficient copies as is required by the AHJ for submittals and procuring all required permits. The Project Manual may also be referred to as "Project Specifications"

C. Revised Drawings and Specifications - In the event that drawings are revised due to subsequent changes by the Owner or comments by the AHJ, the Contractor will be furnished amended documents by emailed .pdf files, either by individual sheet, or groups of sheets, or full set. Contractor is responsible for distribution and receipt of amended sheets to all subcontractors, vendors, and trades.

D. Drawings and Specifications for Construction– Contractor will maintain the official printed permit set of drawings and specifications for use as the master construction set. These drawings will be labeled *Drawings and Project Manual For Construction* and will contain the Architect's Alabama registration seal, and the AHJ certification stamp. The Contractor alone is authorized to make an unlimited number of copies for his and his sub-contractors' use, at the

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUPPLEMENTARY CONDITIONS**

SECTION 00-0050 – Page 2 of 2

Contractor's expense. Such authorization shall expire at the completion of construction, and all drawings that can be accounted for, except final record sets, shall be destroyed or returned to Architect.

E. Additional Insured Provisions – Contractor's General, Automobile, and Umbrella Liability Insurance Policies shall name the Owner, the Architect, and their agents, consultants, and employees as Additional Insureds, stating that this coverage shall be the primary insurance for the Additional Insureds, and contain no exclusions of the Additional Insureds relative to job accidents. Architect must be furnished Certificates of Insurance listing Architect and consultants as Additional Insured. This requirement is in accord with General Conditions of the Contract 00 0040, Article 29.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INVITATION TO BID**

SECTION 00-0200 – Page 1 of 2

INVITATION TO BID

Project: Shelby County EMA & IT Building Project

Owner: Shelby County Commission

Sealed bids for the **EMA/IT Building, 260 McDow Road, Columbiana, AL 35051** will be received by the Shelby County Commission in the Office of the Chief Financial Officer located at 200 West College Street, Room 125, Columbiana, AL 35051 until 2:00 p.m. on November 25, 2025 and at the time will be opened, and publicly read.

The owner requires the Project to be complete within **365** calendar days from date indicated on the notice to proceed. (See detail on construction time periods in Section 00-1020.)

All interested bidders may obtain copies of the Construction Documents upon receipt of a \$100.00 non-refundable payment. Checks should be made payable to the Shelby County Commission. Interested bidders may obtain Bid Documents from the Shelby County Department of Facilities & General Services office located at 280 McDow Road, Columbiana, Alabama 35051. Electronic copies of bid documents may be obtained at no cost by sending a request to rlecroy@shelbyal.com. Contact Trey Gauntt at 205-670-6461 or at trey@shelbyal.com regarding any questions.

A mandatory pre-bid conference will be held at 10:00 a.m. on November 17, 2025 at the Shelby County Administration Building, 200 West College Street, Columbiana, AL 35051.

Attendance at the Pre-Bid Conference IS REQUIRED for all General Contractor Bidders intending to submit a Proposal, and is highly recommended for Subcontractors. Bids from General Contractors not attending the Pre-Bid Conference will be rejected. Shelby County reserves the right to waive this requirement if it is determined to be in the best interest of the County.

Bidders will be required to provide Bid security in the form of a Bid Bond or cashier's check in the amount of a sum no less than five (5) percent of the Bid Price.

Refer to other bidding requirements described in Document 00201 – Instructions to Bidders

Submit your Bid on the Bid Form provided.

Your Bid will be required to be submitted under a condition of irrevocability for a period of sixty (60) days after submission.

The attention of bidders is called to the provisions of State Law Governing General Contractors, as set forth in Sections 34-8-1 to 34-8-24, inclusive, Code of Alabama of 1975, as amended; and the provisions of said law shall govern bidders insofar as it is applicable.

SHELBY COUNTY EMA & IT BUILDING PROJECT

INVITATION TO BID

SECTION 00-0200 – Page 2 of 2

The above-mentioned provisions of the Code make it illegal for the Owner to consider a bid from anyone who is not properly licensed under such code provisions. The Owner, therefore will not consider any bid unless the bidder produces evidence that he is licensed. Neither will the Owner enter into a Contract with a foreign corporation which is not qualified under State Law to do business in the State of Alabama.

The attention of non-resident bidders is called to the provisions of Alabama Law, Section 39-3-5, Code of Alabama 1975, as amended, relating to preference to be given to resident contractors in Alabama over non-resident contractors in the award of contracts in the same manner and to the same extent as provided by the laws of the state of domicile of the non-resident contractor, and to the requirements that the bid documents tendered by any non-resident contractor must be accompanied by "a written opinion of an attorney-at-law licensed to practice law in such non-resident contractor's state of domicile as to the preference, if any or none, granted by the law of the state to its own business entities whose principal places of business are in that state in the letting of any or all public contracts."

REQUIREMENTS FOR BIDDERS

Bidding contractor will be required to provide evidence of E-Verify documentation and Section 84 business license.

IMMIGRATION LAW

By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

OPEN TRADE

By signing this contract, vendor agrees that it is not currently engaged in, nor will it engage in, any boycott of a person or entity based in or doing business with a jurisdiction with which the State of Alabama can enjoy open trade.

Please provide your bid response in triplicate, one original and two copies.

The Owner reserves the right to accept or reject any or all Bids.

Chad Scroggins
County Manager

SHELBY COUNTY EMA & IT BUILDING PROJECT INSTRUCTIONS TO BIDDERS

SECTION 00-0201 – Page 1 of 6

1.1 SECURITY DOCUMENTS

Bidders may obtain Bid Documents from the Shelby County Facilities & General Services office located at 280 McDow Road, AL 35051 (telephone 205/670-6461). Electronic copies of bid documents may be obtained at no cost by sending a request to rlcroy@shelbyal.com.

1.2 BID FORM

- A. In order to receive consideration, make all bids in strict accordance with the following:
 - 1. Make bids upon the forms provided therefore, properly executed and with all items filled out.
 - 2. Do not change the wording of the Bid Form, and do not alter the Bid Form.
 - 3. Unauthorized conditions, limitations, or provisions attached to the proposal shall be cause for rejection of the proposal.
 - 4. Telegraphic bid or telegraphic modification of bid will not be considered.
 - 5. Bids received after the time specified for receiving them will not be considered.
 - 6. Late bids will be returned to the sender unopened.
 - 7. Each bid shall be addressed to the Owner, and shall be delivered to the Owner at the address given in the Invitation to Bid on or before the day and hour set for receiving bids.
 - 8. Each bid shall be enclosed in a sealed envelope bearing the title of the Work, the name of the Bidder and address, Bidder's license number, classification of license, limits of classification, expiration date, and the date and hour of the bid opening.
 - 9. It is the sole responsibility of the bidder to see that his bid is received on time.

Bidders are cautioned that, in order to be considered responsive, a complete bid for the project, including unit prices and any specified allowances, must be submitted. A bid for less or with exceptions or clarifications will not be considered responsive.

1.3 BONDS

- A. BID BONDS
 - 1. A Certified Check or Bid Bond for the lesser of five percent (5%) of the proposed Contract Amount or \$10,000 made payable to Shelby County Commission must accompany each bid as evidence of good faith.
 - 2. All Bid Bonds shall be on the standard form provided.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INSTRUCTIONS TO BIDDERS**

SECTION 00-0201 – Page 2 of 6

3. The Successful Bidder's bond will be retained until he has signed the Contract and furnished the required Labor and Materials Payment and Performance Bond.
4. The Owner reserves the right to retain the bond of the two next lowest Bidders until the lowest Bidder enters into contract or until 60 days after the Bid Opening, whichever is shorter.
5. All other Bid Bonds will be returned as soon as practicable, and in accordance with Alabama State Law.
6. If any bidder refuses to enter into a Contract, the Owner will retain his Bid Bond as liquidated damages, but not as a penalty.

B. OTHER BONDS

1. Prior to signing the Contract, the Owner will require the successful bidder to secure and post a Performance Bond in the amount of 100 percent of the Contract Sum, Labor and Materials Payment Bond in the amount of 50 percent of the Contract Sum.
2. All such bonds shall be issued by Surety acceptable to the Owner. Include the costs of all such bonds in the proposed Contract Sum.

1.4 PRIOR TO BID

A. Examination of Drawings, Project Manual and Site of Work:

1. **Before submitting a Bid, each Bidder shall carefully examine the Drawings, read the Bid Documents, and visit the site of the Work. Bidders will need to coordinate with Owner to get access to the site.**
2. Each Bidder shall fully inform himself prior to bidding as to all existing conditions and limitations under which the Work is to be performed, and he shall include in his Bid a sum to cover all costs of all items necessary to perform the Work as set forth in the proposed Bid Documents.
3. Allowance will not be made to any Bidder because of lack of such examination or knowledge of the existing conditions.
4. The submission of a Bid will be construed as conclusive evidence that the Bidder has made such examination.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INSTRUCTIONS TO BIDDERS**

SECTION 00-0201 – Page 3 of 6

B. Interpretation of Bid Documents Prior to Bidding

1. If any person contemplating submitting a Bid for construction of the Work is in doubt as to the true meaning of any part of the proposed Bid Documents, or finds discrepancies in or omissions from any part of the proposed Bid Documents, he may submit to the Owner a written request by email to trey@shelbyal.com for interpretation thereof not later than three days before Bids are specified to be received.
 - a. The person submitting the request shall be responsible for its prompt delivery.
 - b. Interpretation or correction of proposed Bid Documents will be made only by Addendum and will be mailed, faxed, or delivered to each bidder of record. Each Addendum will have a location for acknowledgement of receipt and understanding of its contents. **Bids will not be considered complete if a signature of an officer of the bidding party does not appear thereon.**
 - c. The Owner will not be responsible for any other explanations or interpretations of the proposed Bid Documents.

1.5 BIDS

A. Withdrawal of Bids

1. Any Bidder may withdraw his Bid, either personally or by written request, if received by the Owner at any time prior to scheduled time for opening bids.
2. Bidder cannot withdraw his Bid for a period of 60 days after the date set for receiving thereof.
3. Each Bid shall be subject to acceptance by the Owner during this period.

B. Award or Rejection of Bids

1. **The Contract, if awarded will be awarded to the responsive low Bidder who proposes the lowest Contract Sum on the basis of the Base Bid plus any approved alternates**, subject to the Owner's right to reject any or all Bids and waive informality and irregularity in the Bids and in the bidding.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INSTRUCTIONS TO BIDDERS**

SECTION 00-0201 – Page 4 of 6

- C. Proof of Competency of Bidder
 - 1. At the time of bid, bidder must furnish a list of previous projects successfully completed. The list provided must include specific contacts and telephone numbers for each project. All projects must meet the requirements listed in Section 00 00200.
 - 2. Any Bidder may be required to furnish additional evidence satisfactory to the Owner that he and his proposed Subcontractors have sufficient experience in the types of work called for to assure completion of the Contract in a satisfactory manner and that their current project workload will not limit their capability.

1.6 EXECUTION OF AGREEMENT

- A. Public Works Contract.
- B. The Bidder to whom the Contract is awarded by the Owner shall, within 10 days after Notice of Award and receipt of Agreement forms from the Owner, sign and deliver to the Owner all required copies of the Contract.
- C. The Bidder to whom the Contract is awarded by the Owner shall receive five (5) sets of Construction documents. Any sets needed beyond the initial five sets may be purchased from the Owner.
- D. At or prior to the delivery of the signed Agreement, the Contractor shall deliver to the Owner the Labor and Materials Payment Bond, the Performance Bond, and the policies of insurance or Insurance Certificates as required by the Bid Documents.
- E. All bonds and policies of insurance must be approved by the Owner before the successful Bidder can proceed with the Work.
- F. Failure or refusal to furnish bonds or insurance policies or certificates in a form satisfactory to the Owner and in a timely manner, shall subject the Bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INSTRUCTIONS TO BIDDERS**

SECTION 00-0201 – Page 5 of 6

CONTRACT TIMES

- G. Contractor agrees that the work will be substantially complete within **365** calendar days from the date indicated on the Notice to Proceed.
- H. If the Contractor is delayed, hindered or impeded at any time in the progress of the Work for any reason or by any alleged act or neglect of the Owner, or the Architect, or by any employee of any of them or by a separate Contractor employed by the Owner, or by changes ordered in the scope of the Work, or by other causes beyond the Contractor's control, then the Contract Time may be extended by Change Order for such reasonable time as is agreed to by the Owner. However, to the fullest extent permitted by law, and notwithstanding any other provisions in the Contract Documents, and whether contemplated or not, and whether or not arising by active interference by the Owner and his agents and employees shall not be liable for any damages for delay whether for direct or indirect costs, extended home office overhead, idle or inefficient labor or equipment, cost escalations, or monetary claims of any nature arising from or attributable to delay by any cause whatsoever. The Contractor's sole and exclusive right and remedy for delay by any cause whatsoever is an extension of the Contract Time but no increase in the Contract Sum.
- I. 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.
- J. The Contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and delay to construction activities which do not affect the overall completion of the Work does not entitle the Contractor to any extension in the Contract Time.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
INSTRUCTIONS TO BIDDERS**

SECTION 00-0201 – Page 6 of 6

K. Time Extension for Unusually Severe Weather:

This provision specifies the procedure for determination of time extensions for unusually severe weather. In order for the Owner 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 to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

1.7 LIQUIDATED DAMAGES

Should the Contractor fail to substantially complete the work within the specified time, an assessment of \$1300 per day shall be applied as damages and not as a penalty.

1.8 COORDINATION

It is the responsibility of the Contractor to schedule and coordinate any required testing and inspections.

End of Section

**SHELBY COUNTY EMA & IT BUILDING PROJECT
BID REQUIREMENTS**

SECTION 00-0202 – Page 1 of 2

BID REQUIREMENTS

INSURANCE REQUIREMENTS:

The Contractor shall provide certification of required coverage to the Owner. Certification shall provide Owner with **10 days Notice of Cancellation**. Required insurance shall not be written for less than the following limits, or greater if required by law. Additional named insured shall be the Shelby County Commission, its officers, agents, and employees, successors or assigns.

Contractor's Liability Insurance:

1. Worker's Compensation
 - a. State Statutory
 - b. Applicable Federal Statutory
 - c. Employer's Liability \$500,000
 - d. Benefits required by Union labor as applicable
 - e. Voluntary Compensation \$100,000
 - f. Broad Form all States Endorsement

2. Comprehensive General Liability (including Premises - Operations; Independent Contractor's Protective; Products and Completed Operations; Broad Form Property Damage; Contractual Liability; Personal Injury; all as combined single limits):
 - a. Bodily Injury/Property Damage, each occurrence \$1,000,000
 - b. Products/Completed Operations annual aggregate \$1,000,000

Products and Completed Operations Insurance shall be maintained for 3 years after the work has been completed; Property Damage liability insurance will provide X, C, or U coverage as applicable; Fellow employee Suits to be included.

3. Comprehensive Automobile Liability (owner, non-owned, hired): Combined single limits for bodily injury and property damage:
 - a. Bodily Injury/Property Damage, each occurrence \$1,000,000

**SHELBY COUNTY EMA & IT BUILDING PROJECT
BID REQUIREMENTS**

SECTION 00-0202 – Page 2 of 2

Indemnity:

The Contractor shall assume all liability for and shall indemnify and save harmless the Shelby County Commission, its officers, agents, and employees, and their successors and assigns, and their consultants and employees from all damages and liability for injury to any person or persons, and injury to or destruction of property, including the loss of use thereof, by reason of an accident or occurrence arising from operations under the Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them, occurring on or about the premises or the ways and means immediately adjacent, during the term of the Contract, or any extension thereof, and shall also assume the liability for injury and/or damages to adjacent or neighboring property by reason of work done under this Contract.

The insurance shall extend to and include all of the Contractor's operations, regardless of whether they may be in connection with work that is temporary, permanent, or classified as "extra work".

NOTICE OF COMPLETION:

The CONTRACTOR immediately after the completion of the contract shall give notice in writing to the COUNTY. The COUNTY, upon completion and acceptance by COUNTY of the work, shall give notice of completion of the PROJECT by advertising and publishing on the COUNTY website. The publication and advertisement shall be posted for three consecutive weeks. Final settlement shall not be made upon the contract until the expiration of 30 days after the completion of the notice.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROPOSAL FORM AND SAMPLE BID BOND**

SECTION 00-0300 – Page 1 of 3

Bids shall be submitted in triplicate.

DATE: _____

TO: Mr. Chad Scroggins
Shelby County Commission
Contractor 200 West College Street
Columbiana, AL 35051

Bidding

1. Pursuant to and in compliance with the Invitation to Bid and the proposed Contract Documents relating to the construction of:

**Shelby County EMA & IT Building Project
Shelby County**

Including Addenda _____

The undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the Work at the place where the Work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the Work within the time stated and in strict accordance with the proposed Contract Documents, including furnishing any and all labor and materials, and to do all work required to construct and complete said Work in accordance with the Contract Documents, for the following sum of money:

Total Base Bid Amount - \$ _____

Add Alternate #1

Item Description	Unit	Quantity	Unit Price	Amount Bid
Proposed Parking Lot (See Plan Sheet C200)	LS	1		

Add Alternate #2

Item Description	Unit	Quantity	Unit Price	Amount Bid
Existing Parking Lot Repair (See Plan Sheet C200)	SY	700		

Add Alternate #3

Item Description	Unit	Quantity	Unit Price	Amount Bid
Existing Parking Lot, Wearing Surface & Striping (See Plan Sheet C200)	LS	1		

Total Base Bid Amount and All Alternates - \$ _____

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROPOSAL FORM AND SAMPLE BID BOND**

SECTION 00-0300 – Page 2 of 3

2. I understand that Shelby County reserves the right to reject this Bid, but that this Bid shall remain open and not be withdrawn for a period of sixty (60) days from the date prescribed for its receiving.
3. There will not be a pre-bid meeting for this project. Any questions or clarifications regarding the bid should be submitted in writing and answers will be provided.
4. The Bidder, if awarded the contract, hereby agrees to commence work under this contract on or before a date to be specified in a written Notice to Proceed from the Owner and to fully complete work as specified in the required timeframe.
5. If written notice of the acceptance of this Bid is mailed or delivered to the undersigned within sixty (60) days after the date set for the receiving of this Bid, or at any other time thereafter before it is withdrawn, the undersigned shall execute and deliver the Contract Documents to the Owner in accordance with this Bid as accepted, and will also furnish and deliver to the Owner the proof of insurance coverage, within ten (10) days after personal delivery or any deposit in the mails of the notification of acceptance of this Bid.
6. Notice of Acceptance or request for additional information may be addressed to the undersigned at the address set forth in Item 7 below.
7. The names of all persons interested in foregoing Bid as principals are:

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, give legal name of corporation, state where incorporated, and names of president and secretary; if a partnership, give name of firm and names of all individual co-partners composing the firm; if Bidder or interested person is an individual, give first and last names in full.)

NOTE: If Bidder is a corporation, set forth the legal name of the corporation together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation. If Bidder is a partnership, set forth the name of the firm together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership.

The Bidder acknowledges by his signature that he agrees to requirements contained in the Invitation to Bid and the Instructions to Bidders, and that should he fail to execute a Contract with the Owner, should the Owner award said Contract to him, that the Owner may rightfully collect the sum of the Bid Bond. The required Bid Bond is attached to this Bid.

NAME OF FIRM: _____

ADDRESS: _____

ALABAMA GENERAL CONTRACTOR'S LICENSE #: _____

SIGNED: _____

PRINT NAME: _____

TITLE: _____

Note: If a corporation, Bid must be signed by person authorized by corporation by-laws to bind it to a contract.

The entirety of this project shall be bid as a **“LUMP SUM BID”**. The Bidder agrees to perform all necessary work described in the **CONTRACT DOCUMENTS** for the project, constituted by the **LUMP SUM BID**.

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS:

That the contractor, as Principal, and _____
(Name of Surety)

_____, as Surety, are held and firmly bound
unto _____
(Address)

the **SHELBY COUNTY COMMISSION** as Obligee in the full and just sum of five percent (5%) of amount bid (Maximum amount - \$10,000.00), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal is herewith submitting its proposal for

PROJECT NAME: _____

The condition of this obligation is such that:

If the aforesaid Principal shall be awarded the contract and 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 will be void; otherwise, the Principal and the Surety will pay unto the Obligee the difference in money between the amount of the contract as awarded and the amount of the proposal of the next lowest acceptable bidder, but not to exceed the total amount of the proposal guaranty. If no other bids are received, the full amount of the proposal guaranty shall be retained and/or recovered as liquidated damages for such default.

Witness our hands and seals this _____ day of _____,
20____.

SIGNATURE OF INDIVIDUAL BIDDER: (USE ONLY WHERE BIDDER IS AN INDIVIDUAL)

_____, Doing Business As, _____
(Name of Individual) (Business Name)

Business Mailing Address: _____

NAME OF PARTNERSHIP, JOINT VENTURE OR CORPORATION:

(Name of Partnership, Joint Venture or Corporation*) – (If Two Corporations**)

Business Mailing
Address: _____ BY: _____ (L.S.)

(Signature and Position or Title of
Officer Authorized to Sign Bids and
Contracts for the Firm)

Business Mailing
Address: _____ BY: _____ (L.S.)

(Signature and Position or Title of
Officer Authorized to Sign Bids and
Contracts for the Firm)

Business Mailing
Address: _____ BY: _____ (L.S.)

(Signature and Position or Title of
Officer Authorized to Sign Bids and
Contracts for the Firm)

* (Corporate Seal)
Attest:

Name of State under the laws of which the
Corporation was chartered:

(Secretary)

** (Corporate Seal)
Attest:

Name of State under the laws of which the
Corporation was chartered:

(Secretary)

(Name of Surety)

BY: _____
(Attorney-in-Fact)

**PROPOSAL WILL NOT BE ACCEPTED UNLESS THIS FORM FOR BID BOND IS USED,
AND BIDS WILL NOT BE CONSIDERED UNLESS THIS FORM IS SIGNED BY PRINCIPAL
AND SURETY OR A CERTIFIED CHECK IN THE PROPER AMOUNT IS FURNISHED.
CASHIER'S CHECK IS NOT ACCEPTABLE.**

PLEASE LEAVE ATTACHED IN YOUR BIDDING FORM

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT SUMMARY**

SECTION 00-1010 – Page 1 of 1

Part 1 – General

Project Description:

Contractor shall provide materials and construction services for the project at EMA & IT building, as shown on the project drawings and specifications. The work shall comply with the following specifications; see attached exhibits.

Requirements for Contractor:

Contractor and contractors on site staff shall have experience in the construction of similar projects. Contractor shall provide documentation satisfactory to Owner of compliance with these experience requirements and that contractor's operator is competent to construct the proposed project.

Construction Timeframe:

Project to be complete within the allowed contract time specified in Section 00-0201.

Construction Scope and Site Conditions:

Operator(s) to construct the project per the project specifications and layout.

Contractor is expected to execute a Public Works Contract, Bonds and provide other required documents as required by the contract and Local and State laws.
(Sample Attached)

Building permit and other permits required are the responsibility of the Contractor.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT NOTES**

SECTION 00-1020 – Page 1 of 2

1. The successful bidder, upon notification by the Owner, shall have ten (10) days to execute a contract pertaining to the scope of work as identified within this bid proposal package. Failure to do so shall result in forfeiture of the bidder's bond subject to stipulations as provided herein.
2. After the contract is signed and executed by both parties, the Owner shall issue a "Notice to Proceed" to the successful bidder.
3. Upon failure of the Contractor to complete the contract work within the specified time in Section 00-1010, the Contractor shall be assessed liquidated damages of the amount specified in Section 00-0201. Construction can begin on site any time after the date on the Notice to Proceed and must be substantially complete no later than time indicated on construction documents.
4. The contractor shall locate all utilities prior to commencing construction. Prior to the start of construction, the contractor shall field verify the locations of all pipes, power lines, and utilities to check for conflicts with the construction project. The Contractor shall notify the Owner immediately if a conflict is found prior to commencement of construction. It shall be the responsibility of the Contractor to determine the exact location of all existing utilities, whether shown on the plans or not. In the event of a conflict it shall be the responsibility of the contractor to cooperate with the applicable utility company.
5. It is the responsibility of the contractor to verify all quantities and site conditions prior to bidding. The Contractor shall notify the Owner prior to bidding of any discrepancies in the plans.
6. The Contractor shall be responsible for obtaining all construction permits, (building permit and NPDES permit if required).
7. If required, any erosion control devices required will be the responsibility of the contractor and shall be installed and maintained by the contractor per the project plans and per ADEM BMP specifications.
8. The existing access drive will remain open during construction.
9. The Contractor will be responsible for any and all aspects of job safety. The Owner will not supervise or inspect any safety feature.
10. It shall be the duty and the responsibility of the Contractor to give notification to the Owner 24 hours prior to commencement of any construction activity. Failure to notify as required may be grounds for non-acceptance.
11. Proof of Competency of Bidder – At the time of bid, bidder must furnish a list of previous similar projects successfully completed. The list provided must include specific contacts and telephone numbers for each project. Upon request prior to award of bid the Owner may request any bidder to furnish additional evidence satisfactory to the Owner that he and his proposed Subcontractors have sufficient experience in the types of work called for to assure completion of the Contract in a satisfactory manner and that their current project workload will not limit their capability. Successful Bidder shall submit a list of subcontractors to be employed on the project.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT NOTES**

SECTION 00-1020 – Page 2 of 2

12. Prior to installation or request for associated field inspections, shop drawings shall be submitted for review and approval, designed in accordance with the project plans and specifications.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
COST REPORTING AND PAYMENTS**

SECTION 00-1025 – Page 1 of 2

Part 1 – General

1.1 SECTION INCLUDES

- A. Procedural requirements for processing the following:
 - 1. Schedule of Values
 - 2. Cash flow projections for the project
 - 3. Lump Sum and Unit prices (if any)
 - 4. Payment applications
 - 5. Payments at substantial completion
 - 6. Payment at final completion
 - 7. Identification of substitutions and alternatives in payment requests
 - 8. Accounting of Change Order amounts and allowances, and similar cost and pay-out related requirements

1.2 LUMP SUM PRICE SCHEDULE

- A. General:
 - a. It is recognized that this project is a lump sum bid as listed in the Bid Form, and that the Owner - Contractor Agreement records acceptance or rejection of the bid price, either as bid or as otherwise agreed upon by the date of the Agreement.
 - b. It is recognized that the utilization of the lump sum price contain total costs as defined therein, and include each entity's total cost to include margins for overhead and profit.

1.3 PAYMENT REQUESTS

- A. General:
 - a. Except as otherwise indicated in the Contract Documents, comply with the procedures and requirements of the General Conditions, including the submittal of supporting documentation and waivers or releases of lien.
 - b. Refer to the Supplementary Conditions for requirements concerning "retainage" by Owner on payment.
 - c. Except as otherwise indicated, sequence of progress payments shall be made on a regular basis, and each must be consistent with previous applications and payments.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
COST REPORTING AND PAYMENTS**

SECTION 00-1025 – Page 2 of 2

B. Payment Application Times:

The period of construction work covered by each payment request is the period indicated in the General Conditions.

C. Final Payment Application:

- a. The administrative actions and submittals which must precede or coincide with submittal of the final payment application can be summarized as follows but not necessarily limited to these:

- i. Completion of project closeout requirements
- ii. Completion of items specified for payment application at time of substantial completion (regardless of whether such application was made).
- iii. Written assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
- iv. Transmittal of required project construction records to Owner.
- v. Proof, satisfactory to Owner, that taxes, fees and similar obligations of the Contractor have been paid.
- vi. Removal of temporary facilities, services, surplus materials, rubbish and similar provisions.
- vii. Final payment for the work to be performed under this project shall be in accordance with the advertisement of completion requirements as set forth in the State of Alabama Public Works Bid Law.

Part 2 – Products

Not Used

Part 3 –Execution

Not Used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
MEASUREMENT AND PAYMENT**

SECTION 00-1026 – Page 1 of 1

Part 1 – General

1.1 SECTION INCLUDES

- A. The entirety of the Project shall be bid lump sum price. The Bidder agrees to perform all necessary work described in the Contract Documents. Alterations to the Construction Contract will be based on the lump sum price established in the Base Bid Schedule, and the Bidder will receive no additional compensation for items covered under this scope. All materials and services provided for construction on this project shall meet or exceed the requirement of the project specifications outlined herein.
- B. Even though an item of work is included in the technical specifications, if it is not both covered herein and specifically itemized in the Bid Form, payment for it shall not be separately made. Such work shall be considered a necessary part of or incidental to its related work and shall be subsidiary obligation to the items of work being performed.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CHANGE ORDER PROCEDURES**

SECTION 00-1028 – Page 1 of 3

Part 1 – General

1.1 SECTION INCLUDES

- A. Procedural requirements for considering and processing Change Orders.
- B. Related Requirements:
 - a) Agreement: The amounts of established unit prices
 - b) Conditions of the Contract:
 - 1. Methods of determining cost or credit to Owner resulting from changes in Work made on a time and material basis.
 - 2. Contractor's claims for additional costs
 - c) Section 01025: Cost Reporting and Payments

1.2 PRELIMINARY PROCEDURES

- A. Owner or Engineer may initiate a potential change by submitting a Proposal Request to Contractor. Request will include the following:
 - a) Detailed description of the change, products, and location of the change in the Project.
 - b) Supplementary or revised drawings and specifications.
 - c) The Projected time span for making the change, and a specific statement as to whether overtime work is, or is not, authorized.
 - d) A specific period of time during which the requested price will be considered valid.
 - e) Such request is for information only, and is not an instruction to execute the changes, nor is it a mandate to stop work in progress.
- B. Provide full written data required to evaluate changes.
 - a) Maintain detailed records of work performed on a time-and-material/force account basis.
 - b) Provide full documentation to Owner upon request.
- C. Designate in writing the member of Contractor's organization:
 - a) Who is authorized to accept changes in the work
 - b) Who is responsible for informing others in the Contractor's organization of the authorization of changes in the work.
- D. Owner will designate in writing the person who is authorized to execute Change Orders.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CHANGE ORDER PROCEDURES**

SECTION 00-1028 – Page 2 of 3

1.3 CONSTRUCTION CHANGE DIRECTIVES

- A. In absence of total agreement on the terms of a Change Order, the Owner may prepare and issue a Construction Change Directive directing a change in the work, for subsequent inclusion in a Change order.
 - a) Construction Change Directive will describe changes in the Work, and describe the method of determining any change in the Contract Sum or Contract Time, or both
 - b) The Owner will sign construction Change Directive
- B. Upon receipt of a Construction Change Directive, Contractor shall do the following:
 - a) Promptly proceed with the change in the work involved
 - b) Promptly advise the Owner 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.
- C. A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them.
 - a) Such agreement shall be effective immediately and shall be recorded as a Change Order
 - b) If Contractor does not respond promptly or if he disagrees with the Construction Change Directive, he shall comply with General Conditions.
- D. A Construction Change Directive shall be processed in compliance with requirements of the General Conditions.

1.4 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for a lump-sum proposal, and for each unit price that has not previously been established, with sufficient substantiating data to allow Owner to evaluate the quotation.
- B. On request provide additional data to support time and cost computations:
 - a. Labor required
 - b. Equipment required:
 - i. Recommended source of purchase and unit cost
 - ii. Quantities required
 - c. Taxes, insurance and bonds
 - d. Credit for work deleted from Contract, similarly documented
 - e. Overhead and profit, for subcontractor and General Contractor separately
 - f. Justification for any change in Contract Time

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CHANGE ORDER PROCEDURES**

SECTION 00-1028 – Page 3 of 3

- C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump sum proposal, plus the following additional information:
 - a. Name of the Owner's authorized agent who ordered the Work, and date of the order
 - b. Dates and hours work was performed, and by whom
 - c. Time record, summary of hours worked, and hourly rates paid
 - d. Receipts and invoices for:
 - e. Equipment used, listing dates and times of use
 - f. Products used, listing of quantities
 - g. Subcontracts
 - h. Overhead and Profit, taxes, insurance
- D. Document requests for substitutions for Products as specified elsewhere in Division One

1.5 PREPARATION OF CHANGE ORDERS

- A. Contractor will prepare each Change Order.
- B. Change Order will describe change in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.
- C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.6 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of Work, and to record the adjusted Contract Sum.
- B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub-schedules to show changes for other items of Work affected by the changes.
- C. Upon completion of Work under a Change Order, enter pertinent changes in Record Documents.

PART 2 -- PRODUCTS

Not Used

PART 3 -- EXECUTION

Not Used

END OF SECTION

Part 1 – General

1.1 PRE-CONSTRUCTION MEETING

- A. Schedule meeting within the early stages of Construction as determined by the owner.
- B. Suggested Agenda: Contractor shall prepare written material, distribute lists, and discuss the following:
 - a. Identification of major Subcontractors and Suppliers
 - b. Projected construction schedule (To be supplied in bar chart format by the Contractor prior to beginning work)
 - c. Critical work sequencing
 - d. Major Equipment deliveries and priorities
 - e. Project coordination, including designation of responsible persons
 - f. Procedures for, and processing of:
 - i. Field decisions
 - ii. Proposal requests
 - iii. Submittals
 - iv. Change orders
 - v. Applications for payments
 - g. Adequacy of distribution of Contract Documents
 - h. Procedures for maintaining Record Documents
 - i. Use of premises
 - i. Work and storage areas
 - ii. Owner's requirements
 - j. Construction facilities, construction aids, and controls
 - k. Temporary utilities
 - l. Safety and first aid procedures
 - m. Security procedures
 - n. Housekeeping procedures
 - o. Working days/hours
 - p. Erosion control and stormwater management

1.2 PROGRESS MEETINGS

- A. Schedule progress meetings as determined by the owner when they are necessary.
- B. Suggested Agenda:
 - a. Review and approval of minutes of previous meeting
 - b. Review of work progress since previous meeting
 - c. Field observations, problems, conflicts.
 - d. Problems which impede construction schedule

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT MEETINGS**

SECTION 00-1200 – Page 2 of 2

- e. Corrective measures and procedures required to regain projected schedule
- f. Revisions to construction schedule
- g. Plan progress and schedule for succeeding work period
- h. Coordination of schedules
- i. Review submittal schedules; expedite as required
- j. Review proposed changes for:
 - i. Effect on construction schedule and on completion date
 - ii. Effect on other contracts of the Project
- k. Other Business

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONSTRUCTION SCHEDULES**

SECTION 00-1310 – Page 1 of 2

Part 1 – General

1.1 SECTION INCLUDES

Procedures for preparation, submission and review of “Horizontal Bar Type” Progress or Construction Schedules for the entire project, and bi-weekly updating.

1.2 FORM OF SCHEDULES

Prepare Construction Schedules in the form of a horizontal bar chart prior to commencing the work. Work shall not commence until the Contractor submits the project schedule for review.

1.3 CONTENT OF SCHEDULES

- A. Construction Schedules shall include the following:
 - a. Complete sequence of construction by activity.

1.4 SUBMITTALS

- A. Submit Design and Construction Schedule within five (5) calendar days after date of a contract award
 - a. Owner will review design and schedule and return a copy marked approved or with comments.
 - b. If required, resubmit for final review.

1.5 DISTRIBUTION

- A. Distribute copies of approved Design and Construction Schedule to job file and other concerned parties.
- B. Instruct all recipients to report any inability to comply and provide detailed explanation with suggested remedies.

1.6 DURATION AND MILESTONES

- A. The Contract Time shall commence to run on the date of issuance of the Notice to Proceed. The project shall be substantially completed within the allowed contract time specified in Section 00-0201. Upon reaching substantial completion, the successful contractor will be issued a letter stating the project has reached substantial completion, the work will be inspected, and a punch list will be generated and forwarded.
- B. The Contractor shall prosecute the work diligently and will avoid interfering with or delaying any progress of any other Contractors or the Owner’s own forces on other project related work.
- C. The Contractor shall be allowed 30 calendar days from the date of award to

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONSTRUCTION SCHEDULES**

SECTION 00-1310 – Page 2 of 2

procure all required materials after such period, contract time charges shall commence. Contract time specified in Section 00-201 will be allowed.

Part 2 - Products

Not used

Part 3 - Execution

Not used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SHOP DRAWINGS, PRODUCT DATA, SAMPLES**

SECTION 00-1340 – Page 1 of 1

Part 1 – General

1.01 SECTION INCLUDES

Procedures for processing Shop Drawings, Product Data, Office Samples, and Certificate of Compliance

1.02 GENERAL PROCEDURES

- A. The approval of submittals does not constitute a Change Order.
- B. All items shall be submitted under Contractor's transmittal letter. The Contractor shall stamp each submittal with his submittal stamp, and shall include the following information:
 - 1. Project by title and Owner's project number
 - 2. Work and products by Specifications Section and Article number
 - 3. Contractor shall submit one copy of every submittal or sample to Owner for review.
- C. Resubmittals: When Owner requires that a submittal be "resubmitted," comply with the requirements of this Section and identify changes made since the previous submittal.
- D. Notify Owner in writing at time of submittal of any deviations from the requirements of Contract Documents.
- E. Make all submittals far enough in advance of scheduled dates for installation to provide sufficient time for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing deliver.
 - 1. Review Time: In scheduling work activities, allow at least seven (7) working days from Owner's receipt for his review. The seventh day shall be defined as the first day of return to the Contractor.
 - 2. Delays caused by the tardiness of the Contractor in preparing and in forwarding of submittals will not be an acceptable basis for extension of the Contract completion date nor for consideration of alternate products that do not meet the specified requirements of this Project Manual.
- F. Starting work which requires submittals to be approved by Owner before Owner approves and returns the submittals to Contractor shall be at Contractor's risk.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STORAGE AND PROTECTION**

SECTION 00-1620 – Page 1 of 2

Part 1 – General

1.01 GENERAL STORAGE

- A. Store products immediately on delivery in accordance with the manufacturer's printed instructions, with seals and labels intact and legible, and protect until installed in the work.
- B. Arrange storage in a manner to provide easy access for inspection.
- C. Provide protection and restrict access to project site, in-place work, and stored materials from vandalism.

1.02 EXTERIOR STORAGE

- A. Provide substantial platforms, blocking or skids to support fabricated products above the ground to prevent soiling or staining.
- B. Cover products that are subject to discoloration, deterioration, or oxidation from exposure to the elements with impervious sheet coverings or sheds constructed of lumber. Provide adequate ventilation to avoid condensation.
- C. Any mechanical or electrical equipment that is to be stored at the Project site shall be protected and periodically maintained in accordance with these Specifications (all applicable sections) and the manufacturer's recommendations. If warehousing of any products to be used in the work is required as a result of inclement weather conditions or other special product needs, all costs shall be borne by the Contractor.
- D. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- E. Provide surface drainage to prevent flow or ponding of rainwater.
- F. Prevent mixing of refuse or chemically injurious materials or liquids.
- G. Maintain a periodic system of inspections of stored products on a scheduled basis to assure that:
 - a. Condition of storage facilities is adequate to provide required conditions.
 - b. Required environmental conditions are maintained on a continuing basis

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STORAGE AND PROTECTION**

SECTION 00-1620 – Page 2 of 2

- c. Surfaces of products exposed to elements are not adversely affected. NOTE: any weathering of products, coatings and finishes is not acceptable under requirements of the Contract Documents.

1.03 PROTECTION AFTER INSTALLATION

- A. Provide substantial coverings to protect installed products from damage from subsequent operations and vandalism. Remove when no longer needed, prior to completion of work.
- B. Control traffic to prevent damage to equipment and surfaces.
- C. Provide coverings to protect finished surfaces from damage.
- D. In other areas subject to foot traffic, secure heavy paper, sheet goods or other materials in place.
- E. For movement of heavy products, lay planking or similar materials in place.
- F. Prohibit traffic of any kind across grassed, seeded, or landscaped areas.

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONTRACT CLOSEOUT**

SECTION 00-1700 – Page 1 of 3

Part 1 – General

1.01 SUBSTANTIAL COMPLETION

- A. When the project is considered to be substantially complete, submit written notice to the Owner that the project or designated portion is substantially complete. Include a list of items to be completed.
- B. Within a reasonable time, Owner will inspect to determine status of completion, and compile a punch list of items to be completed and corrected. If Owner determines that Work is not substantially complete, he will immediately notify Contractor in writing. The Owner will generally point out his reasons; he will not be obligated to give an exhaustive list of discrepancies.
- C. Contractor's Duties are to remedy the deficiencies and send the Owner another written Notice of Substantial Completion.
- D. Owners Actions will be to re-inspect the work and issue a Certificate of Substantial Completion when he considers it to be warranted.

1.02 OWNER OCCUPANCY

- A. Owner's Action: Occupy the Project, or designated portion of the Project, in accordance with provisions of the Certificate of Substantial Completion.
- B. Contractor's Duties:
 - a. Obtain Certificate of Occupancy if required by local building codes authority.
 - b. Obtain consent of insurance company or companies to keep insurance in force during partial occupancy by the Owner.
 - c. Make corrections listed on punch list attached to Certificate of Substantial Completion.
 - d. Perform final clean up.

1.03 FINAL COMPLETION

- A. When this Project is considered to be complete, Contractor shall submit certification indicating the following:
 - a. Contract Documents have been reviewed and Work has been inspected for compliance with those Documents.
 - b. Work has been completed in accordance with Contract Documents.
 - c. All punch list items have been corrected
 - d. Work is complete and ready for final inspection.
 - e. Appropriate notifications have been filed with Governmental Agencies (attach copies.)

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONTRACT CLOSEOUT**

SECTION 00-1700 – Page 2 of 3

B. Owner's actions during final inspection:

- a. Inspect to verify the status of completion with reasonable promptness
- b. Notify Contractor in writing about any Work considered to be incomplete or defective.

C. Contractor's Duties: take immediate action to correct deficiencies, and send certification to Owner that Work is complete.

D. Owner's duties: determine when Work is acceptable then request Contractor to make closeout submittals.

1.04 RE-INSPECTION FEES

Should status of completion of work require re-inspection by Engineer due to failure of work to comply with Contractor's claims on initial inspection, Owner will deduct the amount of Engineer's compensation for re-inspection services from final payment to Contractor.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS REQUIRED

- A. Documents required by State Licensure inspectors and other authorities having jurisdiction.
- B. Project Record Documents: Comply with Section 01720
- C. Operation and Maintenance Data: Comply with Section 01730
- D. Warranties and Bonds: Comply with Section 01740
- E. Evidence of Payment and Release of Liens: Comply with requirements and Conditions of the Contract
- F. Consent of Surety to Final Payment
- G. Certificates of Insurance for Products and Completed Operations: Comply with Supplementary Conditions
- H. Test Results: Complete, dated test results of various systems signed by persons authorized to sign for the qualified testing agencies that conducted tests.
- I. Closeout documents shall require written acceptance by the governing agency.

1.06 STATEMENT OF ADJUSTMENT OF ACCOUNTS

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONTRACT CLOSEOUT**

SECTION 00-1700 – Page 3 of 3

- A. Submit a final statement to Owner indicating all adjustments to the Contract Sum.
Include the following:
- a. Original Contract Sum
 - b. Previous change orders
 - c. Changes under allowances
 - d. Changes under unit prices.
 - e. Deductions for uncorrected work
 - f. Penalties and bonuses
 - g. Deductions for liquidated damages.
 - h. Deductions for re-inspection fees
 - i. Other adjustments to Contract Sum
 - j. Total Contract Sum, as adjusted.
 - k. Previous payments.
 - l. Sum remaining due
- B. If required, a final Change Order will be prepared reflecting approved adjustments to Contract Sum that were not previously made on Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

Submit final Application for Payment in accordance with procedures and requirements of the Conditions of the Contract and Alabama State Law.

1.08 FINAL PAYMENT

Owner will make final payment.

1.09 POST-CONSTRUCTION INSPECTION

Prior to expiration of one year from the Date of Substantial Completion, the Owner will make a visual inspection of the Project to determine whether correction of Work is required, in accordance with the Conditions of the Contract.

The Owner will promptly notify the Contractor, in writing, of any observed deficiencies. Contractor shall then correct deficiencies promptly.

Part 2 – Products

Not Used

Part 3 – Execution

Not Used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT RECORD DOCUMENTS**

SECTION 00-1720 – Page 1 of 2

Part 1 – General

1.01 SECTION INCLUDES

- A. Procedural requirements for maintaining documents and samples at the site as required in the General Conditions.
- B. The General Conditions require the Contractor to maintain a record copy of the following for Owner's review:
 - a. Drawings
 - b. Specifications and Schedules (Project Manual)
 - c. Addenda
 - d. Change Orders and other documents which modify original document
 - e. Approved shop drawings, product data and samples
 - f. Records of all changes made during construction
- C. In addition to the above, the Contractor shall maintain at the site a record copy of the following where applicable:
 - a. Field test records
 - b. Manufacturer's certificates
 - c. Inspection certificates

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Maintain Record Documents on site, apart from the documents used for construction.
- B. Label and file Record Documents in sequence with section number listings in Table of Contents of this Project Manual. Label each document "Project Record" in the lower right hand corner in neat, large printed letters.
- C. Maintain Record Documents in clean, dry, legible condition. Do not use Record Documents for construction purposes.
- D. Keep Record Document and samples available for inspection by Owner.

1.03 RECORDING

- A. Record information concurrently with construction progress. DO NOT conceal work until required information has been recorded.
- B. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including the following:
 - a. Depth of footings in relation to finish first floor level.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PROJECT RECORD DOCUMENTS**

SECTION 00-1720 – Page 2 of 2

- b. Measured horizontal and vertical locations of underground utilities, valves, etc. referenced to the original survey line. Show direction of flow of pipe and depth of piping underground.
 - c. Field changes of dimensions and details
 - d. Changes made by Contract Modifications
 - e. Details not on original Contract Drawings
- C. Project Manual: Legibly mark to record actual construction , including the following:
 - a. On appropriate pages, record changes made by Addenda, Change Orders and other modifications
 - b. On appropriate pages, enter trade name, manufacturer, catalog number, and name of supplier of each product and item actually installed, if different from that specified
 - c. Other items installed but not originally specified

1.04 RECORD DRAWINGS

- A. Record Drawings that are required for Owner's records, shall be recorded on blueprints (other than the construction drawings) kept on the job by the Contractor. Do not use Record Drawings for construction purposes.
- B. The Contractor shall transfer all changes recorded on construction drawings to the Record Drawings. All information shall be recorded neatly and legibly.

1.05 SUBMITTALS

- A. At Contract Closeout, deliver Record Documents and samples, including Record Drawings, to Owner.
- B. Submit Record Documents under cover of a transmittal letter containing:
 - a. Date
 - b. Project title and number
 - c. Contractor's and subcontractor's names and addresses
 - d. Title and number of each Record Document
 - e. Certification that each document submitted is complete and accurate
 - f. Signature of Contractor or his authorized representative

Part 2 – Products

Not Used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
WARRANTIES AND BONDS**

SECTION 00-1740 – Page 1 of 2

Part 1 – General

1.01 SECTION INCLUDES

Provide warranties and bonds required for specific products: **All materials that will become a permanent part of this project shall require a written manufacturer's warranty.**

1.02 FORM OF SUBMITTALS

- A. Submit by electronic copy.
- B. Label cover of each binder with typed or printed title "WARRANTIES AND BONDS" with title of Project; name, address, and telephone number of contractor; and name of responsible principal.
- C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section that detailed the name of the product or work item.
- D. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing.
 - a. Provide full information using separate typed sheets as necessary
 - b. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.03 PREPARATION OF SUBMITTALS

- A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

1.04 TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents to Owner after acceptance.
- B. Make other submittals to Owner after date of Substantial Completion, prior to final Application for Payment.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
WARRANTIES AND BONDS**

SECTION 00-1740 – Page 2 of 2

- C. For items of work when acceptance is delayed beyond date of Substantial Completion, submit documents to owner after acceptance, listing the date of acceptance as the beginning of the warranty period.

1.05 WARRANTY PERIOD

- A. The warranty period shall continue for a period of one (1) year from final acceptance of the work. All materials of construction, installation, and workmanship shall be covered under this warranty.
- B. Roof warranty shall be as specified in roofing section.
- C. Provide General Contractors 5 year Roofing Guarantee.

Part 2 – Products

Not Used

Part 3 –Execution

Not Used

END OF SECTION



SHELBY COUNTY, ALABAMA
PUBLIC WORKS CONTRACT
For Projects Over \$100,000
Act 97-225

THIS AGREEMENT, entered into as of this _____ day of _____, 2025 by and between SHELBY COUNTY, ALABAMA, a political subdivision of the State of Alabama (hereinafter called the COUNTY) and _____ (hereinafter called the CONTRACTOR). This agreement concerns the _____ Project as described in the noted attached plans index, specifications index, project issued addenda, and the contractor's bid (herein called the PROJECT).

WITNESSETH THAT:

WHEREAS, the COUNTY is currently involved in the planned construction of the PROJECT as specified in design and bid specifications dated _____ which said design and bid specifications are incorporated into this Contract by reference and made part and parcel hereof as fully as if set out herein. (See also attached bid by CONTRACTOR on the _____, 2025) and

WHEREAS, CONTRACTOR submitted the lowest responsive and responsible bid for the construction of the PROJECT; and

WHEREAS, the COUNTY desires to engage and contract with the CONTRACTOR to provide technical, professional, and construction services and to construct and complete the PROJECT herein described; and

WHEREAS, the CONTRACTOR desires to contract to provide technical, professional, and construction services and to complete the construction of the PROJECT herein described:

NOW, THEREFORE, in consideration of the mutual covenants and agreements contained herein, the COUNTY and the CONTRACTOR do hereby mutually agree, covenant, and contract as follows:

Section 1. CONTRACTOR

The COUNTY agrees to engage the CONTRACTOR, and the CONTRACTOR hereby agrees, to perform the construction services hereinabove and hereinafter set forth, and to construct the PROJECT described within this Contract in accord with the accompanying plans and specifications in a good, competent, and workmanlike manner as requested and determined by the COUNTY and in strict compliance with the design and bid specifications for such PROJECT as referenced in other portions of this Contract.

The CONTRACTOR will supply to the COUNTY prior to the commencing of work the following documents, together with any other documents as are required by Alabama law:

- A) Certificate of Insurance (with unconditional cancellation clause), said insurance in the amounts as specified in the contract documents and as approved by the COUNTY.
- B) Section 84 Business License, Applicable City Business License and all other licenses required by law to complete this project
- C) The CONTRACTOR will furnish to the COUNTY a performance bond equaling the total bid amount of the PROJECT payable to the COUNTY, which said bond shall be in form and substance as approved by the COUNTY. The CONTRACTOR shall also execute and furnish to the COUNTY a payment bond securing the CONTRACTOR'S obligation to pay for all labor, materials, or supplies for work done pursuant to this contract, which said payment bond shall be in an amount equal to fifty percent (50%) of the total contract price and shall be in form and substance as approved by the COUNTY. Said payment bond shall also provide bonded coverage to cover and to compensate for reasonable attorney fees incurred by a successful party in civil actions brought on the bond and ordered to be paid by a court of competent jurisdiction.
- D) The CONTRACTOR shall comply with all applicable laws, ordinances, and codes of the U. S. Government, the State of Alabama, any relevant municipality, and the COUNTY, and, specifically and without limitation, shall comply with all provisions of the Beason-Hammond Alabama Taxpayer and Citizen Protection Act, commonly referred to as the Immigration Act, and amendments thereto adopted from time to time during the performance of this Contract, and shall document CONTRACTOR'S compliance with said law and submit to the COUNTY or at the direction of COUNTY any and all affidavits and proof as are from time to time required by law or required by COUNTY.

The CONTRACTOR, by the execution of this Contract, certifies and confirms that it is, at the time of the signing of this document, in full compliance with the aforesaid Beason-Hammond Alabama Taxpayer and Citizen Protection Act, and further agrees that upon request from the COUNTY it will execute and file and take such action as is deemed by the COUNTY to be necessary to verify the CONTRACTOR's continuing compliance therewith.

Section 2. Scope of Services

The CONTRACTOR shall provide all construction services, work and labor, and other professional and technical services to complete the PROJECT herein described, which shall include, but not necessarily be limited to, the activities, plans, and specifications described in the construction drawings, specifications, bid and related documents.

Section 3. Time of Performance

The CONTRACTOR shall begin work on the PROJECT upon the execution of this Contract and will continue, uninterrupted, for a period of time not to exceed _____ (_____) working days beginning after receiving Notice to Proceed from the COUNTY. Said work to be completed in a good and workmanlike manner by the CONTRACTOR within the period of time specified.

Section 4. General Provisions

- (a) *Personnel.* The CONTRACTOR warrants that it has the expertise, professional personnel, and adequate work force capable of performing this Contract, as called for herein, in a satisfactory and proper manner, in accord with highest industry standards, or will secure the services of such personnel as may be required to perform such services, construct said PROJECT, and perform its obligations pursuant to this Contract.
- (b) *Office Space.* The CONTRACTOR agrees to provide and maintain the office space and facilities required to perform all services as called for under this Contract, at no expense to the COUNTY.
- (c) *Subcontracts.* None of the work or services covered by this contract shall be subcontracted without the prior approval of the COUNTY. Any work or services subcontracted hereunder shall be specified by written contract or agreement and shall be subject to each provision of this contract.
- (d) *Access to Materials.* The COUNTY agrees to make available to the CONTRACTOR, upon request, any maps, documents, and planning materials or any other information in its possession or otherwise readily available, which has a direct bearing on the PROJECT, at no expense to the CONTRACTOR.
- (e) *Communications.* The representatives of the COUNTY and the CONTRACTOR to whom communications regarding the PROJECT which is the subject of this contract should be directed are as follows:
 - (1) COUNTY: Trey Gauntt, PE, Chief Facilities Management Officer,
Shelby County Department of Facilities and General Services
280 McDow Road
Columbiana, Alabama 35051
(205) 670-6461
Email: trey@shelbyal.com
 - (2) CONTRACTOR: _____

Phone _____

- (f) The CONTRACTOR shall perform the work and complete the PROJECT in accord with all laws of the State of Alabama, all laws of the United States of America, relevant municipal laws, and to the satisfaction of the COUNTY. Work will be performed by the CONTRACTOR under the direct supervision of the representative of the COUNTY, who will have sole authority of deciding if work conditions, such as weather, temperature, roadway conditions, and other details of construction are complied with by the CONTRACTOR. At the discretion of the COUNTY, work may be stopped or delayed at any time until conditions are appropriate, in the opinion of the COUNTY, in order that optimum results and work quality may be obtained from the PROJECT in the best interest of the COUNTY. The decision of the COUNTY upon any questions connected with the performance of this Contract or any failure or delay in the prosecution of the work by the CONTRACTOR shall be final and conclusive.
- (g) Attachment A - Supplemental Conditions is hereby incorporated as part of this contract.

Section 5. Compensation and Method of Payment

- (a) For services satisfactorily rendered under this Contract and approved by COUNTY, the COUNTY agrees to pay the CONTRACTOR for fulfillment of the terms and conditions of this Contract as specified in the specifications and bid documents. The total amount to be paid under this section for services shall not exceed _____ dollars and _____ cents (\$_____).

Such payment shall, if due, be made monthly at the end of each calendar month, but in no case later than forty-five (45) days after the acceptance by COUNTY that the estimate and terms of the contract providing for partial payment have been fulfilled. In preparing estimates, the material delivered on the site, materials suitably store, and insured off-site, and preparatory work done may be taken into consideration by COUNTY. If the amount due by COUNTY is not in dispute and the amount payable is not paid within the forty-five (45) day period, the CONTRACTOR shall be entitled to interest from COUNTY at the rate assessed for underpayment of taxes under Section 40-1-44(a), Code of Alabama 1975, on the unpaid balance due. Interest payments shall not be due on payments made after the forty-five (45) day period because of administrative or processing delays at the close of the fiscal year. In making the partial payments, there shall be retained not more than five percent (5%) of the estimated amount of work done and the value of materials stored on the site or suitably stored and insured off-site, and after fifty percent (50%) completion has been accomplished and approved by COUNTY, no further retainage shall be withheld. The retainage as set out herein shall be held until final completion and acceptance of all work covered by the contract. Retainage shall be held until all work has been completed to COUNTY's satisfaction.

The CONTRACTOR immediately after the completion of the contract shall give notice in writing to the COUNTY. The COUNTY, upon completion and acceptance by COUNTY of the work, shall give notice of completion of the PROJECT by advertising and publishing on the COUNTY website. The publication and advertisement shall be posted for three consecutive weeks. Final settlement shall not be made upon the contract until the expiration of 30 days after the completion of the notice.

- (b) PROVISIONS OUTLINING THE SOURCE OF SUFFICIENT FUNDS TO BE UTILIZED BY COUNTY TO FULFILL COUNTY'S OBLIGATIONS UNDER THIS CONTRACT (indicate which applies by entering an appropriate mark opposite the following):

 X The funds to be utilized by COUNTY to fulfill its obligation under this contract are funds which are held by COUNTY at the time of the execution of this contract or will become available at a date following the execution of the contract.

_____ The source of funds to be utilized by COUNTY in fulfilling its obligation under this contract is a grant, award, or direct reimbursement from the State, federal government, or other source which will not become available until after the execution of this contract, and the provision of this contract requiring prompt payment shall not apply until COUNTY is in receipt of the funds as provided in the contract. Upon receipt of such funds, the forty-five (45) day requirement specified in this contract shall commence and shall be enforceable as provided herein.

Section 6. Terms and Conditions

(a) *Termination of Contract for Cause/Breach of Contract.* If through any cause the CONTRACTOR shall fail to fulfill in a timely and proper manner its obligations under this Contract, or if the CONTRACTOR shall violate any of the covenants, agreements, or stipulations of this Contract, the COUNTY shall thereupon have the right to terminate this Contract by giving written notice to the CONTRACTOR of such termination and specifying the effective date of such termination. In such event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs, and reports, or other materials prepared by the CONTRACTOR under this Contract or during the construction performance, shall, at the option of the COUNTY, become its property.

Notwithstanding the above, the CONTRACTOR shall not be relieved of liability to the COUNTY for damages sustained by the COUNTY by virtue of any breach of the Contract by the CONTRACTOR, and the COUNTY may withhold any payments to the CONTRACTOR for the purpose of set-off until such time as the exact amount of damages due the COUNTY from the CONTRACTOR is determined.

(b) *Termination for Convenience of the COUNTY.* The COUNTY may terminate this Contract at any time, with or without just cause, by giving written notice to the CONTRACTOR of such termination and specifying the effective date thereof, at least thirty (30) days prior to the effective date of such termination. In such event, all finished or unfinished documents and other materials, as described in the above clause, shall, at the option of the COUNTY, become its property. If the Contract is terminated by the COUNTY as provided in this subparagraph (b), the CONTRACTOR shall be entitled to receive just and equitable compensation for any work satisfactorily completed on said PROJECT.

(c) *Changes.* The COUNTY may, from time to time, request changes of the CONTRACTOR in the scope of services to be performed hereunder. Such changes, or renegotiation, including any increase or decrease in the amount of the CONTRACTOR's compensation, which is mutually agreed upon by and between the COUNTY and the CONTRACTOR, shall be incorporated in written amendments to this Contract. The Contract can be extended under mutually agreed provisions through a written amendment to this document.

(d) *Assignability.* The CONTRACTOR shall not assign any interest in this Contract, and shall not transfer any interest in the same whether by assignment or novation, without the prior written consent of the COUNTY provided, however, that claims for money by the CONTRACTOR from the COUNTY under this Contract may be assigned to a bank, trust company, or other financial institution without such approval. Written notice of any such assignment or transfer shall be promptly furnished to the COUNTY.

This Contract shall be binding upon and inure to the benefit of any successor to the COUNTY and such successor shall be deemed substituted for the COUNTY under the terms of this Contract. As used in this Contract, the term "successor" shall include any person, firm, employer, or other business entity which at any time, whether by merger, purchase, or otherwise, which assumes or is assigned responsibility of the COUNTY for the covered PROJECT. This Contract shall also be binding upon and inure to the benefit of the CONTRACTOR, his successors, executors, and administrators.

(e) *Reports and Information.* The CONTRACTOR, at such times and in such forms as the COUNTY may require, shall furnish to the COUNTY such periodic reports as it may request pertaining to the work or services undertaken pursuant to this Contract, the costs and obligations incurred or to be incurred in connection therewith, and any other matters covered by this Contract.

(f) *Findings Confidential.* All of the reports, information, data, etc., given to or prepared or assembled by the CONTRACTOR under this Contract are confidential, and the CONTRACTOR agrees that they shall not be made available to any individual or organization without the prior written approval of the COUNTY.

(g) *Waiver of Trial by Jury.* The parties to this Contract desire to avoid the additional time and expense related to a jury trial of any disputes arising hereunder. Therefore, it is mutually agreed by and between the parties hereto, and for their successors and assigns, that they shall and hereby waive trial by jury of any claim, counterclaim, or third-party claim, including any and all claims of injury or damages, brought by either party against the other arising out of or in any way connected with this Contract and the relationship which arises herefrom. The parties acknowledge and agree that this waiver is knowingly, freely, and voluntarily given, is desired by both parties, and is in the best interest of both parties.

(h) *Compliance with Local Laws.* The CONTRACTOR shall, throughout the performance of this Contract, comply with all applicable laws, ordinances, and codes of the U. S. Government, the State of Alabama, any relevant municipality, and the COUNTY, and, specifically and without limitation, shall comply with all provisions of the Beason-Hammond Alabama Taxpayer and Citizen Protection Act, commonly referred to as the Immigration Act, as amended from time to time during the performance of this Contract, and shall document CONTRACTOR's compliance with said law and submit to the COUNTY or at the direction of COUNTY any and all affidavits and proof as are from time to time required by law or required by COUNTY .

(i) *Audits and Inspection/Access to Records/Record Retention.* At any time during normal business hours, with prior arrangement and as often as the COUNTY may deem necessary, the CONTRACTOR shall make available to the COUNTY for examination all of its records with respect to matters covered by this Contract and will permit the COUNTY to audit, examine, and make excerpts or transcripts from such records, and to make audits of all contracts, invoices, materials, payrolls, records of personnel, conditions of employment, and other data relating to all matters covered by this Contract.

The CONTRACTOR shall retain all books, documents, papers, and records which are directly pertinent to this contract for a period of six (6) years following completion of the contracted work and expiration of the Contract, unless written permission to destroy them is granted by the COUNTY.

(j) *Interest of Members of the COUNTY and Other Local Public Officials.* No officer, member, or employee of the COUNTY and no member of its governing body, and no other public official of the governing body of the locality or localities in which the PROJECT is situated or being carried out, who exercises any functions or responsibilities in the review or approval of the undertaking or carrying out of this PROJECT, shall participate in any decision relating to this Contract which affects his personal interest or the interest of any corporation, partnership, or association in which he is directly or indirectly interested or has any personal or pecuniary interest, direct or indirect, in this Contract or the proceeds thereof. The CONTRACTOR shall take appropriate steps to assure compliance.

(k) *Interest of the CONTRACTOR.* The CONTRACTOR covenants that it presently has no interest and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Contract. The CONTRACTOR further covenants that, in the performance of this Contract, no person having any such interest shall be employed.

Section 7. Additional Services of CONTRACTOR

If authorized in writing by the COUNTY, the CONTRACTOR shall furnish additional services that are not considered as an integral part of the PROJECT plans and specifications. Under this Contract, all costs for additional services will be negotiated as to activities and compensation. Upon mutual written agreement between the COUNTY and the CONTRACTOR, and written authorization from the COUNTY to proceed, the CONTRACTOR will provide the additional service.

Section 8. Tax Responsibilities of CONTRACTOR

The parties to this Contract agree that the CONTRACTOR is an independent firm or person and that the relationship created by this Contract is that of an independent contractor. Further, the parties agree that the CONTRACTOR is not an employee of the COUNTY, and will not be treated as such for federal income tax purposes. In this regard, the CONTRACTOR acknowledges and accepts all tax responsibilities imposed by federal income tax laws, and any applicable state income tax laws, on self-employed persons, including, but not limited to, the responsibility of withholding from income the required amounts for federal income taxes, Social Security taxes, federal unemployment tax, and applicable state and local income taxes.

Section 9. Non-Exclusive Contract

The CONTRACTOR shall devote its time, attention, and energies to the fulfillment of this Contract. If, after satisfying its responsibilities to the COUNTY, the CONTRACTOR desires to render similar services to any other persons, or on behalf of any other firms, associations, or corporations, then the CONTRACTOR may contract for such services; provided, however, that in the event that the rendering of such additional services by the CONTRACTOR interferes, in the opinion of the COUNTY, with the quality of services rendered to the COUNTY, then the COUNTY shall have the option of either requesting the CONTRACTOR to cease performing such additional services or canceling this Contract.

Section 10. Independent CONTRACTOR Relationship

In the performance of the work, duties, and obligations evolving under this Contract, it is mutually understood and agreed that the CONTRACTOR is at all times serving as an independent contractor providing the COUNTY with services as a contractor and/or independent contractor. Amounts paid to the CONTRACTOR by the COUNTY as compensation for providing said services and for the performance of this Contract are for services purchased, and amounts paid to the CONTRACTOR shall be deemed to be compensation to an independent contractor and shall not be subject to any tax withholding. It is expressly understood that the COUNTY is interested only in the results to be achieved, and the conduct and control of the work will be the sole responsibility of the CONTRACTOR. The CONTRACTOR is not considered to be an agent or employee of the COUNTY for any purpose, and the CONTRACTOR will not be eligible to participate in any benefits the COUNTY provides for its own employees. It is further understood and agreed that the COUNTY does not agree to use the CONTRACTOR exclusively. It is further understood and agreed that, except as provided herein, the CONTRACTOR is free to contract for similar services to be performed for others during the term of this Contract.

Section 11. Indemnification and Liability

The COUNTY shall not be liable for any injury to the person or property of any person, firm, or corporation resulting directly or indirectly from CONTRACTOR's performance of this Contract, and the CONTRACTOR assumes full and complete responsibility therefore. The CONTRACTOR shall remain insured under terms of a public liability insurance policy as described in the "Certificate of Insurance" attached hereto as Attachment "A" during the entire term of this Contract and for the performance of all work herein provided. The CONTRACTOR shall further indemnify the COUNTY and hold the COUNTY safe and harmless from any and all liability, lawsuits, judgments, attorney fees, and other costs incurred by the COUNTY in defending any claim or lawsuit made against the COUNTY by any person, firm, or corporation arising directly or indirectly out of any work performed by the CONTRACTOR pursuant hereto or any breach or alleged breach of duty or responsibility of the CONTRACTOR related thereto.

IN WITNESS WHEREOF, the COUNTY and the CONTRACTOR have caused this Contract to be executed by their duly authorized officers on the day and year first above written.

ATTEST:

SHELBY COUNTY

By: Chad Scroggins
County Manager

Date

ATTEST:

CONTRACTOR

By (print): _____

Title: _____

Date

ATTACHMENT "A"
SUPPLEMENTAL CONDITIONS

- 1) Work must be coordinated with the COUNTY.
- 2) Construction documents, including the attached Project Plans and Specifications, are included as part of this Contract.
- 3) The CONTRACTOR must maintain work space clean and free of debris.
- 4) The CONTRACTOR's price quote dated _____ is hereby incorporated as a part of this Contract. Construction documents, including the Project Plans and Specifications, are included as part of this Contract.
- 5) By signing this contract, CONTRACTOR represents and agrees that it is not currently engaged in, nor will it engage in, any boycott of a person or entity based in or doing business with a jurisdiction with which the State of Alabama can enjoy open trade.
- 6) The CONTRACTOR shall procure and maintain public liability insurance with a minimum of One Million Dollars (\$1,000,000.00) coverage in form and substance as approved by COUNTY. A "Certificate of Insurance" shall be furnished to COUNTY and shall specify that such insurance is not subject to cancellation without prior written notice to COUNTY of at least thirty (30) days. Please request the additional insured to read: Shelby County, its officers, agents, and employees, successors or assigns.
- 7) When required by law the CONTRACTOR shall also provide to COUNTY a Certificate or Proof of Workmen's Compensation Insurance in form and substance acceptable to COUNTY.
- 8) Contractor agrees that it will fully comply with the Immigration Reform and Control Act of 1986, as amended by the Immigration Act of 1990, and the Beason-Hammon Alabama Taxpayer and Citizen Protection Act, which makes it unlawful for an employer in Alabama to knowingly hire or continue to employ an alien who is or has become unauthorized with respect to such employment or to fail to comply with the I-9 requirements or fails to use E-Verify to verify the eligibility to legally work in the United States for all of its new hires who are employed to work in the State of Alabama. Without limiting the foregoing, Contractor shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien, and shall have an officer or other managerial employee who is personally familiar with the Contractor's hiring practices to execute an affidavit to this effect on the form supplies by Shelby County and return the same to Shelby County. Contractor shall also enroll in the E-Verify Program prior to performing any work, or continuing to perform any ongoing work, and shall remain enrolled throughout the entire course of its performance hereunder, and shall attach to its affidavit the E-Verify Program for Employment Verification and Memorandum of Understanding and such other documentation as Shelby County may require to confirm Contractor's enrollment in the E-Verify Program. Contractor agrees not to knowingly allow any of its subcontractors, or any other party with whom it has a contract, to employ in the State of Alabama any illegal or undocumented aliens to perform any work in connection with the Project, and shall include in all of its contracts a provision substantially similar to the paragraph. If Contractor receives actual knowledge of the unauthorized status of one of its employees in the State of Alabama, it will remove that employee from the project, jobsite or premises of Shelby County and shall comply with the Immigration Reform and Control Act of 186, as amended by the Immigration Act of

1990, and the Beason-Hammon Alabama Taxpayer and Citizen Protection Act. Contractor shall require each of its subcontractors, or other parties with whom it has a contract, to act in a similar fashion. If Contractor violates any term of this provision, this Agreement will be subject to immediate termination by Shelby County. To the fullest extent permitted by law, Contractor shall defend, indemnify and hold harmless Shelby County from any and all losses, consequential damages, expenses included but not limited to, attorney's fees, claims, suits, liabilities, fines, penalties, and any other costs arising out of or in any way related to Contractor's failure to fulfill its obligations contained in this paragraph. Additionally, contractor shall provide County proof that you are in compliance with the immigration law by including a notarized E-Verify Memorandum of Understanding and provide your subcontractors notice of their compliance obligations and obtain from each a notarized Affidavit of Immigration Law Compliance-Subcontractor.

- 9) The contractor, person, firm, or corporation undertaking or contracting to undertake the herein described public works project agrees to use in the execution of the contract materials, supplies, and products manufactured, mined, processed, or otherwise produced in the United States or its territories, if the same are available at reasonable and competitive prices and are not contrary to any sole source specification implemented under subsection (f) of Section 39-2-2, Code of Alabama(1975), as amended. In the event the contractor breaches the agreement to use domestic products, and domestic products are not used, there shall be a downward adjustment in the contract price equal to any realized savings or benefits to the contractor.
- 10) If work being performed interferes with normal operations of the facility, the work shall be scheduled after hours as necessary.

Debarment, Suspension and Other Responsibility Matters

As required by Executive Order 12549, Debarment and Suspensions, and implemented at 2 CFR Part 2867, for the prospective participants in primary covered transactions, as defined at 2 CFR Part 2867.20(a), the applicant certifies that it and its principals:

- A. Are not presently debarred, suspended, proposal for debarment, declared ineligible, sentenced to a denial of federal benefits by a state or federal court, or voluntarily excluded from covered transactions by any federal department or agency:
- B. Have not within a three year period preceding this covered transaction been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) or private agreement or transaction, violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion or receiving stolen property, making false claims, or obstruction of justice, or commission of any offense indicating a lack of business integrity or business honesty that seriously and directly affects your present responsibility;
- C. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph B. of this certification; and
- D. Have not within a three year period preceding this transaction had one of more public transactions (federal, state or local) terminated for cause or default.

I/we hereby certify that I/we are in complete compliance with all of the provisions noted above as of this date _____, 20____.

Print: _____

Print: _____

Print: _____

Print: _____

Print: _____

Print: _____

**BOND
FOR PERFORMANCE OF THE WORK**

STATE OF ALABAMA
SHELBY COUNTY

KNOW ALL MEN BY THESE PRESENTS: That we, _____,
as Principal, _____ and
_____ and
_____ as Surety, are held and
firmly bound unto the County of Shelby, in the penal sum of
_____ and /100 Dollars (\$ _____), for
the payment of which sum, well and truly to be made, we hereby bind ourselves, our heirs, executors,
administrators, successors and assigns.

IN WITNESS WHEREOF, we have hereunto set our hands and affixed our seals, this _____
day of _____, 20____.

PROVIDED, HOWEVER, that the condition of this obligation is such that whereas the above bound
_____ have this day entered into a Contract with the said Shelby County
Commission for the completing the project described in the attached plans and specifications
_____ located within the said County, a copy of which said Contract is hereto
attached.

NOW, THEREFORE, in the event that said _____, as such Contractor,
shall faithfully and promptly perform said Contract and all the conditions and requirements thereof,
then this obligation shall be null and void and to no effect, otherwise to remain and be in full force and
effect.

PROVIDED, FURTHER, THAT upon failure of the said _____, to
promptly and efficiently prosecute said work, in any respect, in accordance with the Contract, the
above bound _____

_____,
as Surety, shall take charge of said work and complete the Contract at their expense, pursuant to its
terms, receiving however, any balance of the funds in the hands of said County due under said
Contract. Said Surety may, if they so elect, by written direction given to the Shelby County Commission
authorize the Commission to advertise for bids to complete the said Contract at the expense of said
Surety, and such Surety hereby agree and bind themselves to pay the expense of the completion of
such work, less any funds in the hands of the County remaining due to the above bound Contractor.

PROVIDED, further, that said Contractor and Surety hereby agree and bind themselves to the mode
of service described in Section 39-1-1, Code of Alabama 1975, as amended, and consent that such
service shall be the same as personal service on said Contractor or Surety.

Upon completion of said Contract pursuant to its terms, if any funds remain due on said
Contract, the same shall be paid to said Principal or Surety.

The decision of said County Manager upon any question connected with the execution of said
Contract, or any failure or delay in the prosecution of the work by said Principal or Surety, shall be
final and conclusive.

The Proposal, Specifications, and the Contract hereinbefore referred to, and the Bond for Performance of the Work executed under the provisions of Section 39-1-1, Code of Alabama 1975, as amended, are made a part of this obligation and instrument is to be construed in connection therewith.

WITNESS our hands and seals this _____ day of _____ 20_.

_____(L.S)

_____(L.S.)
Contractor

Surety

By _____

Address _____

**BOND FOR
PAYMENT OF
LABOR, MATERIAL, FEED-STUFFS OR SUPPLIES**

STATE OF ALABAMA
SHELBY COUNTY

KNOW ALL MEN BY THESE PRESENTS: That we _____, as
Principal, _____ and

_____ as Sureties, are held and firmly
bound unto the County of Shelby, in the penal sum of
_____ and /100 Dollars (\$ _____), for the payment
of which sum, well and truly to be made, we hereby bind ourselves, our heirs, executors,
administrators, successors and assigns.

IN WITNESS WHEREOF, we have hereunto set our hands and affixed our seals, this
_____ day of _____, 20____.

PROVIDED, HOWEVER, that the condition of this obligation is such that whereas the above
bound _____ have this day entered into a Contract with the said County
of Shelby for the for the completing the project described in the attached plans and specifications, to-
wit: known as _____ Project, located within the said County, a copy
of which said Contract is hereto attached.

NOW, THEREFORE, in the event that said _____ as such
Contractor shall promptly make payment to all persons supplying him or them with labor, material,
feed-stuffs, or supplies for or in the prosecution of the work provided for in said Contract, then this
obligation shall be null and void and of no effect, otherwise to remain and be in full force and effect.

PROVIDED, FURTHER, in the event that the said _____ as such
contractor shall fail to make prompt payment to all persons supplying him or them with labor, materials,
feed-stuffs, or supplies for or in the prosecution of the work provided in such contract, the above
bound _____ as
Surety shall be liable for the payment of such labor, materials, feed-stuffs or supplies and for the
payment of reasonable attorney's fees incurred by the successful claimants of plaintiffs in suits on
said bond as provided in Section 39-1-1, Code of Alabama 1975, as amended, are made a part of
this obligation, and this instrument is to be construed in connection therewith.

In the event said Principal shall fail or delay the prosecution and completion of said work and
said Surety shall also fail to act promptly as herein before provided, then said County Manager may
cause ten days notice of such failure to be given, either to said Principal or Surety, and at the
expiration of said ten days, if said Principal or Surety do not proceed promptly to execute said
contract, the Shelby County Commission shall have the authority to cause said work to be done,
and when the same is completed and the cost thereof estimated, the said principal and sureties shall
and hereby agree to pay any excess in the cost of said work above the agreed price to be paid under
said Contract.

Upon completion of said Contract pursuant to its terms, if any funds remain due on said
Contract, the same shall be paid to said Principal or Surety.

The said Principal and Surety further agree as part of this obligation to pay all such damages of any kind to person or property that may result from a failure in any respect to perform and complete said Contract.

The decision of said County Manager upon any question connected with the execution of said Contract, or any failure or delay in the prosecution of the work by said Principal or Surety, shall be final and conclusive.

The Proposal, Specifications and the Contract hereinbefore referred to, and the Bond for Payment of Labor, Materials, Feed-stuffs or Supplies executed under the provisions of Section 39- 1- 1, Code of Alabama 1975, as amended, are made a part of this obligation, and this instrument is to be construed in connection therewith.

WITNESS our hands and seals this _____ day of _____ 20__.

_____(L.S)

_____(L.S.)
Contractor

Surety

By _____

Address _____

CERTIFICATE OF NON-SEGREGATED FACILITIES

The federally assisted construction contractor certifies that he does not maintain or provide for his employee any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the equal opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washroom, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin, because of habit, local custom, or other reason. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause, and that he will retain such certifications in his files.

NOTICE TO PROSPECTIVE CONTRACTORS OF REQUIREMENT FOR CERTIFICATION OF NONSEGREGATED FACILITIES:

A Certification of Non-segregated Facilities must be submitted prior to the award of a contract or subcontract exceeding \$10,000, which is not exempt from the provisions of the Equal Opportunity Clause.

Certification - The information above is true and complete to the best of my knowledge and belief.

(Please Print) Name and Title of Signer

Signature Date

Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

NOTICE OF AWARD

To: _____

Date: _____

Project: _____

The OWNER has considered the BID submitted by you for the above described PROJECT in the bid received _____.

You are hereby notified that your BID has been accepted for items in the amount of \$_____.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER. Please make your required submittals in the bid documents to be reviewed and approved prior to fabrication of the materials.

Owner

By: _____

Fred M. Gauntt III, PE

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____ this the _____ day of _____, 2025.

Contractor

By

Title

NOTICE TO PROCEED

To: _____ Date: _____, 2025

Project:

You are hereby notified to commence WORK in accordance with the Agreement dated _____ on or before _____ and you are to complete the WORK within calendar days thereafter. The date of completion of all WORK is therefore approximately _____.

Shelby County, AL
Owner

By: Fred M. Gauntt, III, PE
Title: Chief Facilities Management
Officer

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____
this the ____ day of _____, 2025.

Contractor

By

Title

PUBLIC WORKS CONTRACT
SHELBY COUNTY COMMISSION

CHANGE ORDER

DATE: _____

CHANGE ORDER NO: 1

PROJECT: _____

CONTRACTOR: _____

CONTRACT DATE: _____
COST CODE NO: _____
CONTRACT NO. _____

YOU ARE DIRECTED TO MAKE THE FOLLOWING CHANGES IN YOUR CONTRACT:

IN STRICT ACCORDANCE WITH THE CONTRACT DOCUMENTS YOU ARE INSTRUCTED TO FURNISH:

See attached quantities

AMOUNT OF ORIGINAL CONTRACT	\$ _____
AMOUNT OF PREVIOUS CHANGES	\$ _____
AMOUNT OF THIS CHANGE	\$ _____
TOTAL AMOUNT OF ADJUSTED CONTRACT	\$ _____

NOTE: IT IS HEREBY UNDERSTOOD AND AGREED THAT THE ABOVE IS COMPENSATION IN FULL FOR CHANGES AS INDICATED. IT IS FURTHER UNDERSTOOD AND AGREED THAT ALL RIGHTS FOR ANY ADDITIONAL COMPENSATION ARE WAIVED CONCERNING THE CHANGES CONTAINED HEREIN.

Shelby County Commission

BY: _____
TITLE: Owner
DATE: _____

BY: _____
TITLE: County Manager
DATE: _____

Sample Contractor Notice of Completion

CONTRACTOR NOTICE OF COMPLETION

In Accordance with Chapter 1, Title 39, Code of Alabama, 1975, as amended by Act 2023-497 (HB168), notice is hereby given that as of _____ (Insert Date),
_____ (Insert Contractor Name), has completed the Contract
for the project described as _____ (Insert Project Name).

Signature

Print Name

Title

Company Name

Date

d.

Shelby County

Affidavit for Payment of Debts Incurred on Construction Projects

Project No. _____
County _____
Contractor _____
Description and Location of Project _____

This is to certify that all known debts for labor and materials used on the project and all approved sub-contractual obligations associated with the construction of Project _____, _____ County, have been paid or will be paid within five (5) days after final payment.

Sworn to this the _____ day of _____, _____.
(Month) (Year)

(Name)

(Title)

(Contractor)

Sworn to and subscribed before me on the _____ day of _____, _____.
(Month) (Year)

(Notary)

For _____ County _____ State

My commission expires _____
(Date)



JULIE P. MAGEE
Commissioner

State of Alabama Department of Revenue

(www.revenue.alabama.gov)
50 North Ripley Street
Montgomery, Alabama 36132

MICHAEL E. MASON
Assistant Commissioner
JOE W. GARRETT, JR.
Deputy Commissioner
CURTIS E. STEWART
Deputy Commissioner

Alabama Department of Revenue NOTICE

Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

Legislative Act 2013-205 requires the Department of Revenue to issue Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects*, to all contractors and subcontractors working on qualifying governmental entity projects once the Form ST: EXC-01 is approved.

Each exempt entity, contractor and subcontractor must make application for qualification of the exemption using Form ST: EXC-01 for each tax-exempt project. The application is available on the department's website at [http://revenue.alabama.gov/sales tax/ST-EXC-01 .pdf](http://revenue.alabama.gov/sales tax/ST-EXC-01.pdf). Applications should be submitted directly to the Sales and Use Tax Division Central Office, P.O. Box 327710, Montgomery, AL 36132-7710.

The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 *Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities.*]

The Alabama Department of Revenue will assign each contractor and subcontractor a consumer use tax account, if one is currently not in place, at the time the Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects*, is issued.

Contractors and sub-contractors for qualifying projects will be required to file monthly consumer use tax returns and report all exempt purchases for ongoing projects, as well as all taxable purchases on one return. These returns are required to be filed through the department's online tax return filing and payment portal, My Alabama Taxes (<https://myalabamataxes.alabama.gov>).

As another option for these types of contracts, as well as with other contracts entered into with other types of exempt entities, the Form ST:PAA1, *Purchasing Agent Appointment*, may be used. However, please be advised that the use of the Form ST:PAA1 option will require the exempt entity to be invoiced directly and pay for directly from their funds any construction and building material and supply purchases.

For additional information concerning this guidance, taxpayers should contact Sales and Use Tax Division representative Thomas Sims at 334-242-1574 or by email at Thomas.Sims@revenue.alabama.gov.

WHAT'S NEW?

TOPIC: Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

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The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities.]

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**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUMMARY OF WORK**

SECTION 01-1100 – Page 1 of 3

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project description.
 - 2. Work by Others.
 - 3. Work sequence.
 - 4. Owner occupancy.
 - 5. Future work.
 - 6. Contractor's use of site and premises.
 - 7. Owner furnished Products.

1.2 PROJECT DESCRIPTION

- A. The use of the building will be the Shelby County Emergency Operations Center, Emergency Management Offices, and Information Technology Offices.
- B. Work of this Project is described as the complete construction of a one-story, 15,616 square feet area, Type II Non-Combustible Building, which includes an ICC 500 Risk Category IV compliant Emergency Operations Center.
- C. The building is constructed in 3 sections. A poured-in-place concrete wall and roof structure to house the Emergency Operations Center, and 2 structural steel frame with steel joist buildings for office areas. All 3 are built as a single attached structure.
- D. The building is clad with steel insulated wall panels and burnished concrete masonry wainscot at perimeter. The building has a rigid insulation and membrane roof system over metal deck at framed section and over concrete roof at Emergency Operations Center.
- E. Work includes a protected Mechanical Court for essential HVAC and Electrical equipment
- F. The Project will be constructed under a single construction contract.
- G. Work includes Building Construction, Site Construction, Plumbing, HVAC, Power, Lighting, Data.
- H. Work includes infrastructure for security cameras and equipment, radio and communications systems, audio-video systems.
- I. Work includes infrastructure for electronic access door controls.
- J. Work includes a 1 hour fire rated Server Room for IT operations.
- K. Work includes an NFPA 13 compliant sprinkler system.
- L. Work includes a Fire Alarm and Notification system.
- M. Work includes an Emergency Generator designed to power all operations.
- N. Work includes soil fill, Rough and Finish Grading and Landscaping.
- O. Work includes exterior dimensional wall signage.
- P. Work includes asphalt and concrete pavement, sidewalks, structures, curbs and gutters.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUMMARY OF WORK**

SECTION 01-1100 – Page 2 of 3

- Q. Work includes localized silt fencing, hay bales, wattle, etc. at building excavation pad to comply with city and county BMP requirements.
- R. Project has Tax Exemption Status.

1.3 WORK BY OTHERS

A. Separate Contracts:

- 1. The Owner has or will execute contracts for additional work at the site that is excluded from the work of this Contract, and that includes:
 - a. Property Boundary Survey
 - b. Property Topographic map
 - c. Soil Compaction Testing and Borings
 - d. Special Inspections
 - e. Radio and Communication Systems
 - f. Security and Camera Systems (as noted in the project plans)
 - g. Electronic Access Systems (as described in the project plans)
 - h. Audio / Video Systems
 - i. See ELECTRICAL for GC-installed cabling and conduit to power these items. (Cameras, intercoms)
- 2. Work under separate contracts may be executed concurrently with Work of this Contract.
- 3. Cooperate with the Owner and separate contractors to accommodate Owner's work.

1.4 WORK SEQUENCE

- A. Construct Work in one single phase.
- B. Coordinate construction schedule and operations with the Owner.
- C. Schedule the Work to accommodate Owner's requirements.

1.5 FUTURE WORK

- A. Ensure that work of this Contract does not encroach on areas of future work.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Contractor shall have complete and exclusive use of site and premises for execution of the Work.
- B. Contractor shall assume full responsibility for protection and safekeeping of products under this Contract stored on site.
- C. Contractor shall obtain and pay for use of any additional storage or work areas needed for operations.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUMMARY OF WORK**

SECTION 01-1100 – Page 3 of 3

D. Contractor shall coordinate use of site and premises with the Owner:

1. Employee parking: In designated areas.
2. Access to site and premises: In designated areas.
3. Storage and staging areas: In designated areas.
4. Transport materials and equipment to and from construction area along routes approved by local jurisdiction

E. Confine operations to construction area unless otherwise approved by Owner.

F. Do not use or store hazardous or flammable materials on premises without Owner's and local Fire Authorities approval; follow requirements of governing authorities having jurisdiction over the work.

G. Prohibit smoking within interior spaces.

1.7 OWNER FURNISHED PRODUCTS

A. Products that will be furnished and paid for by Owner are as follows:

1. Residential Kitchen Appliances to be furnished by Owner and installed by Contractor. See Section 11 3100 for list.
2. Paper Towel Holders and Toilet Tissue Roll Holders in toilet rooms to be furnished by Owner and installed by Contractor. See Section 102813.

B. Contractor's Responsibilities to include but not be limited to:

1. Designate delivery date for each product in Progress Schedule.
2. Review Shop Drawings, Product Data and Samples. Submit to Architect with notification of any discrepancies or problems anticipated in use of product.
3. Receive and unload products at site.
4. Promptly inspect products jointly with Owner; record shortages, damage, and defective items.
5. Handle products at site, including uncrating and storage.
6. Protect products from exposure to elements and from damage.
7. Assemble, install, connect, adjust, and finish products, as stipulated in respective specification section.
8. Repair or replace any items damaged by Contractor's forces.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT CONSTRUCTION DOCUMENTS

SECTION 01 1150 – Page 1 of 1

A. Preliminary Drawings and Specifications – Prior to beginning construction, Contractor shall mark all preliminary drawings as VOID and insure no preliminary drawings will be used during construction. Contractor shall further direct his subcontractors, vendors, and trades to do likewise. At execution of the construction contract, the Contractor and his subcontractors shall certify that all contracts reflect the provisions of the current and official drawing revision that will be used to obtain permits and licenses from the Authorities Having Jurisdiction (AHJ)

B. Drawings and Specifications for Permitting – Contractor will be furnished computer .pdf files for bidding, building permits, and construction transmitted by email. These drawings and specifications will be labeled *Drawings and Project Manual For Construction* and will contain the Architect's Alabama registration seal. The Contractor is authorized to make sufficient copies as is required by the AHJ for submittals and procuring all required permits. The Project Manual may also be referred to as "Project Specifications"

C. Revised Drawings and Specifications - In the event that drawings are revised due to subsequent changes by the Owner or comments by the AHJ, the Contractor will be furnished amended documents by emailed .pdf files, either by individual sheet, or groups of sheets, or full set. Contractor is responsible for distribution and receipt of amended sheets to all subcontractors, vendors, and trades.

D. Drawings and Specifications for Construction– Contractor will maintain the official printed permit set of drawings and specifications for use as the master construction set. These drawings will be labeled *Drawings and Project Manual For Construction* and will contain the Architect's Alabama registration seal, and the AHJ certification stamp. The Contractor alone is authorized to make an unlimited number of copies for his and his sub-contractors' use, at the Contractor's expense. Such authorization shall expire at the completion of construction, and all drawings that can be accounted for, except final record sets, shall be destroyed or returned to Architect.

END OF DOCUMENT

SHELBY COUNTY EMA & IT BUILDING PROJECT SUBSTITUTION PROCEDURES

SECTION 01 2500 – Page 1 of 2

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Product Substitution Procedures.

1.2 GENERAL

- A. Definition: Proposal by Contractor to use manufacturer, product, material, or system different from one required in Contract Documents.
- B. Do not substitute Products unless a substitution request has been approved by Architect.
- C. Substitutions during Bidding: Refer to Instructions to Bidders.
- D. Architect and Owner will consider substitution requests within 30 days after award of Contract. After initial 30 day period, substitutions requests will be considered only due to non-availability of a specified Product through no fault of Contractor.
- E. In case of non-availability of a specified Product, notify Architect in writing as soon as non-availability becomes apparent.

1.3 SUBSTITUTION REQUESTS

- A. Submit substitution requests on copy of form bound into Project Manual.
- B. Document specified product and proposed substitution with complete data, including:
 - 1. Product identification, including name and address of manufacturer.
 - 2. Product description, performance and test data, and reference standards.
 - 3. Sample, if requested.
 - 4. Description of any anticipated effect that acceptance of proposed substitution will have on Progress Schedule, construction methods, or other items of Work.
 - 5. Description of any differences between specified product and proposed substitution.
 - 6. Difference in cost between specified product and proposed substitution.
- C. Burden of proof for substantiating compliance of proposed substitution with Contract Document requirements remains with Contractor.
- D. A request constitutes a representation that the Contractor;
 - 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Will reimburse Owner for A&E design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the substitution.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUBSTITUTION PROCEDURES**

SECTION 01 2500 – Page 2 of 2

- E. Substitutions will not be considered if:
 - 1. They are indicated or implied on Shop Drawings or other submittals without submittal of a substitution request.
 - 2. Approval will require substantial revision of Contract Documents without additional compensation to Architect and Engineers.
- F. Submit to Architect electronically in Adobe PDF format.
- G. Architect will notify Contractor of approval or rejection of each Substitution Request.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

DOCUMENT 01 2519

SUBSTITUTION REQUEST FORM

DATE: _____

TO: _____

ATTENTION: _____

PROJECT: _____

We submit for your consideration the following product as a substitution for the specified product:

Section No.	Paragraph	Specified Product
-------------	-----------	-------------------

_____	_____	_____
-------	-------	-------

Proposed Substitution: _____

Reason for Substitution: _____

Product Data:

Attach complete technical data for both the specified product and the proposed substitution. Include information on changes to Contract Documents that the proposed substitution will require for its proper installation.

Samples:

☐ Attached ☐ Will be furnished upon request

Does the substitution affect dimensions shown on Drawings?

☐ No ☐ Yes (explain) _____

Effects of proposed substitution on other Work:

Differences between proposed substitution and specified Product:

Manufacturer's warranties of the proposed substitution are:

___ Same ___ Different (explain) _____

Maintenance service and spare parts are available for proposed substitution from:

Previous installations where proposed substitution may be seen:

Project: _____ Project: _____

Owner: _____ Owner: _____

Architect: _____ Architect: _____

Date Installed: _____ Date Installed: _____

Cost savings to be realized by Owner, if proposed substitution is approved:

Change to Contract Time, if proposed substitution is approved:

___ No Change ___ Add _____ days ___ Deduct _____ days

Submittal constitutes a representation that Contractor has read and agrees to the provisions of Section 01 2500.

Submitted by Contractor;

Signature

Firm

For Use by Architect:

Based on the information supplied by the Contractor, the Architect has reviewed the proposed substitution on the basis of design concept of the Work and conformance with information given in Contract Documents.

___ Approved ___ Approved as Noted ___ Rejected

Submit Additional Information: _____

By: _____ Date: _____

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONSTRUCTION PROGRESS SCHEDULES**

SECTION 01 3216 – Page 1 of 2

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction progress schedule.
- B. Related Sections:
 - 1. Section 01 1100 - Summary of Work: Work sequence.
 - 2. Section 01 2900 - Payment Procedures.

1.2 FORMAT

- A. Prepare Progress Schedule as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week or
- B. Prepare Progress Schedule on network analysis system using the critical path method.
- C. Sequence of Listings: The chronological order of the start of each item of Work.
- D. Scale and Spacing: To provide space for notations and revisions.
- E. Sheet Size: Multiples of 8-1/2 x 11 inches.

1.3 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification Section number.
- C. Identify work of logically grouped activities.
- D. Provide subschedules to define critical portions of the entire Progress Schedule.
- E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- F. Provide separate schedule of submittal dates for Shop Drawings, Product Data, and Samples, including:
 - 1. Dates reviewed submittals will be required from Architect.
 - 2. Decision dates for selection of finishes.
 - 3. Delivery dates for Owner furnished products and Products identified under Allowance.
- G. Coordinate content with Schedule of Values specified in Section 01 2900.

SHELBY COUNTY EMA & IT BUILDING PROJECT CONSTRUCTION PROGRESS SCHEDULES

SECTION 01 3216 – Page 2 of 2

- H. Revisions:
 - 1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 - 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
- I. Provide narrative report to define problem areas, anticipated delays, and impact on Progress Schedule. Report corrective action taken, or proposed, and its effect.

1.4 SUBMITTAL

- A. Submit initial Progress Schedule to Owner and Architect within 15 days after date of Notice to Proceed. After review, resubmit required revised data within 10 days.
- B. Submit revised Progress Schedule to Owner and Architect with each Application for Payment.
- C. Submit electronically in Adobe PDF format.

1.5 DISTRIBUTION

- A. Distribute copies of approved Progress Schedule to project site file, Subcontractors, suppliers, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in Progress Schedule.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PHOTOGRAPHIC DOCUMENTATION**

SECTION 01 3233 – Page 1 of 1

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction photographs.

1.2 PHOTOGRAPHY

- A. Contractor shall take or employ competent photographer to take construction record photographs during construction. Take photos no less than once per week, more frequently to show work before being covered.
- B. If requested, provide photographs taken each month just prior to date for each scheduled Application for Payment.
- C. Exterior: Photograph project from minimum of four different views at each specified time.
- D. Interior: Photograph from multiple angles to show general progress of work.
- E. Details: Photograph close up specific details that may require special attention.
- F. At successive periods of photography, take photographs from same overall view as previously taken.
- G. Utilize digital technology at minimum 1280 x 960 resolution.
- H. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1.3 DIGITAL FILES

- A. Index digital files in chronological sequence.
- B. Identify each view by listing:
 - 1. Name of Project.
 - 2. Orientation of view.
 - 3. Date taken.
 - 4. Sequential photograph number.

1.4 SUBMITTAL

- A. Submit digital files along with Project Record Documents.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT SUBMITTAL PROCEDURES

SECTION 01 3300 – Page 1 of 3

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Proposed Products list.
 - 3. Submittal schedule.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality control submittals.
- B. Related Sections:
 - 1. Section 01 4000 - Quality Requirements.

1.2 SUBMITTAL PROCEDURES

- A. Number each submittal with Project Manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.
- B. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers, and specification Section number, as appropriate.
- C. Submit all submittals listed under "Submittals for Review" simultaneously for each Product or Specification Section.
- D. Where multiple Products function as an assembly, group submittals for all related Products into single submittal.
- E. Apply Contractor's stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- F. Schedule submittals to expedite the Project, and deliver to Architect. Coordinate submittal of related items.
- G. For each submittal, allow 14 days for Architect's review. Architect will not review incomplete submittals.
- H. Identify variations from Contract Documents and Product or system limitations that maybe detrimental to successful performance of completed Work.
- I. Revise and resubmit submittals when required; identify all changes made since previous submittal.
- J. Distribute copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.

1.3 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice to Proceed, submit a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUBMITTAL PROCEDURES**

SECTION 01 3300 – Page 2 of 3

- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
- C. Submit electronically in Adobe PDF format.

1.4 SUBMITTAL SCHEDULE

- A. Within 15 days after date of Notice to Proceed, submit a submittal schedule showing all submittals proposed for project, including submittals listed as:
 - 1. Submittals for Review.
 - 2. Quality Control Submittals.
 - 3. Closeout Submittals.
- B. Include for each submittal:
 - 1. Specification section number.
 - 2. Description of submittal.
 - 3. Type of submittal.
 - 4. Anticipated submittal date.
 - 5. For submittals requiring Architect's review, date reviewed submittal will be required from Architect.
- C. Submit electronically in Adobe PDF format.

1.5 SHOP DRAWINGS

- A. Present information in clear and thorough manner.
- B. Identify details by reference to sheet and detail numbers or room number shown on Drawings.
- C. Reproductions of details contained in Contract Documents are not acceptable.
- D. Submit electronically in Adobe PDF format. Architect will return Submittal Review Document PDF to Contractor for printing and distribution.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data.
- B. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Submit electronically in Adobe PDF format. Architect will return Submittal Review Document PDF to Contractor for printing and distribution.

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Where so indicated, submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- C. Include identification on each sample, with full Project information.
- D. Unless otherwise specified in individual specifications, submit one of each sample.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SUBMITTAL PROCEDURES**

SECTION 01 3300 – Page 3 of 3

- E. Architect will notify Contractor of approval or rejection of samples, or of selection of color, texture, or pattern if full range is submitted.

1.8 QUALITY CONTROL SUBMITTALS

- A. Quality control submittals specified in Section 01 4000 are for information and do not require Architect's responsive action except to require resubmission of incomplete or incorrect information.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. References.
 - 2. Quality assurance and control of installation.
 - 3. Mockups.
 - 4. Manufacturer's field services and reports.
 - 5. Design data and calculations.
 - 6. Test reports and certifications.
 - 7. Manufacturer's installation instructions.

1.2 REFERENCES

- A. For products or workmanship specified by reference to association, trade, or industry standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Conform to edition of reference standard in effect as of date of Owner/Contractor Agreement.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.3 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 MOCKUPS

- A. Definition:
 - 1. Mockups are field samples constructed, applied, or assembled at the project site for review by the Owner and Architect that illustrate materials, equipment, or workmanship.
 - 2. Approved mockups establish the standard of quality by which the Work will be judged.
- B. Construct, apply, or assemble specified items, with related attachment and anchorage devices, flashings, seals, and finishes.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
QUALITY REQUIREMENTS**

SECTION 01 4000 – Page 2 of 3

- C. Perform work in accordance with applicable specifications sections.
- D. Erect at project site at location acceptable to Architect. Protect from damage.
- E. Removal:
 - 1. Mockups may remain as part of the Work only when so designated in individual specification sections.
 - 2. Do not remove mockups until removal is approved by Architect or upon Final Completion.
 - 3. Where mockup is not permitted to remain as part of the Work, clear area after removal of mockup has been approved by Architect.

1.5 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, or startup of equipment, as applicable, and to initiate instructions when necessary.
- B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report to Architect within 10 days of observation.

1.6 DESIGN DATA AND CALCULATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide design data and calculations.
- B. Accuracy of design data and calculations is the responsibility of the Contractor.
- C. When so specified, prepare design data and calculations under the direction of a professional engineer licensed in the state in which the Project is located. Affix engineer's seal to submittals.
- D. Submit one copy of original stamped and signed document. In addition, submit electronically in Adobe PDF format.

1.7 TEST REPORTS AND CERTIFICATIONS

- A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide test reports and manufacturers' certifications.
- B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Submittals may be recent or previous test results on material or Product, but must be acceptable to Architect.
- D. Submit electronically in Adobe PDF format.

1.8 MANUFACTURER'S INSTALLATION INSTRUCTIONS

**SHELBY COUNTY EMA & IT BUILDING PROJECT
QUALITY REQUIREMENTS**

SECTION 01 4000 – Page 3 of 3

- A. When Contract Documents require that Products be installed in accordance with manufacturer's instructions:
1. Submit manufacturer's most recent printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, as applicable.
 - a. Submit in quantities specified for Product Data.
 - b. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
 - c. Identify conflicts between manufacturers' instructions and requirements of Contract Documents.
 2. Perform installation of Products to comply with requirements of manufacturer's instructions.
 3. If installation cannot be performed in accordance with manufacturer's instructions, notify Architect and await instructions.
 4. Submit electronically in Adobe PDF format.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT STRUCTURAL TESTS AND SPECIAL INSPECTIONS

SECTION 01 4100 – Page 1 of 4

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- b. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.
- c. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve contractor of responsibility for compliance with other construction document requirements.
 - 1) Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2) Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
 - 3) Requirements for contractor to provide quality-assurance and -control services required by architect, owner, or authorities having jurisdiction are not limited by provisions of this section.
- d. The owner will engage one or more qualified special inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.
- e. Related Sections include but are not limited to the following:
 - 1) Section 02 2000 - "Earthwork"
 - 2) Section 31 6316 - "Augered Cast Grout Piles"
 - 3) Section 03 3000 - "Cast-In-Place Concrete"
 - 4) Section 03 4100 - "Structural Precast Concrete Wall Panels"
 - 5) Section 05 1200 - "Structural Steel"
 - 6) Section 05 2100 - "Steel Joist and Joist Girders"
 - 7) Section 05 3100 - "Steel Deck"
 - 8) Section 05 3200 - "Acoustical Steel Deck"
- f. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.
- g. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.
- h. Shop Drawings / Submittal Data: Written, graphic and pictorial documents prepared and / or assembled by the contractor based on the Construction Documents.
- i. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or special inspector.
- j. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The special inspector shall be a licensed professional engineer or engineering intern or a qualified representative from the testing agency.

SHELBY COUNTY EMA & IT BUILDING PROJECT STRUCTURAL TESTS AND SPECIAL INSPECTIONS

SECTION 01 4100 – Page 2 of 4

- k. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
- l. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.
- m. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed professional engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and / or Inspection of Materials Used in Construction.
 - a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
 - 2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.
- B. Qualifications of Special Inspector: The Special Inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation being inspected. The Special Inspector shall meet the legal qualifications of the building code having jurisdiction.
 - 1. Duties and Responsibilities of the Special Inspector:
 - a. The Special Inspector shall observe the work assigned to ascertain, to the best of his/her knowledge that it is in conformance with the approved design drawings and specifications.
 - b. The Special Inspector shall furnish inspection reports to the Building Official, the Architect/Engineer, and the Owner. All discrepancies shall be brought to the immediate attention of the Architect/Engineer, Contractor, and Owner. A report that the corrected work has been inspected shall be sent to the Building Official, the Architect/Engineer, and the Owner.
 - c. The Special Inspector shall create and maintain a log of all discrepancies throughout the duration of the project. This log shall include, but is not limited to, discrepancy date, description, drawing and/or detail reference, description of as-built condition, description of any remedial work performed, and status of discrepancy. This log shall be submitted to the Architect/Engineer on a periodic basis for the review and comment. Upon completion of the project, this log shall be submitted in its entirety as an attachment to the final signed report described below.
 - d. The Special Inspector shall submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the approved plans and specifications and the applicable workmanship provisions of the building code.

1.4 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

STATEMENT OF FINAL INSPECTIONS

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:
Registered Design Professionals (RDP):
Architect:
Geotechnical Engineer:
Structural Engineer:
Mechanical Engineer:
Electrical Engineer:

This statement of special inspections is submitted as a condition for permit issuance in accordance with Chapter 17 of the International Building Code. It includes a *Schedule of Special Inspections* applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the building official and to the registered design professional in responsible charge at a frequency agreed upon by the permit applicant and building official prior to the start of work. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and the registered design professional in responsible charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent at the completion of that phase of work.

Maximum frequency of interim report submittals shall not be less than _____.

The Special Inspection program does not relieve the contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Acknowledgement:

Signature

Date

Building Official's Acceptance:

Signature

Date

Permit No.

FINAL REPORT OF FINAL INSPECTIONS

Project:
Project Address:
Testing / Inspection Agent:

Testing / Inspection Agent Address:
Scope of Testing / Inspections:

(To be completed by Testing / Inspection Agent)

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the *Schedule of Special Inspections* submitted for permit, have been completed in accordance with the contract documents.

Interim reports submitted prior to this final report and numbered _____ to _____ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

(Attach 8 1/2" x 11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

Type or print name

Signature

Date

Special Inspector's Seal

(Licensed Professional Engineer)

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary utilities.
 - 2. Field offices and sheds.
 - 3. Temporary controls.
 - 4. Protection of installed Work.
 - 5. Security.
 - 6. Progress cleaning.
 - 7. Water, erosion, sediment, dust, and mold and mildew control.
 - 8. Access roads and parking areas.
 - 9. Removal.

1.2 REFERENCES

- A. None

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 TEMPORARY ELECTRICITY

- A. Provide temporary electrical service of capacity and characteristics required for construction.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. All work to comply with National Electrical Code and all local ordinances. Provide flexible power cords as required.
- C. Maintain temporary distribution system in good condition and provide routine repairs with Owner's approval.

3.2 TEMPORARY LIGHTING

- A. Provide temporary lighting for construction and security purposes.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required. All work to comply with National Electrical Code and all local ordinances.
- C. Maintain lamps and provide routine repairs.
- D. Provide portable lights when required to provide minimum lighting levels necessary for specific work.

3.3 TEMPORARY HEAT

- A. Provide temporary heating devices required to maintain specified ambient temperatures for construction.
- B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless otherwise indicated in individual specification sections.

3.4 TEMPORARY VENTILATION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY FACILITIES AND CONTROLS**

SECTION 01 5000 – Page 2 of 4

- A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.
- B. Provide temporary fan units as required to maintain clean air for construction.
- C. Provide at minimum manufacturers' ventilation requirements for temporary heating devices

3.5 TEMPORARY TELEPHONE, FACSIMILE, AND COMPUTER SERVICES

- A. Provide temporary or mobile telephone service, required during construction.
- B. Provide computer, smartphone, or tablet in Contractor's field office with internet access and email service.

3.6 TEMPORARY WATER

- A. Provide temporary water as required for construction.
- B. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.
- C. Protect from freezing.
- D. Maintain distribution system and provide routine repairs with Owner's approval.

3.7 TEMPORARY SANITARY FACILITIES

- A. Provide chemical toilets for use during construction.
- B. Permanent toilets may not be used during construction.
- C. Maintain facilities in clean and sanitary condition.

3.8 FIELD OFFICES AND SHEDS

- A. Provide temporary field offices and storage sheds required for construction.
- B. Do not unreasonably encumber site or premises with excess materials or equipment.
- C. Temporary Structures:
 - 1. Portable or mobile buildings, structurally sound, tied down, weathertight, with floors raised above ground.
 - 2. Thermal transmission resistance: Compatible with occupancy and storage requirements.
 - 3. Provide connections for utility services when required.
 - 4. Provide steps and landings at entrances.
- D. Field Office:
 - 1. Size required for Contractor's use and to provide space for project meetings.
 - 2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
 - 3. Provide facilities for storage of Project Record Documents.
 - 4. Provide thermometer mounted at convenient outside location, not in direct sunlight.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY FACILITIES AND CONTROLS**

SECTION 01 5000 – Page 3 of 4

3.9 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from construction operations.
- B. Provide barricades required by governing authorities for public right-of-ways.
- C. Fencing:
 - 1. Provide temporary fencing for construction operations.
 - 2. Construction: Commercial grade chain link.
 - 3. Height: Minimum 6 feet.
 - 4. Locate to protect construction operations, materials, and equipment.
 - 5. Provide vehicular and pedestrian gates.

3.10 EXTERIOR CLOSURES

- A. Provide temporary weathertight closures for exterior openings to provide acceptable interior working conditions, to allow for temporary heating and maintenance of ambient temperatures required in individual specification sections, to protect the Work, and to prevent entry of unauthorized persons.
- B. Provide access doors with locking hardware.

3.11 PROTECTION OF INSTALLED WORK

- A. Protect installed work from construction operations; provide special protection when required in individual specification sections.
- B. Minimize traffic, storage, and construction activities on roof surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from roofing manufacturer.
- C. Prohibit traffic from landscaped areas.

3.12 SECURITY

- A. Provide a project security program, to:
 - 1. Protect the Work, stored products, and construction equipment from theft and vandalism.
 - 2. Prevent entry by unauthorized persons.

3.13 PROGRESS CLEANING

- A. Maintain areas free from waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.
- C. Periodically clean interior areas to provide suitable conditions for finish work.

3.14 TEMPORARY CONTROLS

- A. Water Control:
 - 1. Owner will grade site to drain. Prevent puddling water caused by equipment or storage.
 - 2. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
 - 3. Provide water barriers to protect site from soil erosion.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY FACILITIES AND CONTROLS**

SECTION 01 5000 – Page 4 of 4

- B. Erosion and Sediment Control:
 - 1. Plan and execute methods to control surface drainage from cuts, fills, borrow areas, and waste disposal areas. Prevent erosion and sedimentation.
 - 2. Minimize amount of bare soil exposed at any one time.
 - 3. Provide temporary measures such as silt fences, dikes, berms, settlement basins, and drainage systems to prevent water flow and sedimentation.
 - 4. Periodically inspect earthwork to detect erosion and sedimentation; promptly employ corrective measures.
- C. Dust Control:
 - 1. Provide dust control materials and methods to minimize dust from construction operations.
 - 2. Prevent dust from dispersing into atmosphere.
- D. Mold and Mildew Control:
 - 1. Provide continuous measures to prevent formation of mold and mildew in construction.
 - 2. Do not install materials sensitive to mold and mildew growth until protection can be provided.
 - 3. Promptly remove and replace materials exhibiting mold and mildew growth.

3.15 ACCESS ROADS AND PARKING AREAS

- A. Existing roads designated by Owner may be used for construction purposes. Do not allow heavy vehicles or construction equipment in parking areas.
- B. Provide for access by emergency vehicles.
- C. Keep fire hydrants and water control valves free from obstruction and accessible for use.
- D. Provide parking facilities for construction personnel. When parking needs exceed on site capacity, provide additional off site facilities.
- E. Maintain existing construction, and restore to original or specified condition at completion of Work.

3.16 REMOVAL

- A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.
- B. Remove foundations and underground installations; grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing and permanent facilities used during construction to original or to specified condition.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- B. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.
- C. Section 31 3700 - Riprap: Temporary and permanent stabilization using riprap.
- D. Section 32 1123 - Aggregate Base Courses: Temporary and permanent roadways.
- E. Section 32 9219 - Seeding: Permanent turf for erosion control.
- F. Section 32 9223 - Sodding: Permanent turf for erosion control.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2016.
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.
- I. State General NPDES Permit and NOI associated with construction activities.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of Alabama Department of Environmental Management (ADEM) Erosion and Sedimentation Control Manual and as required by the National Pollution Discharge

Elimination System - General Permit.

- B. Best Management Practices Standard: Alabama Handbook for Erosion Control, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas.
- C. Deleted.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
- E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY EROSION AND SEDIMENT CONTROL**

SECTION 01 5713 – Page 2 of 5

- F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
- G. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- J. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- K. Open Water: Prevent standing water that could become stagnant.
- L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- B. Deleted.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished. The contractor shall be responsible for all Daily Observations, Monthly and Qualifying Event
- D. Complete, pay fee, and provide a copy of the Notice of Termination (NOT). issued for the project

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY EROSION AND SEDIMENT CONTROL**

SECTION 01 5713 – Page 3 of 5

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 - 1. Straw or hay.
 - 2. Wood waste, chips, or bark.
 - 3. Erosion control matting or netting.
 - 4. Cutback asphalt.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec⁻¹, minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
 - 8. Wire Backing: 1" x 4" gage, 6 inch x 12 inch maximum opening.
- D. Silt Fence Posts: One of the following, minimum 5 feet long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
- E. Gravel: See Section 32 1123 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION AND EXECUTION

- A. Deleted.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Width: As required; 20 feet, minimum.
 - 2. Length: 50 feet, minimum.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY EROSION AND SEDIMENT CONTROL**

SECTION 01 5713 – Page 4 of 5

washing area out of direct traffic lane, with drain into sediment trap or basin.

- C. Sedimentation/Silt Fence with Wire Backing: silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. As detailed on drawings
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Soil Stockpiles: Protect using one of the following measure:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges and surrounded with silt fence around the perimeter of the stockpile.
 - 2. Topsoil and seed with temporary seeding when not in use for 13 days. Provide permanent seeding when stock pile is no longer in use and prior to completion permanent project.
- G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
 - 2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.
- H. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches.
 - 2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
 - 3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.
- B. Silt Fences:
 - 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 - 2. Install with top of fabric at nominal height and embedment as specified.
 - 3. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 - 4. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
- C. Temporary Seeding:
 - 1. When hydraulic seeder is used, seedbed preparation is not required.
 - 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 - 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 - 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
 - 5. Incorporate fertilizer into soil before seeding.
 - 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
 - 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 - 8. Repeat irrigation as required until grass is established.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TEMPORARY EROSION AND SEDIMENT CONTROL**

SECTION 01 5713 – Page 5 of 5

3.05 MAINTENANCE

- A. Inspect preventive measures daily, and within 24 hours after the end of any storm that produces .75 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 - 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 - 2. Remove silt deposits that exceed one-third of the height of the fence.
 - 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Clean out temporary sediment control structures weekly and relocate soil on site.
- E. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Products.
 - 2. Transportation and handling.
 - 3. Storage and protection.
 - 4. Reuse of existing materials.
 - 5. Product options.
- B. Related Sections:
 - 1. Section 01 2500 - Substitution Procedures.

1.2 PRODUCTS

- A. Provide interchangeable components by the same manufacturer for identical items.
- B. Do not use products containing asbestos, lead, or other known hazardous materials.
- C. Do not reuse materials and equipment removed from existing construction in completed Work, except as specifically permitted by the Contract Documents.

1.3 TRANSPORTATION AND HANDLING

- A. Coordinate delivery of Products to prevent conflict with Work and adverse conditions at site.
- B. Transport and handle Products in accordance with manufacturer's instructions.
- C. Promptly inspect shipments to ensure that Products comply with requirements of Contract Documents, are undamaged, and quantities are correct.
- D. Provide equipment and personnel to handle products by methods to prevent damage.

1.4 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions with manufacturer's seals and labels intact and legible.
- B. Store Products on site unless prior written approval to store off site has been obtained from Owner.
- C. Store Products subject to damage by elements in weathertight enclosures. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- D. Exterior Storage:
 - 1. Store fabricated Products above ground; prevent soiling and staining.
 - 2. Cover products subject to deterioration with impervious sheet coverings; provide ventilation to prevent condensation.
 - 3. Store loose granular materials in well drained area on solid surfaces; prevent mixing with foreign matter.
- E. Arrange storage areas to permit access for inspection. Periodically inspect stored products to verify that products are undamaged and in acceptable condition.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PRODUCT REQUIREMENTS**

SECTION 01 6000 – Page 2 of 2

1.5 REUSE OF EXISTING MATERIALS

- A. Carefully remove, handle, protect, and store Products.
- B. Clean and refinish Products to original or specified condition.
- C. Restore operable components to working condition.
- D. Arrange and pay for transportation, storage, and handling of Products requiring off site storage, restoration, or renovation.

1.6 PRODUCT OPTIONS

- A. Products specified by reference standard only:
 - 1. Select any Product meeting the specified standard.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.
- B. Products specified by naming two or more acceptable Products: Select any named Product.
- C. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":
 - 1. Select the specified Product or a Product by a named manufacturer having equivalent or superior characteristics to the specified Product and meeting the requirements of the Contract Documents.
 - 2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
 - 3. The specified Product establishes the required standard of quality.
- D. Products specified by naming one or more Products followed by "or approved substitute" or similar statement:
 - 1. Submit a substitution request under provisions of Section 01 2500 for Products not listed.
 - 2. The specified Product establishes the required standard of quality.
- E. Products specified by naming one or more Products or manufacturers followed by the statement "Substitutions: Under provisions of Division 01":
 - 1. Submit a substitution request under provisions of Section 01 2500 for Products not listed.
 - 2. The specified Product establishes the required standard of quality.
- F. Products specified by naming one Product followed by the statement "Substitutions: Not permitted": Substitutions will not be allowed.
- G. Products specified by required performance or attributes, without naming a manufacturer or Product:
 - 1. Select any Product meeting specified requirements.
 - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Survey and field engineering.
 - 2. Submittals.
 - 3. Records.
- B. Provide and pay for field engineering services required for Project:
 - 1. Survey work required in execution of Work.
- C. Work includes preparation of an Existing Grade Topo Map Survey to confirm existing grades are as indicated herein.
- D. Work includes existing building pad soils compaction tests and any required corrective action.
- E. Other professional engineering services specified or required to execute Contractor's construction methods.
- F. Original undisturbed site geotechnical report is available from the Owner on request.

1.2 QUALIFICATIONS

- A. Surveyor: Qualified land surveyor, licensed in State in which project is located.
- B. Soils Engineer: Registered professional engineer of discipline required for specific service on Project. Licensed in State in which project is located.

1.3 SUBMITTALS

- A. Submit documentation to verify accuracy of field engineering work upon Architect's request.
- B. Submit certification that elevations and locations of improvements are in conformance with Contract Documents.

1.4 SURVEY REFERENCE POINTS

- A. Existing horizontal and vertical control points for project are those designated on Drawings.
- B. Locate, verify, and protect control points prior to beginning Work; preserve permanent reference points during construction.

1.5 PROJECT SURVEY REQUIREMENTS

- A. Establish minimum of two permanent bench marks on site, referenced to survey control points. Record locations on Project Record Documents.
- B. Establish lines and levels, locate and lay out, by instrumentation:
 - 1. Site improvements:
 - a. Stakes for grading, fill, and topsoil placement.
 - b. Utility slopes and invert elevations.
 - 2. Building foundation and column locations, floor elevations, and other controlling dimensions.
 - 3. Controlling lines and levels required for mechanical and electrical trades.

- C. Verify property corners, easements, building setbacks, and horizontal control dimensions with information contained in Contract Documents.
- D. Promptly notify Architect of any errors or discrepancies noted; await instructions prior to proceeding with Work.

1.6 RECORDS

- A. Maintain accurate log of control and survey work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction waste management goals, plan, and records.

1.2 WASTE MANAGEMENT GOALS

- A. Reuse, salvage, or recycle non-hazardous waste materials.
- B. Minimize waste sent to landfills and incinerators.
- C. Prioritize non-hazardous construction waste management in following order:
 - 1. Reduce amount of waste generated.
 - 2. Reuse material through on-site reuse or off-site salvaging, including sale or donation.
 - 3. Recycle material including diverting materials for secondary uses whenever economically feasible.
 - 4. Dispose of materials with no practical use or economic benefit at landfill.

1.3 WASTE MANAGEMENT

- A. Pro-actively manage construction and demolition waste:
 - 1. Practice efficient waste management when sizing, cutting, and installing products.
 - 2. Use all reasonable means to divert construction and demolition waste from landfills and incinerators, and to facilitate recycling and reuse.
 - 3. Return unused products and overages to supplier, or donate to non-profit group.
 - 4. Carefully install products; avoid removal of ill-timed and poorly installed products.
 - 5. Use centralized cutting areas to facilitate waste collection.
 - 6. Deliver, store, and handle products to prevent damage.
- B. Require subcontractors and suppliers to participate in waste management efforts.
- C. Construction waste includes:
 - 1. Products from demolition and removal, excluding excavated soil, and land-clearing debris.
 - 2. Excess and unusable construction products.
 - 3. Packaging materials for construction products.
 - 4. Other materials generated during construction process but not incorporated into the Work.
- D. Give consideration to:
 - 1. Availability of viable recycling markets.
 - 2. Condition of materials.
 - 3. Ability to provide material in suitable condition and in quantities acceptable to available markets.
 - 4. Time constraints imposed by internal project completion mandates.
- E. Be responsible for implementation of special programs involving rebates and similar incentives related to recycling of waste.
- F. Revenues and other savings obtained for salvage and recycling accrue to Contractor.
- G. Ensure that firms and facilities used for recycling, reuse, and disposal have legal permits for intended uses.

1.4 QUALITY ASSURANCE

- A. Review and discuss waste management plan implementation and progress at Preconstruction Conference and Progress Meetings.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Designate separate areas to facilitate separation of materials for potential recycling, salvage, reuse and return.
- B. Clearly identify areas and receptacles.
- C. Keep storage areas and receptacles clean and orderly; prevent contamination of materials.
- D. Monitor storage areas; correct problems and implement preventative measures.

1.6 TRAINING

- A. Provide training of waste management methods to be used at appropriate stages of Project.
- B. Require participation of all subcontractors.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 WASTE COLLECTION

- A. Provide containers and storage areas to facilitate waste management, clearly identified.
- B. Handle recyclable materials to prevent contamination by incompatible products and materials.
- C. Separate materials by:
 - 1. Placing into marked separate containers, then transporting to recycling facility.
 - 2. Placing into single container, then transporting to recycling facility for separation.

3.2 DISPOSAL

- A. Dispose of nonhazardous waste materials that cannot be reused, recycled, or salvaged at licensed landfill or incinerator.
- B. Handle, store, and dispose of hazardous wastes in accordance with applicable codes, ordinances, rules, and regulations.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CLOSEOUT PROCEDURES**

SECTION 01 7700 – Page 1 of 4

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.
 - 4. Project record documents.
 - 5. Operation and maintenance data.
 - 6. Warranties.
 - 7. Spare parts and maintenance materials.
 - 8. Starting of systems.
 - 9. Demonstration and instructions.

1.2 CLOSEOUT PROCEDURES

- A. Final Inspection:
 - 1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's inspection.
- B. Submit Final Application for Payment showing original Contract Sum, adjustments, previous payments, retainage withheld from previous payments, and sum remaining due.
- C. Closeout Submittals:
 - 1. Evidence of compliance with requirements of governing authorities.
 - 2. Certificate of Occupancy.
 - 3. Project Record Documents.
 - 4. Operation and Maintenance Data.
 - 5. Warranties.
 - 6. Keys and keying schedule.
 - 7. Spare parts and maintenance materials.
 - 8. Evidence of payment of Subcontractors and suppliers.
 - 9. Final lien waiver.
 - 10. Certificate of insurance for products and completed operations.
 - 11. Consent of Surety to final payment.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean surfaces exposed to view:
 - 1. Clean glass.
 - 2. Remove temporary labels, stains and foreign substances.
 - 3. Polish transparent and glossy surfaces.
 - 4. Vacuum carpeted surfaces; damp mop hard surface flooring.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Clean or replace filters of operating equipment.
- E. Clean debris from roofs and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.

SHELBY COUNTY EMA & IT BUILDING PROJECT CLOSEOUT PROCEDURES

SECTION 01 7700 – Page 2 of 4

- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain following record documents on site; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Material Safety Data Sheets.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Make entries neatly and accurately.
- E. Label each set or volume with title "PROJECT RECORD DOCUMENTS", project title, and description of contents.
 - 1. Organize contents according to Project Manual table of contents.
 - 2. Provide table of contents for each volume.
- F. Drawings: Mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Drawings.
- G. Specifications: Mark each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- H. Shop Drawings: Mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Shop Drawings.
- I. Submit two printed copies, also submit electronically in Adobe PDF format.

1.6 OPERATION AND MAINTENANCE DATA

- A. Identify as "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.

SHELBY COUNTY EMA & IT BUILDING PROJECT CLOSEOUT PROCEDURES

SECTION 01 7700 – Page 3 of 4

- B. Contents:
1. Directory: List names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 2. Operation and maintenance instructions: Arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
 3. Project documents and certificates including:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Copies of warranties and bonds.
- C. Submittal:
1. Submit two printed copies, also submit electronically in Adobe PDF format at least 15 days prior to final inspection.
 2. Architect will notify Contractor of any required revisions after final inspection.
 3. Revise content of documents as required prior to final submittal.
 4. Submit two copies of revised documents, and submit revised documents electronically in Adobe PDF format within 10 days after final inspection.

1.7 WARRANTIES

- A. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- B. Include Table of Contents.
- C. Submit two printed copies, also submit electronically in Adobe PDF format along with final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.9 STARTING OF SYSTEMS

- A. Notify Owner and Architect at least seven days prior to startup of each system or piece of equipment.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CLOSEOUT PROCEDURES**

SECTION 01 7700 – Page 4 of 4

- B. Prior to beginning startup verify that:
 - 1. Lubrication has been performed.
 - 2. Drive rotation, belt tension, control sequences, tests, meter readings, and electrical characteristics are within manufacturer's requirements.
 - 3. Utility connections and support components are complete and tested.
- C. Execute start-up under supervision of applicable manufacturer's representative or Contractor's personnel in accordance with manufacturers' instructions.
- D. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.
- E. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.10 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.
- E. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Abandonment and removal of existing utilities and utility structures.
- B. Selective demolition of curbs, sidewalks, paving, aggregate surfacing, etc.
- C. Removal of above grade improvements and below grade improvements in conflict with proposed improvements.

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion and Sediment Control.
- B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- D. Section 31 1000 - Site Clearing: Vegetation, existing debris and topsoil removal.
- E. Section 31 2200 - Grading: Topsoil removal.
- F. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations. Topsoil removal.
- G. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- H. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 2323 - Fill.

PART 3 EXECUTION

3.01 SCOPE

- A. Remove curbs, sidewalks, paving, retaining walls, aggregate surfacing, landings, etc. as required to accomplish new work.
- B. Remove all other paving and curbs within construction limits indicated on drawings.
- C. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet

- D. below finished grade and as needed to allow for new work.
- E. Remove concrete slabs on grade within construction limits indicated on drawings.
- F. Remove manholes and manhole covers, curb inlets and catch basins.
- G. Remove fences and gates.
- H. Remove above grade improvements and below grade improvements in conflict with proposed improvements.
- I. Remove septic tanks and field lines associated with building structures that been removed from the site. Septic tanks shall be pump out prior to removal. Septage shall be disposed of in a legal manner.
- J. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2323 Filling .

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- G. Provide traffic control and when working near or adjacent to open roads, streets, walks, etc.
- H. Provide temporary construction barricades to as needed to separate the work zone from open facilities and the public.
- I. Protect site benchmark and property corners. If destroyed, replace site benchmark and property corners at no expense to the owner.
- J. Protect existing improvements to remain and adjacent properties from damage.
- K. Restore damaged improvements and adjoining properties as acceptable to party having jurisdiction and at no cost to the owner.

- L. Provide positive drainage as needed to keep the site in a dry condition.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Provide temporary services during interruptions as needed.
- E. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- F. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- G. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- H. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- I. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all demolished improvements.
- C. Leave site in clean condition, ready for subsequent work.
- D. All debris, waste and other demolished material shall be disposed of in a legal manner.
- E. No burning of demolished material shall be allowed on site.
- F. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Formwork.
 - 2. Reinforcing.
 - 3. Cast-in place concrete including mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
 - 1. Foundations and footings.
 - 2. Slabs-on-grade.
 - 3. Slab on deck.
 - 4. Foundation and retaining walls.
 - 5. Building frame members.
 - 6. Equipment pads and bases.
 - 7. Stairs.
- C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 02 20 00, "Earthwork": Drainage fill under slabs on grade.
 - 2. Section 02 51 40, "Portland Cement Concrete Paving": Concrete paving and walks.
 - 3. Section 03 4100, "Structural Precast Concrete Wall Panels."
 - 4. Section 05 50 00, "Metal Fabrications": Metal items to be built into concrete.
 - 5. Section 07 90 00, "Sealants and Joint Fillers": Sealants and joint fillers in concrete work.
 - 6. Respective Sections of Division 15 and 16, as applicable, for furnishing of inserts, anchorage and erection items required for mechanical and electrical work.
 - 7. Divisions 15 and 16, as applicable, for furnishing and setting of conduit, pipes and sleeves for mechanical and electrical equipment.

1.2 SUBMITTALS:

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
 - 1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.
 - 2. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
 - 3. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually. Formwork drawings shall bear the seal and signature of a Professional Engineer registered in the State of Alabama.
 - 4. Coordination drawings for all installed embeds, anchor bolts, embedded piping, etc.
 - 5. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 2 of 20

6. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
 - a. Color finishes.
 - b. Normal weight aggregates.
 - c. Reglets.
 - d. Waterstops.
 - e. Vapor retarder/barrier.
7. Laboratory test reports for concrete materials and mix design test.
8. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
9. Minutes of preinstallation conference.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 1. ACI 301, "Specifications for Structural Concrete for Buildings".
 2. ACI 302, "Guide for Concrete Floor and Slab Construction".
 3. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 4. ACI 305, "Hot Weather Concreting".
 5. ACI 306, "Cold Weather Concreting".
 6. ACI 309, "Guide for Consolidation of Concrete".
 7. ACI 311, "Recommended Practice for Concrete Inspection".
 8. ACI 318, "Building Code Requirements for Reinforced Concrete".
 9. ACI 347, "Recommended Practice for Concrete Formwork".
 10. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
 11. American Welding Society, AWS D1.4 "Structural Welding Code - Reinforcing Steel".
- B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.
 1. Refer to Division 1 Section "Special Conditions" for additional information and requirements.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Owner's expense.
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:
 1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 3 of 20

- a. Contractor's superintendent.
- b. Agency responsible for concrete design mixes.
- c. Agency responsible for field quality control.
- d. Ready-mix concrete producer.
- e. Concrete subcontractor.
- f. Primary admixture manufacturers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Care shall be taken with the formwork on the bottom of the slabs, which will be exposed ceilings, to avoid the need for patching or repairs following the removal of the formwork. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
 - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
 - 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.
- E. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use concrete bricks or supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 4 of 20

- E. Bar and Rod Mats: ASTM A 184 "Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement".
- F. Threaded Dowels: Continuous threaded high-strength steel bars equal to "Lasstud" by Richmond Screw Anchor Co., Inc. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the drawings.
- G. Mechanical Splices: Equal to "Cadweld Rebar Splices", as manufactured by Erico Products, Inc., "C" Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on drawings.
- H. Steel Shapes, Plates and Rods: Conform to ASTM A 36, "Specification for Structural Steel".
- I. Do Not Weld Reinforcing Steel: Unless specifically noted on drawings. If welding is shown, conform to latest revision of AWS D12.1, "Reinforcing Steel Welding Code of the American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type I, II or IL.
 - 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type F.
 - 1. Limit use of fly ash to not exceed 25 percent of cement content by weight.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
 - 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
- D. Water: Potable.
- E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Air-Tite, Cormix Construction Chemicals.
 - b. Air-Mix or Perma-Air, Euclid Chemical Co.
 - c. Darex AEA or Daravair, W.R. Grace & Co.
 - d. MB-VR or Micro-Air, Master Builders, Inc.
 - e. Sealtight AEA, W.R. Meadows, Inc.
 - f. Sika AER, Sika Corp.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. PSI N, Cormix Construction Chemicals.
 - b. Eucon WR-75, Euclid Chemical Co.
 - c. WRDA, W.R. Grace & Co.
 - d. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - e. Plastocrete 161, Sika Corp.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 5 of 20

- H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucon 37, Euclid Chemical Co.
 - b. WRDA 19 or Daracem, W.R. Grace & Co.
 - c. Rheobuild or Polyheed, Master Builders, Inc.
 - d. Sikament 300, Sika Corp.
- I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accelguard 80, Euclid Chemical Co.
 - b. Daraset, W.R. Grace & Co.
 - c. Pozzutec 20, Master Builders, Inc.
- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucon Retarder 75, Euclid Chemical Co.
 - b. Daratard-17, W.R. Grace & Co.
 - c. Pozzolith R, Master Builders, Inc.
 - d. Protard, Prokrete Industries.
 - e. Plastiment, Sika Corporation.
- K. Crystalline Capillary Waterproofing Admixture:
 - 1. Xypex (or equal) at rate of 2% by weight of cement content indicated in construction documents. Coordinate locations with architectural waterproofing details.

2.4 RELATED MATERIALS:

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (22 gage) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Waterstops: Provide strip applied, flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
 - 1. Flexible Butyl Rubber Strip Applied Waterstops:
 - a. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Swellstop, as manufactured by Greenstreak.
 - 2. Synkoflex.
 - 2. Rubber Waterstops: Corps of Engineers CRD-C 513.
 - a. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. The Burke Co.
 - 2. Progress Unlimited.
 - 3. Williams Products, Inc.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 6 of 20

3. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.
 - a. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 1. The Burke Co.
 2. Greenstreak Plastic Products Co.
 3. W.R. Meadows, Inc.
 4. Progress Unlimited.
 5. Schlegel Corp.
 6. Vinylex Corp.
- D. Vapor Barrier:
 1. Vapor Barrier, General Use (except as indicated below): At least, 10-mil thick polyethylene-coated barrier paper, or 1/8" thick asphalt core membrane sheet.
 - a. Product/Manufacturer: Equivalent to "Moistop Underslab", as manufactured by Fortifiber Building Products Systems; Reno, NV. Including in part, joint mastic and/or seals, and all other components required for a complete, proper, and vaporproof installation.
 - b. Locations for Use: Continuous below all building slabs, and other structural slabs, porches, stoops, pads, covered (below roofs) areas, etc., on grade, and turned-down to tops of footings.
- E. Coordinate the use (or non-use) of membrane-forming compounds with the suppliers of finishes to be provided on concrete surfaces. Do not use membrane-forming compounds at locations where they may have a detrimental effect on the permanent installation of the finish materials, floor coverings, their adhesives, setting beds, etc. At such locations, utilize only dissipating type compounds.
- F. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Spartan-Cote, The Burke Co.
 - b. Day-Chem Cure and Seal, Dayton Superior Corp.
 - c. Eucocure, Euclid Chemical Co.
 - d. Horn Clear Seal, A.C. Horn, Inc.
 - e. L&M Cure R, L&M Construction Chemicals, Inc.
 - f. Masterkure, Master Builders, Inc.
 - g. CS-309, W.R. Meadows, Inc.
 - h. Kure-N-Seal, Sonneborn-Chemrex.
- G. V.O.C. Compliant Acrylic Curing and Sealing Type (30 Percent): Liquid type membrane-forming curing compound complying with ASTM C 309, Type 1, Class A and B. Provide 30 percent solids minimum, for surfaces indicated to be sealed.
- H. Safe Cure and Seal: 30 percent (J-19), Dayton Superior Inc.
- I. Evaporation Control:
 1. Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 7 of 20

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Eucobar, Euclid Chemical Co.
 - 2. E-Con, L&M Construction Chemicals, Inc.
 - 3. Confilm, Master Builders, Inc.
- J. V.O.C. Compliant Evaporation Control: Sure Film (J-74), Dayton Superior Inc.
- K. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. K-15, Ardex, Inc.
 - b. LevelLayer II, Dayton Superior Corp.
 - c. Flo-Top, Euclid Chemical Co.
 - d. Gyp-Crete, Gyp-Crete Corp.
 - e. Levelex, L&M Construction Chemicals, Inc.
 - f. Underlayment 110, Master Builders, Inc.
 - g. Thoro Underlayment Self-Leveling, Thoro System Products.
- L. Bonding Agent: Polyvinyl acetate or acrylic base.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polyvinyl Acetate (Interior Only):
 - 1. Superior Concrete Bonder, Dayton Superior Corp.
 - 2. Euco Weld, Euclid Chemical Co.
 - 3. Weld-Crete, Larsen Products Corp.
 - 4. Everweld, L&M Construction Chemicals, Inc.
 - 5. Ready Bond, Symons Corp.
 - b. Acrylic or Styrene Butadiene:
 - 1. Acrylic Bondcrete, The Burke Co.
 - 2. Day-Chem Ad Bond, Dayton Superior Corp.
 - 3. SBR Latex, Euclid Chemical Co.
 - 4. Daraweld C, W.R. Grace & Co.
 - 5. Hornweld, A.C. Horn, Inc.
 - 6. Everbond, L&M Construction Chemicals, Inc.
 - 7. Acryl-Set, Master Builders Inc.
 - 8. Intralok, W.R. Meadows, Inc.
 - 9. Sonocrete, Sonneborn-Chemrex.
- M. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Resi-Bond (J-58), Dayton Superior.
 - b. Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - c. Epoxite Binder 2390, A.C. Horn, Inc.
 - d. Epabond, L&M Construction Chemicals, Inc.
 - e. Concrese Standard Liquid, Master Builders, Inc.
 - f. Rezi-Weld 1000, W.R. Meadows, Inc.
 - g. Sikadur 32 Hi-Mod, Sika Corp.
- N. Interior Epoxy Sealer: Use a maximum 35 percent type.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 8 of 20

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Epoxy-Plus; Dayton Superior Inc.
 - b. Eucopoxy 1; Euclid Chemical
 - c. Oauerseal 30E; Non-Crete, Inc.
 - d. Rescon R117; Symons Corp.
 - e. Son-No-Mar; Sonneborn, Div./Chem Rex Inc.
 - f. Super Seal 35; L & M Const. Chem. Co.
- O. V.O.C. Compliant Urethane Sealer:
 1. Day Chem Urethane V.O.C. (J-39); Dayton Superior Inc.

2.5 PROPORTIONING AND DESIGNING MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial mixtures or field experience methods as specified in ACI 318-89 Section 5.3. If trial mixtures method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing, unless otherwise acceptable to Architect.
- B. Trial mix designs and strength tests, made by qualified independent material laboratory, in accordance with ACI 318-89 Section 5.3 are required for the following types of concrete:
 1. Normal weight concrete with specified strength in excess of 4000 psi.
 2. All concrete designs for which a suitable experience record is not available.
- C. Mix design based on a record of past performance in accordance with ACI 318-89 Section 5.3, may be provided by qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.
- D. All concrete mix designs shall include the following information:
 1. Proportions of cement, fine and coarse aggregate and water.
 2. Water/cement ratio, design strength, slump and air content.
 3. Type of cement and aggregates.
 4. Type and dosage of all admixtures.
 5. Type, color and dosage of integral coloring compounds, where applicable.
 6. Special requirements for pumping.
 7. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.
- E. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.
- F. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:
 1. 5000-psi, 28-day compressive strength.
 2. 4000-psi, 28-day compressive strength.
 3. 3000-psi, 28-day compressive strength.
- G. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
 1. Subjected to freezing and thawing: W/C 0.45.
 2. Subjected to deicers/watertight: W/C 0.40.
 3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 9 of 20

- H. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps and sloping surfaces: Not more than 3 inches.
 2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
 3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
 4. Other concrete: Not more than 5 inches or less than 3 inches.
- I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.6 ADMIXTURES:

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg.F (10 deg.C).
- C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
 - a. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.
 - b. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2-inch maximum aggregate.
 2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.
- E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.
- F. Xypex Admixture (or equal) at rate of 2% by weight of cement content as indicated in construction documents. Coordinate locations with architectural waterproofing details.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
1. When air temperature is between 85 deg.F (30 deg.C) and 90 deg.F (32 deg.C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg.F (32 deg.C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS:

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Formwork drawings shall bear the seal and signature of a Professional Engineer registered in the State of Alabama. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.Care shall be taken with the formwork on the bottom of the slabs, which will be exposed ceilings, to avoid the need for patching or repairs following the removal of the formwork.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION:

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.

3.4 PLACING REINFORCEMENT:

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

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 11 of 20

1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS:

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Joint fillers and sealants are specified in Section 07900, "Sealants and Joint Fillers".
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.
 1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 12 of 20

4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS:

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Install dovetail anchor slots in concrete structures as indicated on drawings.
- D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES:

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT:

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 13 of 20

- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- G. When air temperature has fallen to or is expected to fall below 40 deg.F (4 deg.C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg.F (10 deg.C) and not more than 80 deg.F (27 deg.C) at point of placement.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg.F (32 deg.C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES:

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 14 of 20

with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Care shall be taken with the formwork on the bottom of the slabs, which will be exposed ceilings, to avoid the need for patching or repairs following the removal of the formwork. Repair and patch defective areas with fins and other projections completely removed and smoothed.

- B. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.
 - 1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES:

- D. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 - 1. After placing slabs, finish surface to tolerances specified in Section 3.11. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- E. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances specified in Section 3.11. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- F. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 - 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances specified in Section 3.11. Grind smooth any surface defects that would telegraph through applied floor covering system.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 15 of 20

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 FLOOR FLATNESS/LEVELNESS REQUIREMENTS:

- A. After placing slabs, finish surface to the following tolerances of F(F) (floor flatness) and F(L) (floor levelness) measured according to ASTM E 1155:

FINISH	SLAB-ON-GRADE				FRAMED FLOOR	
	OVERALL		LOCAL		OVERALL	LOCAL
	FF	FL	FF	FL	FF	FF
Scratch Finish	18	15	15	13	25	22
Float Finish	20	17	17	15	25	22
Trowel Finish	25	22	22	19	25	22

Specified overall F-numbers apply to the whole floor, taken as one. Minimum local F-numbers apply to each slab, bounded by construction joints.

3.12 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 16 of 20

- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
 - 2. Provide moisture curing by the following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.
 - c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
 - 3. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 4. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
 - a. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
 - 1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 SHORES AND SUPPORTS:

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.
- B. Shoring requirements shall be designed by a professional engineer registered in the State of Florida. All designs shall be submitted to the Architect bearing the seal and signature of the Professional Engineer.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 17 of 20

- C. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted.
- D. Extend shoring at least three floors under floor or roof being placed for structures over four stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
- E. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.
- F. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.
- G. For concrete exposed to view, all formwork shall be tight to prevent leaks and fins.

3.15 REMOVING FORMS:

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg.F (10 deg.C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.16 REUSING FORMS:

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.17 CONCRETE SURFACE REPAIRS:

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.
- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 18 of 20

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 19 of 20

- I. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- J. Repair methods not specified above may be used, subject to acceptance of Architect.

3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. General: The Owner will employ a testing agency to perform tests and to submit test reports.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg.F (4 deg.C) and below, when 80 deg.F (27 deg.C) and above, and one test for each set of compressive-strength specimens.
 - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
- C. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day, or for each 5000 sq ft of surface are placed; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - 1. Any additional cylinder required by the Contractor for early strength gain tests for form stripping or post-tensioning are Contractor's responsibility and shall be paid for by Contractor.
 - 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - 4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 ps

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CAST-IN-PLACE CONCRETE**

SECTION 03-3000 – Page 20 of 20

5. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
6. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
7. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF CAST-IN-PLACE CONCRETE

**SHELBY COUNTY EMA & IT BUILDING PROJECT
MASONRY MORTARING**

SECTION 04-0513 – Page 1 of 3

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mortar for masonry.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 04 2000 – Brick Unit Masonry.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C91 - Standard Specification for Masonry Cement.
 - 2. C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 3. C150 - Standard Specification for Portland Cement.
 - 4. C199 - Standard Test Method for Pier Test for Refractory Mortar.
 - 5. C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 - 6. C270 - Standard Specification for Mortar for Unit Masonry.
 - 7. C1329 - Standard Specification for Mortar Cement.
- B. The Masonry Society (TMS):
 - 1. 402 - Building Code for Masonry Structures.
 - 2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Samples: 1/2 x 1/2 inch x 3 inch long colored mortar samples.
- B. Quality Control Submittals:
 - 1. Test reports: Indicating mortar compliance with ASTM C270.
 - 2. Delivery tickets: If mortar is delivered to site dry and pre-blended, furnish delivery tickets indicating quantity, mortar type, and date of manufacture.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS 402 and 602.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver cement and lime in manufacturer's original, unopened packages or containers.
- B. Protect materials from moisture absorption and damage; reject damaged containers.
- C. Store aggregate to prevent inclusion of foreign matter.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Cement:
 - 1. Essroc Cement Corp. (www.essroc.com)
 - 2. LaFarge North America, Inc. (www.lafarge-na.com)
 - 3. Lehigh Cement Co. (www.lehighcement.com)
 - 4. Texas Industries, Inc. (www.txi.com)
- B. Acceptable Manufacturers - Lime:
 - 1. Graymont Dolime (OH) Inc. (www.graymont-oh.com)
 - 2. Lhoist North America. (www.lhoist.us)
- C. Acceptable Manufacturers - Preblended Mortars and Grouts:
 - 1. Quikrete Companies. (www.quikrete.com)
 - 2. Cemex. (www.cemex.com)
- D. Acceptable Manufacturers - Colorants:
 - 1. Cathay Pigments. (www.cathaypigments.com)
 - 2. Davis Colors. (www.daviscolors.com)
 - 3. Solomon Colors. (www.solomoncolors.com)
- E. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150, Type I.
 - 2. For exposed surfaces, provide cement from one source throughout project.
- B. Aggregate:
 - 1. ASTM C144, standard masonry type.
 - 2. For exposed surfaces, provide aggregate from one source throughout project.
- C. Lime: ASTM C207, Type S.
- D. Colorant: Pure mineral oxide type, color to be selected from manufacturer's full color range.
- E. Water: Clean and free from oils, acids, alkalies, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.3 MIXING

- A. Mix mortar in accordance with ASTM C270.
- B. Jobsite Proportioning of Mortar:
 - 1. Mix using mechanical mixer. Hand mixing not permitted.
 - 2. Mix approximately three-quarters of required water, all of cement and lime, and one-half of aggregate for minimum of 2 minutes.
 - 3. Add remainder of water and aggregate; mix for minimum of 3 minutes.

- C. Dry Preblended Mortar:
 - 1. Mix using continuous, self-cleaning mixer mounted at apex of silo cone.
 - 2. Set water flow valve to provide workable consistency.
- D. Provide uniformity of color in exposed mortar.
- E. Colorant may not exceed 9 pounds per 94 pound bag of cement for mineral oxides.
- F. Thoroughly mix ingredients in quantities needed for immediate use.
- G. Discard lumpy, caked, frozen, and hardened mixes.
- H. Mortar may be retempered by adding water as required. Use mortar within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-1/2 hours after initial mixing at ambient temperatures over 80 degrees F.
- I. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect's approval.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Follow requirements specified in referenced sections.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete unit masonry.
 - 2. Brick unit masonry.
 - 3. Autoclaved aerated concrete unit masonry.
 - 4. Fireclay brick and clay flue linings.
 - 5. Integral flashings.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 04 0513 - Masonry Mortaring.
 - 3. Section 04 0516 - Masonry Grouting.
 - 4. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A153/A153M - Standard Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
 - 2. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 4. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 5. A951 - Standard Specification for Masonry Joint Reinforcement.
 - 6. B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 7. C27 - Standard Classification of Fireclay and High-Alumina Refractory Brick.
 - 8. C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - 9. C90 - Standard Specification for Hollow Loadbearing Concrete Masonry Units.
 - 10. C129 - Standard Specification for Hollow Nonloadbearing Concrete Masonry Units.
 - 11. C216 - Standard Specification for Facing Brick (Solid Units Made from Clay or Shale).
 - 12. C315 - Standard Specification for Clay Flue Linings.
 - 13. C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
 - 14. C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
 - 15. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Concrete.
 - 16. C1019 - Standard Test Method for Sampling and Testing Grout.
 - 17. C1261 - Standard Specification for Firebox Brick for Residential Fireplaces.
 - 18. C1283 - Standard Practice for Installing Clay Flue Linings.
 - 19. C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
 - 20. C1386 - Standard Specification for Precast Autoclaved Aerated Concrete (PAAC) Wall Construction Units.
- B. The Masonry Society (TMS):
 - 1. 402 - Building Code for Masonry Structures.
 - 2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Provide information on reinforcing and anchors including sizes, profiles, materials, and finishes.
 - 2. Samples: Concrete masonry samples in quantities showing full color and texture range.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Mockup:
 - 1. Size: 4 feet high x 8 feet wide.
 - 2. Show:
 - a. Masonry color and texture range.
 - b. Mortar joint size, color, and profile.
 - c. Each bond pattern.
 - d. Anchors.
 - e. Flashings and weeps.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.
- C. Perform Work in accordance with TMS 402 and 602.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store masonry off ground; prevent contact with materials that could cause staining or damage.
- B. Protect reinforcement and anchors from corrosion.

1.6 PROJECT CONDITIONS

- A. Wall Protection:
 - 1. During erection, cover tops of partially completed walls with strong waterproof membrane at end of each day or work stoppage.
 - 2. Extend cover minimum of 24 inches down both sides; hold securely in place.
- B. Load Application:
 - 1. Do not apply uniform loads for at least 12 hours after building masonry columns or walls.
 - 2. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.
- C. Environmental Requirements:
 - 1. Hot weather requirements: If ambient temperature is over 95 degrees F or relative humidity is less than 50 percent, protect from direct sun and wind exposure for minimum 48 hours after installation.
 - 2. Cold weather requirements: Do not use frozen materials or build on frozen work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Concrete Masonry Units:
 - 1. Nettleton Concrete "Bunished Face"

- B. Acceptable Manufacturers - Masonry Accessories:
 - 1. Blok-Lok Ltd. (www.blok-lok.com)
 - 2. Dur-O-Wal. (www.dur-o-wal.com)
 - 3. Heckmann Building Products. (www.heckmannbuildingprods.com)
 - 4. Hohmann and Barnard, Inc. (www.h-b.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Concrete Masonry Units: Burnished Face:
 - 1. ASTM C129, solid or hollow non-load bearing type, normal weight.
 - 2. Size: Nominally 8 inches high x 16 inches long x 4 inches thick.
 - 3. Special shapes: Corners
 - 4. Surface finish: Ground and polished.
 - 5. Color: To be selected from manufacturer's full color range.
- B. Mortar: Specified in Section 04 0513.
- C. Veneer Ties: Hot dip galvanized steel wire ties. Basis of design H&B X0SEAL at exterior metal stud walls, H&B DW-10HS at concrete wall.
- D. Flexible Flashings:
 - 1. Polyethylene sheet laminated to plastic film, release paper facing, self-adhering. Min 40 mil thick.
 - 2. Termination mastic: Type recommended by flashing manufacturer.
- E. Rigid Flashings: Kynar finish galvalume.
- F. Termination Bars: Aluminum, 14 ga. 1" wide with 3/8" sealant lip
- G. Weeps: Polypropelene Cell Vents 3/8 x 3 1/2 x 3 3/8 at 48" c/c.
- H. Mortar Dropping Control: Preformed plastic mesh
- I. Joint Sealer: Specified in Section 07 9200.
- J. Cleaner: Type recommended by masonry manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Wet brick having an absorption rate in excess of 20 g per 30 square inches per minute as determined by ASTM C67 so that absorption rate when laid does not exceed this amount.
- B. Remove dirt, loose rust, and other foreign matter from reinforcement and anchors.

3.2 INSTALLATION

- A. Establish lines, levels and courses indicated. Protect from displacement.

SECTION 04-2000 – Page 4 of 5

- B. Maintain masonry courses to uniform dimensions. Form horizontal and vertical joints of uniform thickness.
- C. Lay concrete masonry veneer in **stacked** bond.
- D. Lay masonry plumb and level. Do not adjust masonry units after mortar has set.
- E. Lay solid masonry units in full mortar bed, with full head joints. Lay hollow masonry units with face shell bedding on head and bed joints.
- F. Do not butter corners or excessively furrow joints.
- G. Machine cut masonry with straight cuts and clean edges; prevent oversized or undersized joints. Discard damaged units. Do not expose cut cells.
- H. Isolate masonry from structural members with compressible filler.
- I. When joining fresh masonry to partially set masonry, remove loose masonry and mortar; clean and lightly wet exposed surface of set masonry.
- J. Stop horizontal runs by racking back normal bond unit in each course. Tothing not permitted.
- K. Veneer Ties:
 - 1. Space ties to provide one tie per 2.67 square feet at maximum spacing of 32 inches on center horizontally.
 - 2. Locate ties within 12 inches of ends of masonry walls and openings.
- L. Control and Expansion Joints:
 - 1. Do not continue horizontal joint reinforcement through joints.
 - 2. Keep joints free from mortar and grout.
 - 3. Install joint backing and joint sealer at control joints in accordance with Section 07 9200.
 - 4. Form expansion joint as indicated on Drawings.
- M. Finishing Mortar Joints:
 - 1. Exposed locations: Tool joints to struck profile.
 - 2. Concealed locations: Cut joints flush.
- N. Flashings:
 - 1. Install flashing with outer edge flush with outside face of masonry; extend up backup 8 inches minimum and seal.
 - 2. Lap end joints 4 inches minimum and seal.
 - 3. Form end dams where flashing is stopped or interrupted.
 - 4. Apply trowel coat of mastic along flashing at top edge, seams, cuts, and penetrations.
- O. Weeps:
 - 1. Locate in head joints in first course above flashings at maximum 48 inches on center.
 - 2. Set weeps flush with exterior face of masonry
- P. Install mortar dropping control continuously in cavities above flashings.

SECTION 04-2000 – Page 5 of 5

- Q. Installation Tolerances; Maximum variation from:
1. Alignment of columns and pilasters: Plus or minus 1/4 inch.
 2. Alignment face to face of adjacent units: Plus or minus 1/8 inch.
 3. Vertical alignment of head joints: Plus or minus 1/2 inch in 10 feet.
 4. True plane of wall: Plus or minus 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
 5. Plumb: Plus or minus 1/4 inch in 10 feet noncumulative; 1/2 inch in 20 feet or more.
 6. Level coursing: Plus or minus 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch in 30 feet.
 7. Joint thickness: Plus or minus 3/32 inch.
 8. Cross sectional thickness of walls: Plus or minus 1/4 inch.

3.3 CLEANING

- A. Protect adjacent and underlying surfaces.
- B. Apply masonry cleaner in accordance with manufacturer's instructions.
- C. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Structural steel work including schedules, notes and details showing size and location of members, typical connections, and type of steel required.
 - 2. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
 - 3. Related work specified elsewhere:
 - a. Miscellaneous Metal Fabrications are specified elsewhere in Division 5
 - b. Refer to Division 3 for anchor bolt installation in concrete, Division 4 for anchor bolt installation in masonry.
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 05500, "Metal Fabrications": Loose steel bearing plates and miscellaneous steel framing.

1.2 PERFORMANCE REQUIREMENTS:

- A. Structural Performance: Engineer structural steel members and connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.
- B. Design of Members and Connections: Details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1.3 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
 - 1. Submit all shop drawings on one reproducible print (sepia) and two blue line prints only. The reproducible print will be returned. All blue line prints required by the contractor are the responsibility of the Contractor and shall be made after reproducible is returned.
- B. Product Data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards). This data is submitted for information only.
 - 1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 - 2. High-strength bolts (each type), including nuts and washers.
 - a. Include Direct Tension Indicators if used.
 - 3. Structural steel primer paint.
 - 4. Shrinkage-resistant grout.
 - 5. Welder's certificates
 - 6. Submit evidence of fabricator and erector qualifications.
- C. Shop Drawings prepared under the supervision of, signed and sealed by a Licensed Professional Engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
 - 1. Include details of cuts, connections, camber, holes, and other pertinent data

2. Welds: Indicate welds by standard AWS A2.1 and A2.4 symbols. Distinguishing between shop and field welds, and show size, length, and type of each weld.
 3. Bolts: Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
 4. Setting Drawings: Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage's to be installed by others.
 5. Erection Drawings: Prepare and furnish to the Architect for review, erection drawings, detailed shop drawings and connection design calculations for all structural steel. Manufacturing of any material or performing of any work before final review of shop drawings will be entirely at risk.
 6. Contract documents shall not be used for shop drawing, including erection plans or details.
 7. All shop drawings which are resubmitted for any reason shall have all revised items clouded or identified for each submittal.
 8. Fabrication, assembly and erection shall conform to reviewed shop drawings.
- D. Connection Calculations:
1. All structural steel connections not specifically detailed on the drawings shall be designed to resist forces indicated, by the Contractor, under the direct supervision of a professional engineer registered in the State of Alabama.
 2. Design calculations for the connections designed by the Contractor shall be submitted for the files of the Architect and Engineer. Calculations shall bear the seal of a professional engineer registered in the State of Alabama. Shop drawings containing connections for which calculations have not been received will be returned unchecked as an incomplete submittal.
 3. For each connection, the following shall be noted on the shop drawings:
 4. Required design reaction.
 5. Calculation sheet number for design.
 6. Capacity of detailed connection.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
1. Structural steel, including chemical and physical properties.
 2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 3. Direct-tension indicators.
 4. Shear stud connectors.
 5. Shop primers.
 6. Nonshrink grout.

1.4 QUALITY ASSURANCE:

- A. Erector Qualifications: Engage an experienced Erector who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

SECTION 05 1200 – Page 3 of 9

- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
1. AISC's "Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design."
 2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
 3. AISC "Specifications for Structural Steel Buildings, Section 10, Architecturally Exposed Structural Steel."
 4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 5. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 6. AISC's "Seismic Provisions for Structural Steel Buildings."
 7. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges", dated June 10, 1992
 - a. General: AISC "Code of Standard Practice" shall apply except to the extent that references are made to the responsibility of the Owner and/or Architect or Engineer in which event those references shall have no applicability. Where a conflict exists between the Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.
 - b. Paragraph 3.1: Add the following: "3.1.8 Include in the bid price for the work structural steel members shown on drawings, but not identified as to size, section, and material grade by assuming sizes, sections, and material grades shown for similarly loaded members having approximately the same overall length except on areas that are noted on the drawings as incomplete. Identify such members and their associated cost in the bid for the work".
 - c. Paragraph 3.3: Delete the first sentence, "In case of discrepancies between plans and specifications for buildings, the specifications govern", and insert the following in its place, "In case of discrepancies between drawings and specifications for buildings, the drawings govern".
 - d. Paragraph 3.4: In the first sentence, delete the phrase "and made to a scale not less than 1.8" to the foot".
 - e. Paragraph 5.1: Delete the first sentence, "When the fabricator receives 'released for construction' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". and insert the following in its place "when the fabricator receives 'issued for structural steel mill order of wide flange beams, girders and columns only' plans and specifications, the fabricator may immediately place orders for the material necessary for fabrication". Delete the second sentence, "The contract documents must note any materials or areas which should not be ordered due to a design which is incomplete or subject to revision".
 8. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 9. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 10. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel."
- E. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification in the past year.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING:

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

1.7 TESTING SERVICES:

- A. Provide the Testing Laboratory with the following:
 - 1. A complete set of shop and erection drawings reviewed by the Architect.
 - 2. Mill test reports, cutting lists, order sheets, material bills and welder's certificates.
 - 3. Full and ample means and assistance for testing all material.
 - 4. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.
- B. Propose procedures, acceptable to the Architect, to correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements.
- C. Provide additional tests, by the Quality Control Testing Laboratory, as may be necessary, to reconfirm any noncompliance of the original work, and as may be necessary to show compliance off corrected work.

PART 2 – PRODUCTS

2.1 STEEL MATERIALS:

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. Structural Steel Shapes, Plates, and Bars: As follows:
 - 1. Carbon Steel: ASTM A 36 (ASTM A 36M).
 - 2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A 572 (ASTM A 572M), Grade 50.
- C. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.
- D. Hot-Formed Structural Steel Tubing: ASTM A 501.
- E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
 - 1. Finish: Black, except where indicated to be galvanized.
- F. Connection Material: Unless noted otherwise on the drawings, stiffener plates, doubler plates, gusset plates and the connecting plates shall be the same grade of steel as members being connected.
 - 1. Finish: Black, except where indicated to be galvanized.

- G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.
- H. Anchor Rods, Bolts, Nuts, and Washers: As follows:
 - 1. Unheaded Rods: ASTM A 36 (ASTM A 36M).
 - 2. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
 - 3. Washers: ASTM A 36 (ASTM A 36M).
- I. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain, uncoated.
- J. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER:

- A. Primer: SSPC-Paint 15, Type I, red oxide.

2.3 GROUT:

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time. Subject to compliance with requirements, provide one of the following:
 - 1. High Performance (Non-Metallic):
 - a. "Masterflow 928"; Master Builders.
 - b. "Crystex"; L & M Const. Chemical Co.
 - 2. Construction Grade (Non-Metallic):
 - a. "Set Grout"; Master Builders.
 - b. "Euco-NS Grout"; Euclid Chemical Co.
 - c. "Duragrout"; L & M Const. Chemical Co.
 - d. "Horn Non-Corrosive Non-Shrink Grout"; A.C. Horn, Inc.
 - e. "588 Grout"; W.R. Meadows, Inc.
 - f. "Five Star Grout"; Five Star Products, Inc.

2.4 FABRICATION:

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
 - 1. Camber structural steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 - 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 - 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
 - 7. Piping and/or cracks in flanges or webs of all rolled shapes or plates are to be removed and welded solid by AISC procedures.

SECTION 05 1200 – Page 6 of 9

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded.
- C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.
- E. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.
- F. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.
- G. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.
- H. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.5 SHOP CONNECTIONS:

- A. Simple Beam Connections: Standard double angle framed beam connections using bolts as specified.
 - 1. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.
- B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.6 SHOP PRIMING:

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed-on fireproofing, [unless otherwise specified].
 - 5. Galvanized surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
 - 1. SSPC-SP 2 “Hand Tool Cleaning.”

2.7 SOURCE QUALITY CONTROL:

- A. Independent Testing and Inspecting Laboratory: Owner will engage an Independent Testing and Inspecting Laboratory to perform shop inspections and tests and to prepare test reports.
 - 1. Testing laboratory will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
 - 2. Provide testing laboratory with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor’s expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Shop-bolted connections will be tested and inspected according to RCSC’s “Specification for Structural Joints Using ASTM A325 or A 490 Bolts”.
- E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing laboratory’s option.
 - 1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 2. Ultrasonic Inspection: ASTM E 164.

PART 3 –EXECUTION:

3.1 INSPECTION:

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete [and masonry bearing surfaces] and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.
- B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

3.3 ERECTION:

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

SECTION 05 1200 – Page 8 of 9

- C.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout materials.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection.
- H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS:

- A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.
- D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL:

- A. Testing Laboratory Responsibility: The Owner's Testing Laboratory will perform field special inspections and tests on and to prepare test reports as follows:

1. Testing Laboratory shall also approve welding certificates. Contractor shall submit three (3) copies of welding certificates and procedures for each welder involved in the Work.
2. Testing Laboratory shall conduct and interpret tests, certificates and procedures and state in each report whether tested Work complies with or deviates from requirements.
- B. Quantity of Required Inspections and Tests: Testing Laboratory shall perform inspections or tests in accordance with AISC specification:
 1. Shop Bolted Connections: Special Inspection requirements per 2012 IBC. Refer to Special Inspection Schedule in Construction Documents.
 2. Shop Welded Connections: Special Inspection requirements per 2012 IBC. Refer to Special Inspection Schedule in Construction Documents.
 3. Field-Bolted Connections: Special Inspection requirements per 2012 IBC. Refer to Special Inspection Schedule in Construction Documents.
 4. Field Welding: Special Inspection requirements per 2012 IBC. Refer to Special Inspection Schedule in Construction Documents.
 5. Other Inspections as required by AISC and indicated on Special Inspection Schedule in Construction Documents.
- C. Provide access for Testing Laboratory to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Deficiencies: Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- E. Field Inspections and Tests: check steel as received in the field for possible shipping damage workmanship, piece making and verification of required camber.
- F. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.6 CLEANING

- A. Touch up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).
- B. Touch up Painting: Cleaning and touch up painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Section 09900, "Painting."

END OF STRUCTURAL STEEL

SECTION 05 2100 – Page 1 of 4

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. K-series open-web steel joists.
 - 2. LH-series long span steel joists.
 - 3. Joist accessories.
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 01 4100, "Testing and Inspection Services - General": Independent testing agency procedures and administrative requirements.
 - 2. Section 03 3000, "Concrete": Installing anchors set in concrete.
 - 3. Section 04 2000, "Unit Masonry": Installing anchors set in unit masonry.
 - 4. Section 05 1200, "Structural Steel": Field quality-control procedures .
 - 5. Section 03 4100, Structural Precast Concrete Wall Panels.
 - 6. Section 05 5000, "Metal Fabrications": Loose, steel bearing plates and miscellaneous steel framing.
 - 7. Section 09 9000, "Painting": Surface preparation and prime painting.

1.2 PERFORMANCE REQUIREMENTS:

- A. Structural Performance: Engineer, fabricate, and erect joists and connections to withstand design loads within limits and under conditions required.
 - 1. Design Loads: As indicated.
 - 2. Design joists to withstand design loads without deflections greater than the following:
 - a. Roof Joists: Vertical deflection of 1/360 of the span.
- B. Engineering Responsibility: Engage a joist manufacturer who utilizes a qualified professional engineer to prepare design calculations, shop drawings, and other structural data for steel joists.

1.3 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of joist, accessory, and product specified.
- C. Shop Drawings showing layout, mark, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, accessories, splice and connection details, and attachment to other units of Work.
 - 1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
 - 2. For joists indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Design calculations submit for record one copy of design calculations, sealed by an engineer registered in the state where the project is located, for joist and joist girders with cantilevers or concentrated loads or joist sizes for which standard load tables are not applicable.
- E. Material certificates signed by joist manufacturer certifying that joists comply with SJI's "Specifications."
- F. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.
- G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- I. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence joists' compliance with building code in effect for Project.

SECTION 05 2100 – Page 2 of 4

1.4 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing joists similar to those indicated for this Project and that have a record of successful in-service performance.
 - 1. Manufacturer must be certified by SJI to manufacture joists conforming to SJI standard specifications and load tables.
- B. SJI Design Standard: Comply with recommendations of SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders," applicable to types of joists indicated.
- 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. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.
- E. Inspection: Inspect joists and girders in accordance with SJI "Specifications."

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.6 SEQUENCING:

- A. Deliver steel bearing plates and other devices to be built into concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel: Comply with requirements of SJI's "Specifications" for chord and web section material.
- B. Steel Bearing Plates: ASTM A 36 (ASTM A 36M).
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish:
 - a. Plain, noncoated.
- D. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish:
 - a. Plain, noncoated.
- E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS:

- A. Steel Prime Paint: Manufacturer's standard.

2.3 STEEL JOISTS:

- A. Manufacture joists according to SJI's "Specifications," with steel angle top and bottom chord members, of joist types, end arrangements, and top chord arrangements indicated.
- B. Manufacture joists according to SJI's "Specifications," with steel angle top and bottom chord members, and as follows:
 - 1. Joist Type:
 - a. K-series steel joists.
 - b. LH-series steel joists.
 - 2. End Arrangement:
 - a. Underslung.
 - b. Underslung with bottom chord extensions.
 - 3. Top Chord Arrangement:
 - a. Parallel.
 - b. Top chord single pitched

SECTION 05 2100 – Page 3 of 4

- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members where shown for securing other work to steel joists. However, deduct area of holes from the area of chord when calculating strength of member.
- E. Extend top chords of joists with SJI Type S top chord extensions where indicated, complying with SJI's "Specifications" and load tables.
- F. Extend bearing ends of joists with SJI Type R extended ends where indicated, complying with SJI's "Specifications" and load tables.
- G. Camber K-series steel joists according to SJI's "Specifications."
- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes when joist slope exceeds 1/4 inch in 12 inches (1:48).

2.4 JOIST ACCESSORIES:

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.
 - 1. Supply additional bridging to ensure stability of structure during construction period.
- B. Fabricate steel bearing plates with integral anchorage's as indicated and finish as follows:
 - 1. Finish: Shop prime paint.
- C. Steel bearing plates with integral anchorages are specified in Section 05500, "Metal Fabrications."
- D. Supply miscellaneous accessories, including splice plates and bolts required by the joist manufacturer to complete the joist installation.

2.5 SHOP PAINTING:

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed as follows:
 - 1. Surface Preparation:
 - a. Either hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
- B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film thickness of not less than 1 mil (0.025 mm).

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of joists. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's recommendations, and the requirements of this Section.
- C. Before installation, splice joists delivered to Project site in more than one piece.
- D. Space, adjust, and align joists accurately in location before permanently fastening.
- E. Install temporary bracing and bridging, connections, and anchors to ensure joists are stabilized during construction.
- F. Anchors: Furnish anchor bolts, steel bearing plates, and other devices to be built into concrete masonry construction.
- G. Provide unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.
- H. Field weld joists to supporting steel framework and steel bearing plates. Coordinate welding sequence and procedure with placing of joists.
- I. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- J. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
- K. Comply with the Research Council on Structural Connections' (RCSC) "Specification for Structural Joints

SECTION 05 2100 – Page 4 of 4

Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

- L. Comply with the Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- M. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.3 FIELD QUALITY CONTROL:

- A. Testing Laboratory Responsibility: The Owner's Testing Laboratory will perform field special inspections and tests on and to prepare test reports as follows:
 - 1. Testing Laboratory shall also approve welding certificates. Contractor shall submit three (3) copies of welding certificates and procedures for each welder involved in the Work.
 - 2. Testing Laboratory shall conduct and interpret tests, certificates and procedures and state in each report whether tested Work complies with or deviates from requirements.
- B. Testing and verification procedures will be required of high-strength bolted connections and field welds per Special Inspection requirements per 2012 IBC. Refer to Special Inspection Schedule in Construction Documents.
- C. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.
- D. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.2 REPAIRS AND PROTECTION:

- A. Touch Up Painting: Following installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes:
 - 1. Steel roof deck.
 - 2. Composite steel floor deck.
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 03 3100, "Concrete":
 - 2. Section 05 1200, "Structural Steel": Shop-welded shear connectors.
 - 3. Section 05 2100, "Steel Joists and Joist Girders".
 - 4. Section 05 5000, "Metal Fabrications": Framing openings with miscellaneous steel shapes.
 - 5. Section 07 8150, "Sprayed-On Fireproofing".
 - 6. Section 09 9000, "Painting":
 - a. Touch-up and repair painting of deck.
 - b. Touch-up and repair of special deck coatings.

1.2 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Submit all shop drawings on one reproducible print (sepia) and one blue line print only. The reproducible print will be returned. All blue line prints required by the Contractor will be the responsibility of the Contractor and shall be made after reproducible is returned.
- C. Product data for each type of deck, accessory, and product specified.
 - 1. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.
- D. Shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, cut openings, closure strips, deck openings, special jointing, accessories, and attachments to other construction.
- E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- F. Product test reports from qualified independent testing agencies evidencing compliance with requirements of the following based on comprehensive testing:
 - 1. Mechanical fasteners.
- G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:
 - 1. American Iron and Steel Institute (AISC), "Specification for the Design of Cold-Formed Steel Structural Members".
 - 2. American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel".
 - 3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks".
- B. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

SECTION 05 3100 – Page 2 of 6

- 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. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.
- E. Fire-Test-Response Characteristics: Where indicated, provide steel deck panels identical to those tested as part of an assembly for fire resistance per ASTM E 119 by a testing and inspection agency performing testing and follow-up services, that is acceptable to authorities having jurisdiction.
- F. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency.
- G. Labeling: Identify steel deck with appropriate markings of applicable testing and inspecting agency.
- H. Installation Tolerances: Conform to the installation tolerances specified in Part 3.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.5 COORDINATION:

- A. Coordinate installation of sound-absorbing insulation strips in acoustic deck ribs with related units of Work specified in other Sections to ensure that the insulation is protected against damage from effects of the weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Roof Deck:
 - a. Bowman Metal Deck Armco, Inc.
 - b. Epic Metals Corp.
 - c. Centria/Robertson.
 - d. Vulcraft Div. of Nucor Corp.
 - e. New Millenium.
 - 2. Composite Metal Floor Deck Units:
 - a. Bowman Metal Deck Armco, Inc.
 - b. Epic Metals Corp.
 - c. Centria/Robertson.
 - d. Vulcraft Div. of Nucor Corp.
 - e. New Millenium.

2.2 ROOF DECK:

- A. Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:
 - 1. Galvanized-Steel Sheet: ASTM A 446, Grade A, G 60 (ASTM A 446M, Grade A, Z 180) zinc coated according to ASTM A 525 (ASTM A 525M).
 - 2. Deck Profile:
 - a. Type WR, wide rib. Vented deck at light gauge roof trusses.
 - 3. Profile Depth:

SECTION 05 3100 – Page 3 of 6

- a. 1-1/2 inches.
- 4. Design Uncoated-Steel Thickness:
 - a. 0.0358 inch.
- 5. Span Condition:
 - a. Triple span or more.
- 6. Side Joints:
 - a. Overlapped or interlocking seam at Contractor's option.

2.3 FLOOR DECK:

- A. Composite Steel Floor Deck: Fabricate panels with integrally embossed or raised pattern ribs and interlocking side laps, conforming to SDI Publication No. 31 "Specifications and Commentary for Composite Steel Floor Deck," the minimum section properties indicated, and the following:
 - 1. Galvanized-Steel Sheet: ASTM A 446, Grade A, G 90 (ASTM A 446M, Grade A, Z 275) zinc coated according to ASTM A 525 (ASTM A 525M).
 - 2. Profile Depth:
 - a. 1 ½ inches (storm shelter)
 - 3. Design Uncoated-Steel Thickness:
 - a. 0.0474 inch.
 - 4. Span Condition:
 - a. Triple span or more.

2.4 FABRICATION AND ACCESSORIES:

- A. General: Form deck units in lengths of three or more spans, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, unless noted. End laps shall occur over a support.
- B. Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck".
- C. Cant Strips: Fabricate cant strips of not less than 20 gage galvanized sheet steel of same quality as the deck units. Bend cant strips to form a 45 degree cant not less than 5 inches wide with top and bottom flanges not less than 2 inches wide, unless noted. Provide cant strips in 10 foot lengths where possible.
- D. Ridge and Valley Plates: Fabricate ridge and valley plates of not less than 20 gage galvanized sheet steel of the same quality as deck units. Bend to provide tight-fitting closure with deck units. Each leg of bend shall not be less than 3 inches. Provide plates in 10 foot lengths where possible.
- E. Accessories: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.
- F. Mechanical Fasteners: Manufacturer's standard, corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.
- G. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 (4.8 mm) minimum diameter.
- H. Rib Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- I. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359-inch (0.91-mm) thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.
- J. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.

SECTION 05 3100 – Page 4 of 6

- K. Weld Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch (1.5 mm) thick with 3/8-inch (9.5-mm) minimum diameter prepunched hole.
- L. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch- (1.8-mm-) thick minimum, of same material as deck panels, with 1-1/2-inch- (38-mm-) minimum deep level recessed pans and 3-inch- (76-mm-) wide flanges. Cut holes for drains in the field.
- M. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071-inch- (1.8-mm-) thick minimum units, of same material as deck panels. Cut holes for drains in the field.
- N. Shear Connectors: ASTM A 108, Grade 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B.
- O. Steel Sheet Accessories: ASTM A 446, G 60 (ASTM A 446M, Z 180) coating class, galvanized according to ASTM A 525 (ASTM A 525M).
- P. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 – EXECUTION

3.1 EXAMINATION:

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 PREPARATION:

- A. Do not place deck panels on concrete supporting structure until concrete has cured and is dry.
- B. Locate decking bundles to prevent overloading of supporting members.

3.3 INSTALLATION, GENERAL:

- A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.
- B. Install temporary shoring before placing deck panels when required to meet deflection limitations.
- C. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.
 - 1. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
 - 2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
 - 3. Do not use deck units for storage or working platforms until permanently secured.
 - 4. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
 - 5. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
 - 6. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
 - 7. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
 - 8. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.
- D. Deck Edge Tolerances: Perimeter deck edges shall be within \pm 1/2 inch of the indicated lines.

SECTION 05 3100 – Page 5 of 6

3.4 ROOF DECK INSTALLATION:

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
 - 2. Weld Diameter:
 - a. 5/8 inch (16 mm), nominal.
 - 3. Weld Spacing: Space and locate welds as indicated.
 - 4. Weld Washers: Install weld washers at each weld location.
 - 5. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches (910 mm), using one of the following methods:
 - a. Mechanically fasten with self-drilling No. 10- (4.8-mm-) diameter or larger carbon steel screws.
- B. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints:
 - a. Lapped 2 inches (51 mm) minimum.
- C. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 psf at eave overhang and 30 psf for other roof areas.
- D. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.
- E. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.
- F. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.

3.5 FLOOR DECK INSTALLATION:

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
 - 3. Weld Washers: Install weld washers at each weld location.
 - 4. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, or at intervals not exceeding 36 inches (910 mm), using one of the following methods:
 - a. Mechanically fasten with self-drilling No. 10- (4.8-mm-) diameter or larger carbon steel screws.
- B. Shear Connectors: Weld shear connectors through deck to support framing according to AWS D1.1 and manufacturer's instructions. Butt end joints of deck panels; do not overlap.
- C. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

SECTION 05 3100 – Page 6 of 6

- 1. End Joints:
 - a. Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck according to SDI recommendations to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

3.6 FIELD QUALITY CONTROL:

- A. Testing Agency: A qualified independent testing agency employed and paid Owner will perform field quality-control testing.
 - 1. Field welds will be subject to inspection.
- B. Testing Agency will report test results promptly and in writing to Contractor and Architect.
- C. Remove and replace work that does not comply with specified requirements.
- D. Additional testing will be performed to determine compliance of corrected work with specified requirements.

3.7 REPAIRS AND PROTECTION:

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF STEEL DECK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formed steel stud framing, exterior and interior walls.
 - 2. Formed steel joist framing.

- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Division 09: Metal Support Assemblies.

1.2 REFERENCES

- A. American Iron and Steel Institute (AISI) - Specification for the Design of Cold-Formed Steel Structural Members.

- B. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

- C. American Welding Society (AWS) D1.3 - Structural Welding Code - Sheet Steel.

- D. ASTM International (ASTM):
 - 1. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 - 2. C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases.
 - 3. C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
 - 4. C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

- E. Steel Framing Alliance (SFA).

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Indicate framing components, sizes, materials, finishes, and accessories.
 - 2. Shop drawings indicating all members, beams, jambs, sills, headers, connections, etc. required for complete installation of structural cold-formed framing.

- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certificate from Professional Structural Engineer responsible for light-gage structural framing system design, that system was designed in accordance with Contract Document requirements, applicable Building Codes, and generally accepted engineering practices.

1.4 QUALITY ASSURANCE

- A. Manufacturer and Installer Qualifications: Minimum 5 years documented experience in work of this Section.
- B. Manufacturer: Current member of SFA.
- C. All Structural Design framing shall be by a Professional Structural Engineer with minimum 5 years experience in the work of this Section and licensed in the State in which the Project is located.
- D. Design exterior wall stud system to withstand:
 - 1. Live and dead loads in accordance with adopted edition of the International Building Code.
 - 2. Wind pressure loads in accordance with adopted edition of the International Building Code.
- E. Design system to accommodate construction tolerances, deflection of building structural members, and clearances at openings.
- F. Welder Qualifications: AWS D1.3.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. California Expanded Metal Company. (www.cemcosteel.com)
 - 2. ClarkDietrich Building Systems. (www.clarkdietrich.com)
 - 3. Marino Ware Industries. (www.marinoware.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Framing Materials:
 - 1. ASTM A1003/A1003M, galvanized sheet steel, G40 coating class.
 - 2. Fabricate components to ASTM C955.
 - 3. Studs: Channel profile, punched for utility access.
 - 4. Tracks:
 - a. Channel profile, same gauge and depth as studs, unpunched.
 - b. Top track: Deflection compensating type, deep leg runner with slotted screw holes; permit plus or minus 1/2 inch movement of overhead structure without damage to framing.
 - c. Top and Bottom track: 1-1/4 inch – 1 1/2 inch high legs.
 - 5. Joists: Channel profile, unpunched.
 - 6. Joist end closures: Channel profile, same gauge and depth as joists, unpunched.

2.3 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.
- C. Fasteners: ASTM C1513; self-drilling, self-tapping screws.
- D. Touch Up Paint: SSPC Paint 20, Type I or II.

- E. Welding Materials: AWS D1.3; type required for materials being welded.

2.4 FABRICATION

- A. Framing components may be prefabricated using templates.
- B. Cut and fit members to tight fit.
- C. Assemble components using screw connection method.
- D. Fabricate straight, level, and true, without warp or rack.
- E. Fabrication Tolerances:
 - 1. Variation from indicated length: Maximum 1/4 inch for components up to 30 feet long; maximum 1/2 inch for components over 30 feet long.
 - 2. Variation from indicated height: Maximum 1/8 inch for components up to 5 feet high; maximum 1/4 inch for components over 5 feet high.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install framing components in accordance with ASTM C1007, manufacturer's instructions, and approved Shop Drawings.
- B. Welding: In accordance with AWS D1.3.
- C. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.2 INSTALLATION - STUD FRAMING

- A. Place top and bottom tracks in straight lines with ends butted. Fasten tracks at maximum 12 inches on center.
- B. Place studs at spacing indicated and not more than 2 inches from abutting walls and at each side of openings.
- C. Connect studs to top and bottom tracks using fastener method.
- D. Construct corners using minimum of three studs.
- E. Double studs at wall openings, door jambs, and window jambs.
- F. Do not splice studs.
- G. Erect studs, brace, and reinforce to develop full strength, to achieve design requirements.
- H. Install headers above openings and intermediate studs above and below openings to align with wall stud spacing.
- I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- J. Diagonally brace walls at location indicated for shear construction.

3.3 INSTALLATION - JOISTS

- A. Place joists at spacings indicated and not more than 2 inches from abutting walls. Connect members to supports using fastener method.
- B. Set members parallel and level, with lateral bracing and bridging where indicated.
- C. Locate joists directly over bearing studs or load distribution member.
- D. Provide additional joists under parallel partitions when partition length exceeds one-half of joist span and around openings that interrupt one or more joists.
- E. Do not splice joists.
- F. Provide web stiffeners at reaction points and points of concentrated loads.
- G. Provide end blocking where joist ends are not otherwise restrained from rotation.

3.4 INSTALLATION TOLERANCES

- A. Maximum Variation from True Position: 1/8 inch.
- B. Maximum Variation of any Member from Plane: 1/4 inch.

3.5 ADJUSTING

- A. Touch up field connections and breaks in factory coatings with touch up paint applied in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated metal components.
 - 2. Gratings.
 - 3. Ladders and safety cages.
 - 4. Guard rails and handrails.
 - 5. Bollards.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Welding Society (AWS):
 - 1. D1.1 - Structural Welding Code - Steel.
- B. ASTM International (ASTM):
 - 1. A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. A123/A123M - Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 - 3. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
 - 4. A307 - Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
 - 5. A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
 - 6. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 7. E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

1.3 SYSTEM DESCRIPTION

- A. Minimum design loads:
 - 1. Guard rails and handrails:
 - a. 50 pounds per linear foot applied in any direction at top, transferred via attachments and supports to building structure.
 - b. Concentrated 200 pound load applied in any direction at any point along top, transferred via attachments and supports to building structure.
 - c. Maximum deflection under loading: $L/120$.
 - 2. Concentrated and uniform loads do not need to be applied simultaneously.
- B. Fabricate guard rails and handrails in accordance with ASTM E985.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show dimensions, metal thicknesses, finishes, joints, attachments, and relationship of work to adjacent construction.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum 10 years documented experience in work of this Section.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Substitutions: Under provisions of Division 01.

2.2 MATERIALS - STEEL

- A. Shapes: ASTM A36/A36M.
- B. Plate: ASTM A283.
- C. Checkered Plate: ASTM A1011/A1011M, diamond pattern.
- D. Sheet: ASTM A1008/A1008M.
- E. Pipe: ASTM A501.
- F. Tube: ASTM A500.
- G. Bars: ASTM A108.
- H. Bolts: ASTM A307, hexagonal head type.
- I. Primer Paint: SSPC Paint 15, Type 1, red oxide.
- J. Anchoring Cement: [Non-shrink cementitious] [Two component epoxy] type.

2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Conceal fastenings where possible.
- G. Welding to conform to AWS [1.1]
 - 1. Use welds for permanent connections where possible. Grind exposed welds smooth.
 - 2. Tack welds prohibited on exposed surfaces.

2.4 FINISHES

- A. Exterior Ferrous Metal: Galvanized; ASTM A123/A123M, to 1.3 ounces per square foot.
- B. Interior Ferrous Metal:
 - 1. Shop painted except steel to be encased in concrete and surfaces to be welded.
 - 2. Surface preparation: SSPC SP2 - Hand Tool Cleaning or SP3 - Power Tool Cleaning.
 - 3. Application: One coat; follow coating manufacturer's instructions.
 - 4. Minimum dry film thickness: 2.0 mils.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install items in accordance with approved Shop Drawings.
- B. Install components plumb, level, and rigid.
- C. Welding: AWS D1.1. Grind and fill exposed welds; finish smooth and flush.
- D. Install sleeved components with anchoring cement.
- E. Prevent contact of aluminum and dissimilar metals by use of zinc rich paint, bituminous coating, or non-absorptive gaskets.

3.2 ADJUSTING

- A. Clean and touch up damaged primer paint with same product as applied in shop.
- B. Clean and touch up galvanized coatings at welded and abraded surfaces in accordance with ASTM A780.

3.3 SCHEDULE

- A. This Schedule includes principal items only; refer to Drawings for additional items not listed.
- B. Guard Rails and Handrails:
 - 1. Fabricate from steel pipe or tube as drawn, stock of sizes and types indicated.
 - 2. Make bends uniform and free from buckles and other defects.
 - 3. Cut intersections square to within 1 degree and to length within 1/8 inch. Remove burrs from cut ends.
 - 4. Miter and cope intersections within 1 degree, fit to within 1/16 inch.
 - 5. Continuously weld connections.
 - 6. Where length exceeds that suitable for shipping and handling, fabricate in sections with concealed internal sleeves forming slip joints. Extend sleeves minimum 2 inches on both sides of joint; field weld and grind smooth.
- C. Bar Grating:
 - 1. NAAMM MBG 531, welded type.
 - 2. Fabricate supporting frame for opening size and configuration.
 - 3. Bearing bars: 1 1/2 inches deep x 3/16 inches wide, spaced 1 3/16 inch on center.
 - 4. Cross bars: Spaced 4" inches on center.
 - 5. Top surface: Serrated.

- D. Bollards:
1. Fabricate from steel pipe of sizes indicated.
 2. Set into concrete footing.
Fill pipe with concrete; rod to consolidate. Dome top to shed water.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior gypsum wall sheathing: fiberglass-mat faced, moisture and mold resistant.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C514 - Standard Specification for Nails for the Application of Gypsum Wallboard.
 - 2. C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board.
 - 3. C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 4. C1280 - Standard Specification for Application of Gypsum Sheathing Board.
 - 5. C1396 - Standard Specification for Gypsum Board.
 - 6. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate panel product types, thicknesses, and installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. GP Gypsum Corporation. (www.gp.com)
 - 2. National Gypsum Co. (www.nationalgypsum.com)
 - 3. Temple Inland. (<http://www.greenglassinfo.com>)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Exterior Sheathing:
 - 1. Type: ASTM C1177; 48" x 96" inches x 5/8 inch thick, maximum practical length, ends square cut, tongue and groove edges. "Densglass" or equivalent.

2.3 ACCESSORIES

- A. Fasteners: [ASTM C1002, Type W or S screws, hot-dip galvanized or fluoropolymer coated steel, minimum 1/2 inch penetration into framing.

SECTION 06 1643 – Page 2 of 2

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with ASTM C1280 and manufacturer's instructions.
- B. Accurately cut panels to fit around openings and projections.
- C. Apply panels horizontally, tongue edge up, with ends occurring over supports. Stagger end joints in adjacent rows.

**** OR ****

- D. Apply panels vertically, with ends and edges occurring over supports.
- E. Fasten panels to framing at maximum 8 inches on center. Place fasteners minimum 3/8 inch from edges of panels; drive heads flush with surface. Stagger fasteners at abutting edges.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fabricated cabinet units.
 - 2. Plastic laminate surfaces.
 - 3. Shop finishing.
 - 4. Cabinet hardware.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 06 6116 - Solid Surfacing Fabrications.
 - 3. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. Architectural Woodwork Institute (AWI) Architectural Woodwork Standards.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Include dimensioned plan, sections, elevations, and details, including interface with adjacent work.
 - b. Designate wood species and finishes.
 - 2. Samples:
 - a. 3 x 3 inch plastic laminate samples in each color and finish.
 - b. Each hardware component.
 - c. 12 inch long lumber samples for transparent finish.
 - d. 12 x 12 inch sheet product samples for transparent finish.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Minimum 10 years documented experience in work of this Section.
 - 2. Certified under AWI Quality Certification Program.
- B. Pre-Installation Conference:
 - 1. Convene 2 weeks prior to beginning work of this Section.
 - 2. Attendance: Architect, Owner, Contractor, installer, and related trades.
 - 3. Review, discuss and resolve:
 - a. Critical dimensions.
 - b. Product delivery and storage.
 - c. Staging and sequencing.
 - d. Protection of completed work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver materials until proper protection can be provided, and until needed for installation.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain following conditions in building for minimum 7 days prior to, during, and after installation of casework:
 - 1. Temperature: 60 to 80 degrees F.
 - 2. Humidity: 30 to 70 percent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Plastic Laminate:
 - 1. Formica Corp. (www.formica.com)
 - 2. Nevamar Co. (www.nevamar.com)
 - 3. Wilsonart International, Inc. (www.wilsonart.com)
- B. Substitutions: Not permitted.

2.2 MATERIALS

- A. Sheet Products:
 - 1. Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 4 requirements for quality grade specified.
 - 2. Exposed and semi-exposed veneers: Species and cut of quality suitable for transparent finish.
 - 3. Exposed and semi-exposed veneers: Closed grain hardwood, of quality suitable for opaque finish.
 - 4. Sheet core: Plywood of thickness specified, or as appropriate for component.
- B. Lumber:
 - 1. Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 3 requirements for quality grade specified, average moisture content of [6 percent.
 - 2. Exposed and semi-exposed veneers: Species and cut of quality suitable for transparent finish.
- A. Plastic Laminate: NEMA LD-3.
 - 1. High pressure decorative laminate:
 - a. Horizontal surfaces:
 - 1) Backing sheet: Grade BGF.
 - 2) Postformed surfaces: Grade HGP.
 - 3) Other surfaces: Grade HGS.
 - b. Vertical surfaces:
 - 1) Backing sheet: Grade BLF.
 - 2) Cabinet liner: Grade CLS.
 - 3) Other surfaces: Grade VGP.
 - 2. Colors: To be selected from manufacturer's full color range.
 - 3. Finish: Matte.

1.2 ACCESSORIES

- A. Solid Surfacing Countertops: Specified in Section 06 6116.

- B. Fasteners: Type and size as required by conditions of use.
- C. Adhesives:
 - 1. Water based or solvent release type, compatible with backing and materials.
 - 2. Maximum volatile organic compound (VOC) content: 70 grams per liter.
- D. Finish Hardware: As scheduled at end of Section.
- E. Joint Sealers: Specified in Section 07 9200.

1.3 FABRICATION

- A. Cabinets - Plastic Laminate Finish:
 - 1. Quality: AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Custom Grade.
 - 2. Construction type: Face frame.
 - 3. Interface style: Overlay.
 - 4. Semi-exposed surfaces: High pressure decorative laminate. Fit exposed and semi-exposed sheet edges with matching laminate edging.
 - 5. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.
- B. Cabinets - Transparent Finish:
 - 1. Quality: AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Premium Grade.
 - 2. Construction type: Face frame
 - 3. Interface style: Overlay.
 - 4. Semi-exposed surfaces: Wood to match exposed surfaces.
 - 5. Fit exposed and semi-exposed sheet edges with matching wood edging.
 - 6. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.
- C. Shop assemble for delivery to project site in units easily handled.
- D. Prior to fabrication, field verify dimensions to ensure correct fit.
- E. Apply plastic laminate in full uninterrupted sheets; fit corners and joints to hairline. Slightly bevel arises. Apply laminate backing sheet to reverse side of laminate faced surfaces.
- F. Where field fitting is required, provide ample allowance for cutting. Provide trim for scribing and site conditions.
- G. Provide cutouts and reinforcement for plumbing, electrical, appliances, and accessories. Prime paint surfaces of cut edges.

1.4 FINISHES

- A. Factory Finishing:
 - 1. Factory finish casework in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5.
 - 2. Finish system: Polyurethane, catalyzed or acrylic.
 - 3. Color: Custom color to be selected.
 - 4. Sheen: Satin.

PART 2 EXECUTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ARCHITECTURAL WOOD CASEWORK**

SECTION 06 4100 – Page 4 of 4

2.1 PREPARATION

- A. Prior to installation, condition cabinets to average humidity that will prevail after installation.

2.2 INSTALLATION

- A. Install in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
- B. Set plumb, rigid and level.
- C. Scribe to adjacent construction with maximum 1/16 inch gaps.
- D. Adhere countertops, splashes, and skirts with beads of adhesive.
- E. Fill joints between cabinets, tops, splashes, and adjacent construction with joint sealer as specified in Section 07 9200; finish flush.

2.3 FINISH HARDWARE SCHEDULE

DESCRIPTION	MANUFACTURER	MODEL
Door and drawer pulls	Amerock	
Drawer slide	Knape & Vogt	
Door hinge	Knape & Vogt	
Cabinet lock	Knape & Vogt	
Adjustable shelf standards and brackets	Knape & Vogt	

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surfacing countertops with sink bowls.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. ASTM International (ASTM) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
 - 2. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
- B. Closeout Submittals:
 - 1. Maintenance Data: Include recommended cleaning materials and procedures and damage repair.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Fire Hazard Classification: Class A flame spread/smoke developed rating, tested to ASTM E84.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Avonite Surfaces. (www.avonitesurfaces.com)
 - 2. DuPont. (www.corian.com)
 - 3. Formica Corp. (www.formica.com)
 - 4. Wilsonart International, Inc. (www.wilsonart.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Solid Surfacing:
 - 1. Material: Homogenous sheet material composed of acrylic resins and coloring agents.
 - 2. Thickness: 1/2 inch.
 - 3. Color: To be selected from manufacturer's full color range.
 - 4. Surface finish: Satin

- B. Sinks: Molded sinks are not included on this project.

2.3 ACCESSORIES

- A. Adhesive:
 - 1. Type recommended by solid surfacing manufacturer.
 - 2. Maximum volatile organic compound (VOC) content: 70 grams per liter.
- B. Joint Sealer: Specified in Section 07 9200.

2.4 FABRICATION

- A. Fabricate components in shop to sizes and shapes indicated, in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Fabricate splashes and skirts from solid surfacing in color to match countertops.
- C. Form joints to be inconspicuous in appearance and without voids. Join pieces with adhesive.
- D. Provide holes and cutouts for mounting of sinks, trim, and accessories.
- E. Finish exposed edges to smooth, uniform bullnose profile.
- F. Allowable Tolerances:
 - 1. Maximum variation in size: 1/16 inch.
 - 2. Maximum variation in location of openings: 1/8 inch from indicated location.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set plumb, level, and rigid.
- C. Adhere countertops, splashes, and skirts with beads of adhesive.
- D. Seal perimeter with joint sealer as specified in Section 07 9200. Finish smooth and flush.
- E. Allowable Tolerances:
 - 1. Maximum variation from level and plumb: 1/8 inch in 10 feet, noncumulative.
 - 2. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/32 inch.

3.2 ADJUSTING

- A. Sand out minor scratches and abrasions.

3.3 PROTECTION

- A. Protect surfaces from damage with nonstaining coverings.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Batt insulation in exterior wall and interior wall assemblies.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C665 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings.
 - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.

1.3 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Fire Hazard Classification:
 - 1. Noncombustible, tested to ASTM E136.
 - 2. Flame spread/smoke developed rating of 25 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store insulation in clean, dry, sheltered area, off ground or floor, until used. Protect against wetting and moisture absorption.

1.6 PROJECT CONDITIONS

- A. Do not install until insulation until building is substantially water and weather tight.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Johns Manville. (www.jm.com)
 - 2. Knauf Insulation. (www.knaufusa.com)
 - 3. Owens Corning. (www.owenscorning.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Thermal Batt Insulation:
 - 1. Type: ASTM C665, glass fiber composition.
 - 2. Facing: Aluminum foil vapor barrier on one side.(For vapor transmittance)
 - 3. Type: ASTM C665, glass fiber composition.
 - 4. Facing: Unfaced. (For sound transmittance)
 - 5. Type: ASTM C665, glass fiber composition.
 - 6. Facing: White vinyl on one side (For building thermal transmittance)
 - 7. Free from urea-formaldehyde resins.
 - 8. Thermal resistance:
 - a. 3-1/2 inches thick: R-value of 11.00.
 - b. 3-5/8 inches thick: R-value of 13.00.
 - c. 6-1/4 inches thick: R-value of 19.00.
 - d. 6-1/2 inches thick: R-value of 22.0.
 - e. 8-1/2 inches thick: R-value of 25.0.
 - f. 9 inches thick: R-value of 26.0.
 - g. 10 inches thick: R-value of 30.00.
 - h. 12 inches thick: R-value of 38.00.

2.3 ACCESSORIES

- A. Tape: Minimum 2 inches wide, pressure sensitive, foil faced, waterproof.
- B. Wire Mesh: Hexagonal galvanized steel mesh.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Friction fit between framing members.
- B. Retain in place with wire mesh secured to framing.
- C. Butt insulation to adjacent construction. Butt ends and edges.
- D. Carry insulation around pipes, wiring, boxes, and other components.
- E. Ensure complete enclosure of spaces without voids.
- F. Apply with vapor barrier facing towards interior of structure.
- G. Tape seal lapped flanges, butt ends, and tears and holes in facings.

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT ROOF BOARD INSULATION

SECTION 07 2200 – Page 1 of 2

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rigid roof insulation.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Division 05: Steel Decking.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 2. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 3. ASTM E108 – Roofing Systems Classification
 - 4. ASTM E119 – Fire Resistance Calculation
- C. Factory Mutual Insurance Co. (FM) Property Loss Prevention Data Sheet 1-28 - Design Wind Loads.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design roofing system to resist minimum wind loads in accordance with International Building Code Chapter 26, locally adopted edition.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data including thermal values.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Roof Insulation Mechanical Attachment: Conform to requirements for International Building Code Windstorm Classification.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect materials against moisture absorption, direct sunlight, damage, and temperatures above 110 degrees F and below 40 degrees F.
- B. Store materials off ground or roof deck on pallets. Cover materials stored outside with breathable covering, properly vented.

SHELBY COUNTY EMA & IT BUILDING PROJECT ROOF BOARD INSULATION

SECTION 07 2200 – Page 2 of 2

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers- Insulation:
 - 1. Atlas Roofing Corporation. (www.atlasroofing.com)
 - 2. Hunter Panels. (www.hpanels.com)
 - 3. Rmax. (www.rmaxinc.com)
 - 4. Dow (www.dow.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Rigid Roof Insulation:
 - 1. Type: ASTM C1289, Type 2, Class 1, Grade 3 rigid closed-cell polyisocyanurate foam core faced both sides with non-asphaltic, glass fiber reinforced, organic felt facers.
 - 2. Thickness: See Drawings.
 - 3. Thermal resistance: Minimum LTTR value of 5.7 per inch.
 - 4. Compressive Strength: 25 psi (ASTM D1621).
 - 5. Water Absorption: <1.5% (ASTM C209)
 - 6. Water Vapor Transmission: <1.5 perms (ASTM E96).
 - 7. Flame Spread: <75 (ASTM E84).
 - 8. Smoke Development: <450 (ASTM E 84).
 - 9. Tensile Strength: > 730 psf (ASTM D1623).
 - 10. Service Temperature: 250 degrees F.

2.3 ACCESSORIES

- A. Fasteners: Hot-dip galvanized or fluoropolymer coated steel, type and length suited to project conditions, with plastic plates.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION

- A. Apply a minimum of 2 layers of insulation board.
- B. Apply base layer with long edges continuous and perpendicular to deck ribs.
- C. Stagger end joints in adjacent rows.
- D. Locate ends over solid bearing.
- E. Apply top layer with long edges perpendicular to those of base layer, with joints staggered in adjacent rows. Offset joints from those in base layer.

3.2 TOLERANCES

- A. Surface Flatness of Insulation: Plus or minus ¼ inch in 10 feet maximum.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sheet materials for controlling moisture movement at exterior wall assemblies.
 - 2. Sheet underlayment for controlling moisture movement at roof assemblies.
 - 3. Liquid materials for controlling moisture movement at landscape planters.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. E96/E96M - Standard Test Method for Water Vapor Transmission of Materials.
 - 2. E2178 - Standard Test Method for Air Permeance of Building Materials.
 - 3. E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

1.3 QUALITY ASSURANCE

- A. Provide continuous barrier to moisture infiltration, air infiltration and exfiltration, and water vapor transmission, flashed to discharge incidental condensation and water penetration.

1.4 SUBMITTALS

- A. Product specification sheets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Sheet Moisture Barriers:
 - 1. W. R. Grace (www.grace.com)
 - 2. Atas International (www.atas.com)
 - 3. DuPont Tyvek (www.dupont.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Moisture Barrier:
 - 1. Description: ASTM D1970; polymer modified asphalt laminated to polymer coated synthetic woven material, self adhering, with release paper facing.

2. Thickness: 45 mils
 3. Thermal Stability: 240 degrees F.
 4. Elongation: Minimum 250 percent, tested to ASTM D412.
 5. Tensile strength: Minimum 250 PSI, tested to ASTM D412.
 6. Water vapor transmission: Maximum 0.01 grains per square foot, tested to ASTM E96.
 7. Air permeance: Maximum 0.0002 CFM per square foot at 0.3 inch water differential pressure, tested to ASTM E2178.
 8. Assembly air permeance: Maximum 0.0008] CFM per square foot at 0.3 inch water differential pressure, tested to ASTM E2357.
- B. Weather Resistant Barrier (WRB):
1. Commercial grade air and water barrier designed for use between reinforced gypsum sheathing and metal wall panels. Flash spunbonded high density polyethylene fiber sheets with extended UV protection. Meet or exceed ASHRAE 90.1, IECC, and AASTM E2357.

2.3 ACCESSORIES

- A. Joint Tape: Minimum 2 inches wide, pressure sensitive, waterproof, compatible with moisture barrier and of type recommended by moisture barrier manufacturer.
- B. Flashing Sheet: Self adhering, rubberized asphalt laminated to HPDE facing, minimum 30 mil thick. Type recommended by moisture barrier manufacturer.
- C. Primer: Type recommended by moisture barrier manufacturer.
- D. Patching Compound: Type recommended by moisture barrier manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive moisture barrier; remove loose and foreign matter that could impair adhesion or performance.
- B. Protect adjacent and underlying surfaces.
- C. Fill voids, holes, and cracks over 1/16 inch in width with patching compound; finish flush with adjacent surfaces. Apply one coat of moisture barrier over patched areas and allow to dry.
- D. Apply joint tape centered over sheathing joints. Lap ends 2 inches minimum Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

1.1 INSTALLATION - SHEET MOISTURE BARRIERS

- A. Provide complete and continuous barrier.
- B. Apply primer when required by moisture barrier manufacturer.
- C. Install moisture barrier without tears, voids, and holes. Begin application at low point; weatherlap succeeding courses minimum 6 inches.
- D. Lap ends 6 inches minimum. Tape seal lapped ends and edges.
- E. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.
- F. Seal to door and window frames, around penetrations, and at perimeter.

1.2 APPLICATION - FLUID APPLIED MOISTURE BARRIERS

- A. Apply moisture barrier in accordance with manufacturer's instructions.
- B. Apply primer to joints in substrate, inside and outside corners, and around perimeter and penetrations. Joint tape over primer; press to full bond with substrate.
- C. Apply moisture barrier by roller or spray to continuous and uniform coverage with minimum mil thickness as recommended by manufacturer.
- D. Seal to door and window frames, around penetrations, and at perimeter with flashing sheet. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

1.3 FIELD QUALITY CONTROL

- A. Inspect moisture barrier for damage just prior to covering.
- B. Clean damaged areas and cover with additional moisture barrier material minimum 6 inches larger than damaged area on all sides. Seal to main moisture barrier with continuous tape.

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 1 of 8

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.
- B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.
- D. Division 07 Section "Metal Wall and Roof Panels" for factory-formed metal wall, roof, and soffit panels.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
 - 7. ASTM C 273 – Properties of Sandwich Core Materials
 - 8. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 - 9. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
 - 10. ASTM D 1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 - 11. ASTM D 2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 - 12. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 13. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 - 14. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
 - 15. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 - 16. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 2 of 8

17. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 18. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 19. ASTM E 2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
- D. National Fire Protection Association (NFPA)
1. NFPA 259 – Test Method for Potential Heat of Building Materials.
 2. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies.
 3. NFPA 286 – Fire Test of Evaluating Conditions of Wall and Ceiling Finish to Roof Fire Growth.

1.4 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar products and successful use in similar applications.
- C. Installer Qualifications: Experienced Installer [certified by metal panel manufacturer] with minimum of five years' experience with successfully completed projects of a similar nature and scope.
1. Installer's Field Supervisor: Experienced mechanic [certified by metal panel manufacturer] supervising work on site whenever work is underway.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
1. Coordinate building framing in relation to metal panel system.
 2. Coordinate openings and penetrations of metal panel system.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
1. Include data indicating compliance with performance requirements.
 2. Indicate points of supporting structure that must coordinate with metal panel system installation.
 3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification:

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 3 of 8

1. Provide 12-inch long section of each metal panel profile.
2. Provide color chip verifying color selection.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.
 1. Deliver, unload, store, and erect metal panels and accessory items without deforming panels or exposing panels to surface damage from weather or construction operations.
 2. Store in accordance with Manufacturer's written instructions.
 3. Shield foam insulated metal panels from direct sunlight until all components are installed.

1.9 WARRANTY

- A. Special Manufacturer's Warranty: Submit Manufacturer's two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
- B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.
- C. Special Panel Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.
 1. Fluoropolymer Two-Coat System:
 - a. Color fading in excess of [5] or [10] for copper, silver metallic and bright red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [6] for copper, silver metallic and bright red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
 2. Modified Silicone-Polyester Two-Coat System:
 - a. Color fading in excess of [5] or [7] for crimson red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [7] for crimson red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: EXCEPTIONAL Metals' Metal Roof and Wall Systems, Division of Duro-Last® , Inc. Exceptional Metals, Saginaw, (800) 248-0280 Email: info@EXCEPTIONALMETALS.com; Web: www.exceptionalmetals.com.

**SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL
INSULATED WALL PANELS**

SECTION 07 4213 – Page 4 of 8

- B. Approved Equivalent: Metl-Span, a Nucor company; Lewisville, Texas. Email: info@metlspan.com; Web: metlspan.com.
- C. Approved Equivalent: Centria Metals, a Nucor company; Lewisville, Texas. centria.com.
- D. Provide basis of design product or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:
 - 1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and pressure coefficients indicated on drawings.
 - 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure.
- C. FM Approvals Listing: Comply with FM Approval 4881. Provide metal wall panel assembly listed in FM Approvals "Approval Guide."
- D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84. The core shall have:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.
 - 2. Room Test Performance: FM Global 4880: The panel assembly shall meet the performance requirements cited by FM 4880, classifying the exterior building panel as Class 1 and ensuring large-scale integrity when exposed to flame.
 - 3. Fire Propagation: The fire assembly shall meet the requirements of the standard for NFPA 285
 - 4. Fire Growth: The fire assembly shall meet the requirements of the standard for NFPA 286
 - 5. Potential Heat: Determined in accordance with NFPA 259
 - 6. IBC Chapter 26: Panel Performance under the above test methods, shall meet the requirements of IBC, Chapter on foam plastics.
- E. Air Infiltration, ASTM E 283: < 0.01 cfm/ft² air infiltration rate at static pressure differential of 6.24 psf.
- F. Water Penetration Static Pressure:
 - 1. ASTM E 331: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft.
 - 2. ASTM E 331 Modified (2-hour duration): No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft.

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 5 of 8

- G. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
- H. Thermal Performance: When tested in accordance with ASTM C 518, Measurement of Steady State thermal Transmission, the panels shall provide a k factor of 0.114 btu-in/hr-sf-deg F at a 35° F (1.67° C) mean temperature.

2.3 INSULATED METAL WALL PANELS

- A. Concealed Fastener, Insulated Metal Panel with foam core: Structural metal panels consisting of flush, flat exterior metal sheet, and interior metal sheet with a Light Mesa profile, with factory foamed-in-place polyurethane core, with tongue-and-groove panel edges, attached to supports using concealed fasteners.
 - 1. Basis of Design: EXCEPTIONAL Metals, EM CF Architectural
 - 2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.
 - a. Exterior Face Sheet: 22-gauge thickness, with smooth unembossed surface and 1/2" reveals.
 - 1. Finish: Fluoropolymer two-coat system.
 - 2. Color: As indicated on Drawings
 - b. Interior Face Sheet: 24 gauge thickness, with smooth unembossed Light Mesa profile.
 - 1. Finish: Polyester two-coat system
 - 2. Color: Igloo White
 - 3. Panel Widths: 30 inches.
 - 4. Panel Thickness: 2 inch
 - 5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226
 - b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
 - c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
 - d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi as determined by ASTM D 1623
 - e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - f. Thermal Resistance R-Value: 17.5
- B. Concealed Fastener, Insulated Metal Panel with foam core: Structural metal panels consisting of flush, flat exterior metal sheet with DS60 rib pattern, and interior metal sheet with a Light Mesa profile, with factory foamed-in-place polyurethane core, with tongue-and-groove panel edges, attached to supports using concealed fasteners.
 - 1. Basis of Design: Exceptional Metal , EM DS60
 - 2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 6 of 8

- a. Exterior Face Sheet: 22-gauge thickness, with smooth unembossed surface and 1/2" reveals.
 1. Finish: Fluoropolymer two-coat system.
 2. Color: As indicated on Drawings
 - b. Interior Face Sheet: 24 gauge thickness, with smooth unembossed Light Mesa profile.
 1. Finish: Polyester two-coat system
 2. Color: Igloo White
3. Panel Widths: 24 or 36 inches.
4. Panel Thickness: 2 inch
5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226
 - b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
 - c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
 - d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi as determined by ASTM D 1623
 - e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - f. Thermal Resistance R-Value: 15.2
- 6.

2.4 METAL WALL PANEL ACCESSORIES

- A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panels.
- C. Panel Clips: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- D. Panel Fasteners: Self-drilling or Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.
- E. Joint Sealers:
 1. Sealants: Provide Tape Mastic Sealants, Non-skinning sealants, and Urethane Sealants in accordance with manufacturers' standards
 2. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: Black.

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept sealant providing weathertight seal.

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL

INSULATED WALL PANELS

SECTION 07 4213 – Page 7 of 8

- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
- B. Exterior Face Sheet Coil-Coated Finish System
 - 1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, [meeting solar reflectance index requirements].
 - a. Basis of Design: Exceptional Metals, Fluoropolymer.
- C. Interior Face Sheet Coil-Coated Finish System
 - 1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
 - a. Basis of Design: Exceptional Metals, Igloo White

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:
 - a. 1/4 inch in 20 foot in any direction.
 - b. 3/8 inch over any single wall plane.
 - c. Girt Spacing 8 feet or more: 1/4 inch out only.
 - d. Girt Spacing Less Than 8 feet 1/8 inch out only.
 - e. CF Architectural girt spacing less than 4 feet: 1/16 inch out only.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

- A. Concealed-Fastener Insulated Metal Panels with foam core: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.
 - 1. Fasten metal panels to supports with the number and type of fastener(s) at each location as indicated on approved shop drawings, and at a support spacing and material recommended by the manufacturer.
 - 2. Cut panels in field where required using manufacturer's recommended methods.
 - 3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.

SHELBY COUNTY EMA & IT BUILDING PROJECT MANUAL INSULATED WALL PANELS

SECTION 07 4213 – Page 8 of 8

- 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
 - C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealants.
 - D. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies.
 - 1. Seal panel base assembly, openings, panel head joints, and perimeter joints using sealants indicated in manufacturer's instructions.
- 3.3 ACCESSORY INSTALLATION
- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- 3.4 CLEANING AND PROTECTION
- A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.
 - B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Membrane Type: PVC thermoplastic membrane
 - 1. Roll Width: 120" (Installed widths may vary)
 - 2. Thickness: 60 mil
 - 3. Membrane Color: White
 - 4. Attachment Type: Mechanically Fastened
 - 5. Fasteners: HD Screw (#14)
 - 6. Plates: Cleat Plate®
- B. Insulation Assembly Type: Polyisocyanurate Board Insulation
 - 1. Board Application: Flat Stock
 - 2. Board Style: Min. Assembly R-Value
 - 3. Board Size: 4' x 4'
 - 4. Thickness: 6.0" (2 layer at 3.0")
 - 5. Attachment Type: Mechanically Fastened
 - 6. Fasteners: HD Screw (#14)
 - 7. Plates: 3-Inch Metal Plate
- C. Deck Type: Steel Deck (22 ga. min. – See Structural Drawings)
- D. Prefabricated flashings, corners, parapets, stacks, vents, and related details.
- E. Fasteners, adhesives, and other accessories required for a complete roofing installation.
- F. Traffic Protection.

1.2 REFERENCES

- A. ASTM INTERNATIONAL (ASTM)
 - 1. (2019) Standard Test Methods for Coated Fabrics (D751)
 - 2. (2021) Standard Specification for Poly(Vinyl Chloride) Sheet Roofing (D4434/D4434M)
 - 3. (2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board (C1289)
 - 4. (2020) Standard Test Methods for Fire Tests of Roof Coverings (E108)
 - 5. (2020) Standard Test Methods for Fire Tests of Building Construction and Materials (E119)
- B. UL SOLUTIONS (UL)
 - 1. (2021) UL Roofing Systems (TGFU.R10128)
- C. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
 - 1. (2014) Minimum Design Loads for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-10)
 - 2. (2017) Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-16)
 - 3. (2022) Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-22)
- D. NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
 - 1. (2019) NRCA Roofing Manual - Membrane Systems

1.3 SYSTEM DESCRIPTION

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Sustainability:
 - 1. Conform to NSF/ANSI Standard 347, "Sustainability Assessment for Single-Ply Roofing Membranes. Minimum certification level: Gold.
 - 2. Type III product-specific Environmental Product Declaration.
 - 3. Membrane is recyclable at end of use.
- D. Physical Properties (must meet or exceed):
 - 1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D4434.
 - 2. Thickness: 60 mil, nominal, in accordance with ASTM D751.
 - 3. Thickness over Scrim: ≥ 31 mil in accordance with ASTM D7635.
 - 4. Breaking Strength: ≥ 437 lbf. (machine direction) and ≥ 304 lbf. (cross machine direction) in accordance with ASTM D751 Grab Method.
 - 5. Elongation at Break: $\geq 29\%$ (machine direction) and $\geq 30\%$ (cross machine direction) in accordance with ASTM D751 Grab Method.
 - 6. Seam Strength: ≥ 463 lbf. in accordance with ASTM D751 Grab Method.
 - 7. Tear Strength: ≥ 78 lbf. (machine direction) and ≥ 190 lbf. (cross machine direction) in accordance with ASTM D751 Procedure B.
 - 8. Low Temperature Bend: Pass at -40°F in accordance with ASTM D2136.
 - 9. Heat Aging: Pass after being conditioned for 56 days in oven maintained at 176°F in accordance with ASTM D3045.
 - 10. Accelerated Aging: Pass after 10,000 hours of total test time in accordance with ASTM G155.
 - 11. Dimensional Stability: Change of 0.30% (machine direction) and 0.10% (cross machine direction) in accordance with ASTM 1204.
 - 12. Water Absorption: $< 2.29\%$ at 158°F for 168 hours in accordance with ASTM D570.
 - 13. Static Puncture Resistance: ≥ 33 lbf. in accordance with ASTM D5602.
 - 14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D5635.
- E. Cool Roof Rating Council (CRRC) (Membrane must be listed on the CRRC website):
 - 1. Solar Reflectance (Initial): $\geq 85\%$
 - 2. Solar Reflectance (3-Year Aged): $\geq 73\%$
 - 3. Thermal Emittance (Initial): $\geq 89\%$
 - 4. Thermal Emittance (3-Year Aged): $\geq 88\%$
 - 5. Solar Reflectance Index (SRI) (Initial): $\geq 108\%$
 - 6. Solar Reflectance Index (SRI) (3-Year Aged): $\geq 90\%$
- F. Insulation:
 - 1. General Requirements
 - a. Install using a minimum of two layers.

- b. Configuration as indicated on the drawings.
- 2. Polyisocyanurate Board Insulation
 - a. Thickness as shown on drawings

1.4 SUBMITTALS

- A. Product data sheets to be used, with the following information included:
 - 1. Preparation instructions and recommendations
 - 2. Storage and handling requirements and recommendations
 - 3. Installation methods
 - 4. Maintenance requirements
- B. Sustainability Documentation:
 - 1. NSF/ANSI Standard 347 Certificate
 - 2. Type III product-specific Environmental Product Declaration
- C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.
- D. Provide verification samples for each product specified (two samples representing each product, color and finish):
 - 1. 4-inch by 6-inch sample of roofing membrane, of color specified.
 - 2. 4-inch by 6-inch sample of walkway pad.
 - 3. Termination bar, fascia bar with cover, drip edge, and gravel stop if to be used.
 - 4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.
- E. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's installation instructions.
- B. Manufacturer Qualifications: A manufacturer specializing in the production of standard reinforced PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.
- C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.
- D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.
- E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for roof assembly fire hazard, wind uplift, and cool roof requirements.
- B. Fire Hazard Requirements: Provide membrane roofing materials with the following fire-test-response characteristics. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Class A

2. Fire-test-response standard: Comply with ASTM E108 for application and roof slopes indicated.
3. Fire-Resistance Ratings: Comply with ASTM E119 for fire-resistance-rated roof assemblies of which roofing system is a part.
4. Conform to applicable code for roof assembly fire hazard requirements.
- C. Wind Uplift Requirements: Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. Cool Roof Requirements: Conform to IECC (International Energy Conservation Code) and IGCC (International Green Construction Code) cool roof requirements.

1.7 PRE-INSTALLATION MEETING

- A. Convene meeting not less than one week before starting work of this section.
- B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 4. Review structural loading limitations of roof deck during and after roofing.
 5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 6. Review governing regulations and requirements for insurance and certificates if applicable.
 7. Review temporary protection requirements for roofing system during and after installation.
 8. Review roof observation and repair procedures after roofing installation.
 9. Review existing roof manufacturer's recycling program and return roofing system to the manufacturer for recycling.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.

- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

- A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the warranty issued by the manufacturer.
- B. Manufacturer's Warranty: Must be no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition the warranty must meet the following criteria:
 - 1. Warranty Period: 20 years from date issued by the manufacturer.
 - 2. Full system warranty to include all membrane, accessories, insulation, coverboard, edge metal.
 - 3. Issued direct from and serviced by the roof membrane manufacturer.
 - 4. Transferable for the full term of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. All roofing system components to be provided or approved by roof system manufacturer.
- B. Acceptable Manufacturers:
 - 1. Duro-Last- **Basis of Design**
 - 2. Fibertite XT
 - 3. Sarnafil S-327

2.2 ROOFING SYSTEM COMPONENTS

- A. Roofing Membrane:
 - 1. Properties:
 - a. Type: PVC thermoplastic membrane
 - b. Roll Width: 120" (Installed widths may vary)
 - c. Thickness: 60 mil
 - d. Membrane Color: White
 - e. Attachment Type: Mechanically Fastened
 - f. Fasteners: HD Screw (#14)
 - g. Plates: Cleat Plate®
 - 2. Features:
 - a. ASTM D4434, Type III
 - b. Fabric-reinforced, PVC.
 - c. Minimum NSF 347 Gold certified.
- B. Insulation:

1. General Requirements
 - a. Provide preformed roof insulation boards that comply with requirements and referenced standards, as selected from manufacturer's standard sizes.
 - b. Provide preformed saddles, crickets, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
 - c. Provide roof insulation accessories approved by the roof membrane manufacturer and as recommended by insulation manufacturer for the intended use.
2. Component:
 - a. Properties:
 1. Type: Polyisocyanurate Board Insulation
 2. Board Application: Flat Stock
 3. Size: 4' x 4'
 4. Thickness as shown on Drawings
 5. Attachment Type: Mechanically Fastened
 6. Fasteners: HD Screw (#14)
 7. Plates: 3-Inch Metal Plate
 - b. Features:
 1. Closed-cell polyisocyanurate foam core insulation board.
 2. Complying with ASTM C1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 3. Provide factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening insulation and/or insulation cover boards in conformance to specified design requirements.
- C. Deck Type:
 1. Properties:
 - a. Type: Steel Deck (22 ga. Minimum – See Structural Drawings)
- D. Accessory Materials: Provide accessory materials supplied by or approved for use by roof system manufacturer:
 1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
 2. Penetrations and Flashings: Manufactured using standard reinforced PVC membrane.
 - a. Inside and Outside Corners
 - b. Stack Flashing
 - c. Curb Flashing
 3. Drains, Scuppers, and Vents: Manufactured using standard reinforced PVC membrane.
 - a. Two-Way Air Vent
 - b. Drain Boot
 - c. Drain Guard
 - d. Composite Drain Rings
 4. Fasteners: Factory-coated steel fasteners meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by roof system manufacturer.
 - a. Heavy Duty Screw (#14)

5. Plates: Metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by roof system manufacturer.
 - a. Steel Membrane Plate
 - b. 3-Inch Metal Plate
6. Additional Roof Components: Supplied by roof system manufacturer.
 - a. PVC Walkway Pad

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of standing water, ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set.
- F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.

3.3 INSTALLATION

- A. Insulation:
 1. General Requirements
 - a. Install insulation in accordance with the roof manufacturer's requirements.
 - b. Insulation shall be adequately supported to sustain normal foot traffic without damage.
 - c. Where field trimmed, insulation shall be fitted tightly around roof protrusions with no gaps greater than ¼ inch.
 - d. Tapered insulation boards shall be installed in accordance with the insulation manufacturer's shop drawings.
 - e. No more insulation shall be applied than can be covered with the roof membrane by the end of the day or the onset of inclement weather.
 - f. If more than one layer of insulation is used, all joints between subsequent layers shall be offset by at least 6 inches.
 2. Polyisocyanurate Board Insulation

- a. Use only fasteners, stress plates and fastening patterns accepted for use by the roof manufacturer. Fastening patterns must meet applicable design requirements.
 - b. Install fasteners in accordance with the roof manufacturer's requirements. Fasteners that are improperly installed must be replaced or corrected.
 - c. Install all layers in parallel courses with end joints staggered 50% and adjacent boards butted together with no gaps greater than ¼ inch.
- B. Roofing Membrane:
 - 1. General Requirements
 - a. Install membrane in accordance with the roof manufacturer's requirements.
 - b. Cut membrane to fit neatly around all penetrations and roof projections.
 - 2. PVC thermoplastic membrane
 - a. Use only fasteners, stress plates and fastening patterns accepted for use by the roof manufacturer. Fastening patterns must meet applicable design requirements.
 - b. Install fasteners in accordance with the roof manufacturer's requirements. Fasteners that are improperly installed must be replaced or corrected.
 - c. Mechanically fasten membrane to the structural deck utilizing fasteners and fastening patterns in accordance with the roof manufacturer's requirements.
- C. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.
- D. Check field welded seams for continuity and integrity and repair all imperfections by the end of each work day.
- E. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer's requirements.
 - 1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 - a. Do not apply flashing over existing thru-wall flashings or weep holes.
 - b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.
 - c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.
 - d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).
 - 2. Penetrations:
 - a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
 - b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.
 - c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
 - 3. Pipe Clusters and Unusual Shapes:
 - a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.

- b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
 - c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.
- F. Roof Drains: Coordinate installation of roof drains and vents.
 - 1. Drain Assemblies with Clamping Rings:
 - a. Remove existing roofing system materials from drain bowl and clamping ring.
 - b. The membrane must extend beyond the inside of the clamping ring.
 - c. Use a manufacturer supplied or approved sealant (1/2 tube minimum) between the membrane and drain bowl assembly.
 - d. After the membrane is properly installed onto the bowl and the clamping ring set in place, all bolts securing the ring must be installed to provide constant, even compression on the sealant. If bolts are broken or missing, replacements must be installed.
 - 2. Drain Boots:
 - a. Remove existing flashing and asphalt at existing drains in preparation for sealant and membrane.
 - b. Use a manufacturer supplied or approved sealant (1/2 tube minimum) to the outside of the drain boot and insert it into the drain.
 - c. Fasten membrane around the perimeter of the drain with the same fastening pattern as the field membrane, no less than 1 fastener per drain.
 - d. Install a pair of composite drain rings (CDRs) to compress the boot to the pipe. Ensure the CDR openings face in opposite directions.
 - e. Secure the manufacturer's drain guard over the opening by heat welding the attachment tabs to the roof membrane.
- G. Edge Details:
 - 1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.
 - 2. Join individual sections in accordance with the membrane manufacturer's requirements.
 - 3. Coordinate installation of metal flashing and counter flashing.
 - 4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies.
- H. Walkways:
 - 1. Install walkways in accordance with the membrane manufacturer's requirements.
 - 2. Provide walkways where indicated on the Drawings.
 - 3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
 - 4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.
- I. Water Cut-Offs:
 - 1. Provide water cut-offs on a daily basis at the completion of work and at the onset of inclement weather.
 - 2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
 - 3. Remove water cut-offs prior to the resumption of work.

4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

- A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.

3.5 PROTECTION

- A. Protect installed roofing products from construction operations until completion of project.
- B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.
- C. Repair or replace damaged products after work is completed.

PVC ROOFING (FULLY ADHERED)

PART 1 GENERAL

1.1 SUMMARY

- A. Membrane Type: PVC thermoplastic membrane
 1. Roll Width: 10' (Installed widths may vary)
 2. Thickness: 60 mil
 3. Membrane Color: White
 4. Attachment Type: Adhered
 5. Adhesive: Duro-Last Solvent-Grip® Spray Adhesive [Spray Applied]
- B. Cover Board Type: Fiberglass-Faced Primed Roof Board 1/2-Inch
 1. Attachment Type: Adhered
 2. Adhesive: Duro-Grip® TRUFAST® Adhesive [Ribbon Adhered]
- C. Insulation Layer 1 Type: Polyisocyanurate Board Insulation
 1. Board Application: Flat Stock
 2. Board Style: Layer Thickness
 3. Board Size: 4' x 4'
 4. Thickness: 3.00"
 5. Attachment Type: Adhered
 6. Adhesive: Duro-Grip® TRUFAST® Adhesive [Ribbon Adhered]
- D. Insulation Layer 2 Type: Polyisocyanurate Board Insulation
 1. Board Application: Flat Stock
 2. Board Style: Layer Thickness
 3. Board Size: 4' x 4'

- 4. Thickness: 3.00"
- 5. Attachment Type: Adhered
- 6. Adhesive: Duro-Grip® TRUFAST® Adhesive [Ribbon Adhered]
- E.** Vapor Barrier Type: Self-Adhesive Vapor Barrier with VB Primer
- F. Deck Type: Structural Concrete Deck
- G. Prefabricated flashings, corners, parapets, stacks, vents, and related details.
- H. Fasteners, adhesives, and other accessories required for a complete roofing installation.
- I. Traffic Protection.

1.2 REFERENCES

- A. ASTM INTERNATIONAL (ASTM)
 - 1. (2019) Standard Test Methods for Coated Fabrics (D751)
 - 2. (2021) Standard Specification for Poly(Vinyl Chloride) Sheet Roofing (D4434/D4434M)
 - 3. (2022) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board (C1289)
 - 4. (2020) Standard Test Methods for Fire Tests of Roof Coverings (E108)
 - 5. (2020) Standard Test Methods for Fire Tests of Building Construction and Materials (E119)
- B. UL SOLUTIONS (UL)
 - 1. (2021) UL Roofing Systems (TGFU.R10128)
- C. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
 - 1. (2014) Minimum Design Loads for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-10)
 - 2. (2017) Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-16)
 - 3. (2022) Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE Standard - ASCE/SEI 7-22)
- D. NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
 - 1. (2019) NRCA Roofing Manual - Membrane Systems

1.3 SYSTEM DESCRIPTION

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Sustainability:
 - 1. Conform to NSF/ANSI Standard 347, "Sustainability Assessment for Single-Ply Roofing Membranes. Minimum certification level: Gold.
 - 2. Type III product-specific Environmental Product Declaration.
 - 3. Membrane is recyclable at end of use.
- D. Physical Properties (must meet or exceed):
 - 1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D4434.

2. Thickness: 60 mil, nominal, in accordance with ASTM D751.
 3. Thickness over Scrim: ≥ 31 mil in accordance with ASTM D7635.
 4. Breaking Strength: ≥ 437 lbf. (machine direction) and ≥ 304 lbf. (cross machine direction) in accordance with ASTM D751 Grab Method.
 5. Elongation at Break: $\geq 29\%$ (machine direction) and $\geq 30\%$ (cross machine direction) in accordance with ASTM D751 Grab Method.
 6. Seam Strength: ≥ 463 lbf. in accordance with ASTM D751 Grab Method.
 7. Tear Strength: ≥ 78 lbf. (machine direction) and ≥ 190 lbf. (cross machine direction) in accordance with ASTM D751 Procedure B.
 8. Low Temperature Bend: Pass at -40°F in accordance with ASTM D2136.
 9. Heat Aging: Pass after being conditioned for 56 days in oven maintained at 176°F in accordance with ASTM D3045.
 10. Accelerated Aging: Pass after 10,000 hours of total test time in accordance with ASTM G155.
 11. Dimensional Stability: Change of 0.30% (machine direction) and 0.10% (cross machine direction) in accordance with ASTM 1204.
 12. Water Absorption: $< 2.29\%$ at 158°F for 168 hours in accordance with ASTM D570.
 13. Static Puncture Resistance: ≥ 33 lbf. in accordance with ASTM D5602.
 14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D5635.
- E. Cool Roof Rating Council (CRRC) (Membrane must be listed on the CRRC website):
1. Solar Reflectance (Initial): $\geq 85\%$
 2. Solar Reflectance (3-Year Aged): $\geq 73\%$
 3. Thermal Emittance (Initial): $\geq 89\%$
 4. Thermal Emittance (3-Year Aged): $\geq 88\%$
 5. Solar Reflectance Index (SRI) (Initial): $\geq 108\%$
 6. Solar Reflectance Index (SRI) (3-Year Aged): $\geq 90\%$
- F. Insulation:
1. General Requirements
 - a. Install using a minimum of two layers.
 - b. Configuration as indicated on the drawings.
 2. Polyisocyanurate Board Insulation
 - a. Layer 1 Thickness: 3.00"
 3. Polyisocyanurate Board Insulation
 - a. Layer 2 Thickness: 3.00"

1.4 SUBMITTALS

- A. Product data sheets to be used, with the following information included:
1. Preparation instructions and recommendations
 2. Storage and handling requirements and recommendations
 3. Installation methods
 4. Maintenance requirements
- B. Sustainability Documentation:
1. NSF/ANSI Standard 347 Certificate
 2. Type III product-specific Environmental Product Declaration

- C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.
- D. Provide verification samples for each product specified (two samples representing each product, color and finish):
 - 1. 4-inch by 6-inch sample of roofing membrane, of color specified.
 - 2. 4-inch by 6-inch sample of walkway pad.
 - 3. Termination bar, fascia bar with cover, drip edge, and gravel stop if to be used.
 - 4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.
- E. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's installation instructions.
- B. Manufacturer Qualifications: A manufacturer specializing in the production of standard reinforced PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.
- C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.
- D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.
- E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for roof assembly fire hazard, wind uplift, and cool roof requirements.
- B. Fire Hazard Requirements: Provide membrane roofing materials with the following fire-test-response characteristics. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Class B
 - 2. Fire-test-response standard: Comply with ASTM E108 for application and roof slopes indicated.
 - 3. Fire-Resistance Ratings: Comply with ASTM E119 for fire-resistance-rated roof assemblies of which roofing system is a part.
 - 4. Conform to applicable code for roof assembly fire hazard requirements.
- C. Wind Uplift Requirements: Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of ASCE/SEI 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- D. Cool Roof Requirements: Conform to IECC (International Energy Conservation Code) and IGCC (International Green Construction Code) cool roof requirements.

1.7 PRE-INSTALLATION MEETING

- A. Convene meeting not less than one week before starting work of this section.
- B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.
9. Review existing roof manufacturer's recycling program and return roofing system to the manufacturer for recycling.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

- A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the warranty issued by the manufacturer.
- B. Manufacturer's Warranty: Must be no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition the warranty must meet the following criteria:
 1. Warranty Period: 20 years from date issued by the manufacturer.
 2. Full systems warranty to include membrane, accessories, adhesives, insulation, coverboard, perimeter metal edge.
 3. Issued direct from and serviced by the roof membrane manufacturer.
 4. Transferable for the full term of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. All roofing system components to be provided or approved by roof system manufacturer.
- B. Acceptable Manufacturers:
 - 1. Duro-Last- **BASIS OF DESIGN**
 - 2. Fibertite XT
 - 3. Sarnafil G-410

2.2 ROOFING SYSTEM COMPONENTS

- A. Roofing Membrane:
 - 1. Properties:
 - a. Type: PVC thermoplastic membrane
 - b. Roll Width: 120" (Installed widths may vary)
 - c. Thickness: 60 mil
 - d. Membrane Color: White
 - e. Attachment Type: Adhered
 - f. Adhesive: Duro-Last Solvent-Grip® Spray Adhesive [Spray Applied]
 - 2. Features:
 - a. ASTM D4434, Type III
 - b. Fabric-reinforced, PVC.
 - c. Minimum NSF 347 Gold certified.
- B. Barrier Board:
 - 1. Properties:
 - a. Type: Fiberglass-Faced Primed Roof Board 1/2-Inch
 - b. Attachment Type: Adhered
 - c. Adhesive: Duro-Grip® TRUFAST® Adhesive [Ribbon Adhered]
 - 2. Features:
 - a. Glass-mat facer with specially treated core
 - b. Enhanced to provide a broader compatibility and higher performance with roofing adhesives
 - c. Excellent fire, mold, and moisture resistance
 - d. Manufactured to meet ASTM C1177
- C. Insulation:
 - 1. General Requirements
 - a. Provide preformed roof insulation boards that comply with requirements and referenced standards, as selected from manufacturer's standard sizes.
 - b. Provide preformed saddles, crickets, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
 - c. Provide roof insulation accessories approved by the roof membrane manufacturer and as recommended by insulation manufacturer for the intended use.
 - 2. Component:

- a. Properties:
 - 1. Type: Polyisocyanurate Board Insulation
 - 2. Board Application: Flat Stock
 - 3. Size: 4' x 4'
 - 4. Method: Layer Thickness: 6" (2 at 3.00")
 - 5. Attachment Type: Adhered
 - 6. Adhesive: Duro-Grip® TRUFAST® Adhesive [Ribbon Adhered]
 - b. Features:
 - 1. Closed-cell polyisocyanurate foam core insulation board.
 - 2. Complying with ASTM C1289, Type II, felt or glass-fiber mat facer on both major surfaces.
 - 3. Provide insulation adhesive for attaching insulation and/or insulation cover boards in conformance to specified design requirements.
- D. Vapor Barrier:
- 1. Properties:
 - a. Type: Self-Adhesive Vapor Barrier with VB Primer
 - 2. Features:
 - a. 3.75' x 133' - 80 lb. roll
 - b. SBS modified bitumen adhesive on the bottom surface, with tri-laminated woven polyethylene on the top surface
 - c. Solvent-based primer increases adhesion of vapor barrier
- E. Deck Type:
- 1. Properties:
 - a. Type: Structural Concrete Deck
- F. Accessory Materials: Provide accessory materials supplied by or approved for use by roof system manufacturer:
- 1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
 - 2. Penetrations and Flashings: Manufactured using standard reinforced PVC membrane.
 - a. Inside and Outside Corners
 - b. Stack Flashing
 - c. Curb Flashing
 - 3. Drains, Scuppers, and Vents: Manufactured using standard reinforced PVC membrane.
 - a. Drain Boot
 - b. Drain Guard
 - c. Composite Drain Rings
 - 4. Non-Fleece Membrane Adhesives: Compatible with roofing system and supplied by roof system manufacturer.
 - a. Solvent-Based Spray Membrane Adhesive [Splatter Pattern]
 - 5. Low Rise Insulation Adhesives: Compatible with roofing system and supplied by roof system manufacturer.
 - a. Low-Rise Foam Insulation Adhesive [Ribbon Adhered]
 - 6. Additional Roof Components: Supplied by roof system manufacturer.
 - a. PVC Walkway Pad

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of standing water, ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set.
- F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.

3.3 INSTALLATION

- A. Vapor Barrier:
 - 1. General Requirements
 - a. Install vapor barrier in accordance with the roof manufacturer's requirements.
 - 2. Self-Adhesive Vapor Barrier with VB Primer
- B. Insulation:
 - 1. General Requirements
 - a. Install insulation in accordance with the roof manufacturer's requirements.
 - b. Insulation shall be adequately supported to sustain normal foot traffic without damage.
 - c. Where field trimmed, insulation shall be fitted tightly around roof protrusions with no gaps greater than ¼ inch.
 - d. Tapered insulation boards shall be installed in accordance with the insulation manufacturer's shop drawings.
 - e. No more insulation shall be applied than can be covered with the roof membrane by the end of the day or the onset of inclement weather.
 - f. If more than one layer of insulation is used, all joints between subsequent layers shall be offset by at least 6 inches.
 - 2. Polyisocyanurate Board Insulation
 - a. Use only insulation adhesive acceptable to the roof manufacturer that meets applicable design requirements.
 - b. Attach insulation boards with insulation adhesive in parallel courses with end joints staggered 50% and adjacent boards butted together with no gaps greater than ¼ inch
- C. Cover Board:
 - 1. General Requirements
 - a. Install cover board in accordance with the roof manufacturer's requirements.
 - 2. Fiberglass-Faced Primed Roof Board 1/2-Inch

- a. Use only insulation adhesive acceptable to the roof manufacturer that meets applicable design requirements.
 - b. Attach insulation boards with insulation adhesive in parallel courses with end joints staggered 50% and adjacent boards butted together with no gaps greater than ¼ inch
- D. Roofing Membrane:
 - 1. General Requirements
 - a. Install membrane in accordance with the roof manufacturer's requirements.
 - b. Cut membrane to fit neatly around all penetrations and roof projections.
 - 2. PVC thermoplastic membrane
 - a. Read the adhesive's Safety Data Sheet (SDS) prior to using the adhesive.
 - b. Follow application guidelines outlined in the adhesive's Product Data Sheet.
 - c. Inspect the surface of the deck/substrate. The deck/substrate must be clean, smooth, dry, and free of sharp edges, dust, contaminants, oil, grease, and loose, foreign material that may affect the installation of the roofing system and its performance.
 - d. Unroll roofing membrane and position with a minimum 6-inch overlap.
 - e. Fold the roof section back onto itself to expose half of the roof area to be covered by that section.
 - f. Apply adhesive in front of the fold along its length. Apply at the required rate in smooth, even coatings without voids, globs, puddles or similar irregularities. Use care not to contaminate the area of the membrane where hot air welding will occur.
 - g. Lift the top layer of membrane and, starting at the fold, use a stiff squeegee or broom to push the membrane into the adhesive.
 - h. Repeat previous steps for the second half of the roof section.
- E. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.
- F. Check field welded seams for continuity and integrity and repair all imperfections by the end of each work day.
- G. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer's requirements.
 - 1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
 - a. Do not apply flashing over existing thru-wall flashings or weep holes.
 - b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.
 - c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.
 - d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).
 - 2. Penetrations:
 - a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
 - b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.

- c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
- 3. Pipe Clusters and Unusual Shapes:
 - a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.
 - b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
 - c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.
- H. Roof Drains: Coordinate installation of roof drains and vents.
 - 1. Drain Assemblies with Clamping Rings:
 - a. Remove existing roofing system materials from drain bowl and clamping ring.
 - b. The membrane must extend beyond the inside of the clamping ring.
 - c. Use a manufacturer supplied or approved sealant (1/2 tube minimum) between the membrane and drain bowl assembly.
 - d. After the membrane is properly installed onto the bowl and the clamping ring set in place, all bolts securing the ring must be installed to provide constant, even compression on the sealant. If bolts are broken or missing, replacements must be installed.
 - 2. Drain Boots:
 - a. Remove existing flashing and asphalt at existing drains in preparation for sealant and membrane.
 - b. Use a manufacturer supplied or approved sealant (1/2 tube minimum) to the outside of the drain boot and insert it into the drain.
 - c. Fasten membrane around the perimeter of the drain with the same fastening pattern as the field membrane, no less than 1 fastener per drain.
 - d. Install a pair of composite drain rings (CDRs) to compress the boot to the pipe. Ensure the CDR openings face in opposite directions.
 - e. Secure the manufacturer's drain guard over the opening by heat welding the attachment tabs to the roof membrane.
- I. Edge Details:
 - 1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.
 - 2. Join individual sections in accordance with the membrane manufacturer's requirements.
 - 3. Coordinate installation of metal flashing and counter flashing.
 - 4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies.
- J. Walkways:
 - 1. Install walkways in accordance with the membrane manufacturer's requirements.
 - 2. Provide walkways where indicated on the Drawings.
 - 3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
 - 4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.

K. Water Cut-Offs:

1. Provide water cut-offs on a daily basis at the completion of work and at the onset of inclement weather.
2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
3. Remove water cut-offs prior to the resumption of work.
4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

- A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.

3.5 PROTECTION

- A. Protect installed roofing products from construction operations until completion of project.
- B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.
- C. Repair or replace damaged products after work is completed.

END OF SECTION

SECTION 07 6200 – Page 1 of 3

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Edge flashings.
 - 3. Gutters and downspouts.
 - 4. Flashings at metal roofing.
 - 5. Counterflashings over membrane roof base flashings.
 - 6. Counterflashings at roof mounted equipment and utility penetrations.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
 - 3. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- B. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI) ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. B32 - Standard Specification for Solder Metal.
 - 5. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 6. B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 7. B506 - Specification for Copper-Clad Stainless Steel Sheet and Strip for Building Construction.
 - 8. B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- D. Sheet Metal and Air Conditioning Manufacturer's Association International (SMACNA) - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, types and thicknesses of metal, profiles, dimensions, fastening methods, provisions for expansion and contraction, and joint details.

1.4 QUALITY ASSURANCE

- A. Fabricator and Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Design, fabricate, and install metal copings, gravel stops, and edge flashings in accordance with ANSI/SPRI ES-1.
- C. Conform to SMACNA Manual for nominal sizing of gutters and downspouts for rainfall intensity determined by a storm occurrence of 1 in 5 years.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Precoated Aluminum-Zinc Alloy Coated Steel Sheet:
 - 1. ASTM A792/A792M, Commercial Quality, AZ50 aluminum-zinc alloy coating, 24 gage core steel unless noted otherwise.
 - 2. Finish: AAMA 621, fluoropolymer coating, containing minimum 70 percent PVDF resins, color to be selected from manufacturer's full color range.

2.2 ACCESSORIES

- A. Solder: ASTM B32.
- B. Fasteners: Same material and finish as sheet metal, with neoprene gasketed washers where exposed.
- C. Joint Sealers: Specified in Section 07 9200.

2.3 FABRICATION

- A. Fabricate components in accordance with SMACNA Manual.
- B. Profiles:
 - 1. Gutters: 6 X 6 Box Gutters. See exact profile on Drawings.
 - 2. Downspouts: 4" x 5", 24 gage.
 - 3. Fabricate end caps, downspout outlets and headers, straps, brackets, and downspout strainers in profile to suit gutters and downspouts.
- C. Solder shop formed joints. After soldering, remove flux and wash clean.
- D. Fabricate corners in single units with minimum 24 inch long legs. Miter corners.
- E. Fabricate vertical faces with bottom edge formed outward 1/2 inch and hemmed to form drip.
- F. Form sections accurate to size and shape, square and free from distortion and defects.
- G. Provide for thermal expansion and contraction in sheet metal:
 - 1. Gutters:
 - a. Place expansion joints at maximum 50 feet on center.
 - b. Locate expansion joints between downspouts; prevent water flow over joint.

- 2. Other sheet metal:
 - a. Provide expansion joints in sheet metal exceeding 15 feet in running length.
 - b. Place expansion joints at 10 feet on center maximum and maximum 2 feet from corners and intersections.
- 3. Joint width: Consistent with types and sizes of materials, minimum width 1/8 inch.
- H. Fabricate expansion joints in metal copings, edge flashings, and gravel stops with backing and cover plates formed to flashing profile, minimum 8 inches long.
- I. Unless otherwise indicated, provide minimum 3/4 inch wide flat lock seams; lap in direction of water flow.
- J. Fabricate cleats and starter strips of same material as sheet metal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install flashing and sheet metal as indicated and in accordance with SMACNA Manual.
- B. Install cleats and starter strips before starting installation of sheet metal. Fasten at 6 inches on center maximum.
- C. Secure flashings with concealed fasteners where possible.
- D. Apply plastic cement between metal and bituminous flashings.
- E. Fit flashings tight, with square corners and surfaces true and straight.
- F. Seam and seal field joints.
- G. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.
- H. Reglets:
 - 1. Install reglets true to line and level. Seal top of surface mounted reglet with joint sealer.
 - 2. Install flashings into reglets to form tight fit. Secure with lead or plastic wedges at 9 inches on center maximum. Seal remaining space with joint sealer.
- I. Gutters: Secure with straps spaced maximum 36 inches on center and within 12 inches of ends.
- J. Downspouts:
 - 1. Secure with hidden, offset downspout brackets spaced maximum 8 feet on center and within 2 feet of ends and elbows.
 - 2. Flash downspouts into gutters and fasten.
 - 3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.
- K. Apply joint sealers as specified in Section 07 9200.

3.2 CLEANING

- A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joint backup materials.
 - 2. Joint sealers.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
 - 2. C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - 3. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 4. C834 - Standard Specification for Latex Sealing Compounds.
 - 5. C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 6. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 7. C1193 - Standard Guide for Use of Joint Sealants.
 - 8. C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - 9. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 10. D2203 - Standard Test Method for Staining from Sealants.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use.
 - 2. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Maximum Volatile Organic Compound (VOC) Content; interior sealers and accessories:
 - 1. Sealants 250 grams per liter.
 - 2. Primers for non-porous substrates: 250 grams per liter.
 - 3. Primers for porous substrates: 775 grams per liter.
- C. Laboratory Pre-Construction Testing:
 - 1. Obtain representative samples of actual substrate materials.
 - 2. Test sealers and accessories for following:
 - a. Adhesion: Test to ASTM C794 and ASTM C719; determine surface preparation and required primer.
 - b. Compatibility: Test to ASTM C1087; determine that materials in contact with sealers do not adversely affect sealant materials or sealant color.
 - c. Staining: Test to ASTM D2203, ASTM C510, or ASTM C1248; determine that sealants will not stain joint substrates.

- d. Pre-construction testing is not required when sealant manufacturer furnishes data acceptable to Architect based on previous testing for materials matching those of this Project.
- D. Field Pre-Construction Testing: Test each joint sealer and joint substrate before beginning work of this Section:
 - 1. Install sealers in mockups using joint preparation methods and materials recommended by sealer manufacturer.
 - 2. Install field-test joints in inconspicuous location.
 - 3. Test sealers using manufacturer's standard field adhesion test; verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
 - 4. When test indicates sealant adhesion failure, modify joint preparation, primer, or both and retest until joint passes sealant adhesion test.

1.5 PROJECT CONDITIONS

- A. Do not apply sealers at temperatures below 40 degrees F unless approved by sealer manufacturer.

1.6 WARRANTIES

- A. Furnish manufacturer's and applicator's 10 year warranty providing coverage for sealers and accessories that fail to provide air and water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Metzger/McGuire. (www.metzgermcguire.com)
 - 2. BASF Building Systems. (www.buildingsystems.basf.com)
 - 3. Dow Corning Corp. (www.dowcorning.com)
 - 4. GE Silicones. (www.siliconeforbuilding.com)
 - 5. Pecora Corp. (www.pecora.com)
 - 6. Sika Corp. (www.sikausa.com)
 - 7. Tremco, Inc. (www.tremcosealants.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Joint Sealer Type 1: Pavement
 - 1. ASTM C920, Grade P, multiple component polyurethane type, self-leveling and slope grades.
 - 2. Movement capability: Plus or minus 50 percent.
 - 3. Color: To be selected from manufacturer's full color range.
- B. Joint Sealer Type 2: Exterior
 - 1. ASTM C920, Grade NS, single component butyl rubber type, non sag.
 - 2. Movement capability: Plus or minus 12-1/2 percent.
 - 3. Color: To be selected from manufacturer's full color range.
- C. Joint Sealer Type 3: Interior
 - 1. ASTM C834, single component acrylic latex, non sag.
 - 2. Movement capability: Plus or minus 25 percent.

3. Color: White, paintable.
- A. Joint Sealer Type 4: Damp Locations
 1. ASTM C920, Grade NS, single component silicone, non sag, mildew resistant.
 2. Movement capability: Plus or minus 25 percent.
 3. Color: To be selected from manufacturer's full color range.
- B. Joint Sealer Type 5:
 1. ASTM C920, Grade NS, single component polyurethane or polysulfide type, non sag, recommended by manufacturer for continuous water immersion.
 2. Movement capability: Plus or minus 25 percent.
 3. Color: To be selected from manufacturer's full color range.
- C. Joint Sealer Type 6:
 1. ASTM C834, single component acrylic latex, non sag, non-hardening, recommended by manufacturer for acoustical applications.
 2. Movement capability: Plus or minus 5 percent.
 3. Color: White, paintable.

2.2 ACCESSORIES

- A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.
- B. Joint Backing:
 1. ASTM C1330, closed cell polyethylene foam, preformed round joint filler, non absorbing, non staining, resilient, compatible with sealer and primer, recommended by sealer manufacturer for each sealer type.
 2. Size: Minimum 1.25 times joint width.

2.3 MIXES

- A. Mix multiple component sealers in accordance with manufacturer's instructions.
 1. Mix with mechanical mixer; prevent air entrainment and overheating.
 2. Continue mixing until color is uniform.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Protect adjacent surfaces with masking tape or protective coverings.
- D. Sealer Dimensions:
 1. Minimum joint size: 1/4 x 1/4 inch.
 2. Joints 1/4 to 1/2 inch wide: Depth equal to width.
 3. Joints over 1/2 inch wide: Depth equal to one half of width.

3.2 APPLICATION

SECTION 07 9200 – Page 4 of 4

- A. Apply products in accordance with manufacturer's instructions.
- B. Install sealers and accessories in accordance with ASTM C1193.
- C. Install acoustical sealers and accessories in accordance with ASTM C919.
- D. Install joint backing to maintain required sealer dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.
- E. Use bondbreaker tape where joint backing is not installed.
- F. Fill joints full without air pockets, embedded materials, ridges, and sags.
- G. Tool sealer to smooth profile.
- H. Apply sealer within manufacturer's recommended temperature range.

3.3 CLEANING

- A. Remove masking tape and protective coverings after sealer has cured.
- B. Clean adjacent surfaces.

3.4 SCHEDULE

JOINT LOCATION OR TYPE	SEALER TYPE
Exterior Joints:	
Joints in horizontal surfaces subject to pedestrian or vehicular traffic	1
Joints in above-grade surfaces	2
Interior Joints:	
Saw cut slab control joints	5
control joints	
Joints in toilet rooms, countertops, kitchens	4
Joints in acoustical assemblies	6
Other joints	3

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow steel doors and frames.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.
 - 3. Section 08 8000 - Glazing.
 - 4. ELECTRICAL Section: Conduit and wiring between strike hardware and power supply and security system.

1.2 REFERENCES

- A. American National Standards Institute (ANSI)/Steel Door Institute (SDI):
 - 1. A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finished Painted Steel for Steel Doors and Frames.
 - 2. A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
 - 3. A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 4. A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. A250.11 - Recommended Erection Instructions for Steel Frames.
- B. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 3. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 4. C518 - Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. E413 - Classification for Rating Sound Insulation.
- C. National Fire Protection Association (NFPA) 80 - Standard for Fire Doors and Fire Windows.
- D. Steel Door Institute (SDI) 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- E. Underwriters Laboratories (UL):
 - 1. 10B - Standard for Fire Tests of Door Assemblies.
 - 2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, elevations, dimensions, model designations, fire, thermal, acoustical ratings, preparation for hardware, and anchoring details.
 - 2. Product Data: Show elevations, dimensions, gages of metal, hardware reinforcing gages and locations, and anchor types.

- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification that products furnished comply with ANSI/SDI A250.3, ANSI/SDI 250.4, and ANSI/SDI A250.10.

1.4 QUALITY ASSURANCE

- A. Exterior Doors: ANSI/SDI A250.8.
 - 1. Grade: II - Heavy Duty, 18 gage.
 - 2. Galvannealed finish
 - 3. Model: 1 - Full Flush, seamless
 - 4. Exterior doors: Maximum thermal transmittance U-value of 0.50, tested to ASTM C518.
- B. Exterior Door Frames: ANSI/SDI A250.8, Grade II - Heavy Duty, 16 gage, Galvannealed finish.
- C. Interior Drywall Door Frames: ANSI/SDI A250.8, Grade II - Heavy Duty, 16 gage. Galvannealed where noted.
- D. Fire Door and Frame Construction: Conform to UL 10B/C.
- E. Fire Rated Door and Frame Assemblies: Conform to NFPA 80.
- F. Storm Room Doors and Frames: Conform to ICC 500 and FEMA 361.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ship door frames with removable angle spreader; do not remove until frame is installed.
- B. Store doors upright in protected, dry area, off ground or floor, with at least ¼ inch space between individual units.
- C. Do not cover with non vented coverings that create excessive humidity.
- D. Remove wet coverings immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ceco Door. (www.cecodoor.com)
 - 2. Curries. (www.curries.com)
 - 3. Pioneer Industries, Inc. (www.pioneerindustries.com)
 - 4. Steelcraft. (www.steelcraft.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Galvanized Steel Sheet:
 - 1. ASTM A653/A653M, hot dipped, Structural Quality, Class G40 galvanized.

- B. Door Core:
 - 1. Exterior doors: Rigid polystyrene insulation.

2.3 ACCESSORIES

- A. Glass, Glazing Sealers, and Accessories: Specified in Section 08 8000.
- B. Primer: Zinc rich type.

2.4 FABRICATION

- A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.
- B. Fabricate exterior doors and frames from galvanized steel sheet.
- C. Doors:
 - 1. Fabricate from minimum 18 gage sheets.
 - 2. Close top and bottom edges of doors with steel channel, minimum 14 gage, extending full width of door, and spot welded to both faces, with top channel flush and bottom channel recessed.
 - 3. Fill voids between vertical steel stiffeners with batt insulation.
 - 4. Fabricate vertical door edges as vertical seam edge filled, dressed smooth, intermittently welded seams, edge filled, dressed smooth, or continuously welded seam, dressed smooth.
- D. Frames:
 - 1. Fabricate from minimum 16 gage sheets.
 - 2. For knock-down frames, provide self aligning tabs and slots to hold corners in alignment.
 - 3. For welded frames, close corner joints tight with trim faces mitered and face welded, full profile welded, or continuously welded and ground smooth.
 - 4. Anchors:
 - a. Provide one anchor at each jamb for each 30 inches of door height.
 - b. Design anchors to provide positive fastenings to adjacent construction.
 - c. Provide one floor anchor welded to each jamb.
 - 5. Terminate stops 6 inches above finished floor. Cut bottom edge of stop at 45 degree angle and close.
 - 6. Where frames will be filled with concrete or grout, install silencers in frames before erection.
 - 7. Mullions for paired doors: Removable type, of same profiles as jambs.
- E. Accurately form to required sizes and profiles.
- F. Grind and dress exposed welds to form smooth, flush surfaces.
- G. Do not use metallic filler to conceal manufacturing defects.
- H. Fabricate with internal reinforcement for hardware specified in Section 08 7100; weld in place.
- I. Glazing Stops:
 - 1. Manufacturer's standard, screw on type with mitered corners.
 - 2. Form stops from minimum 20 gage steel; pre-fit for field glazing.
 - 3. Locate screws within 1 inch of ends of stops and maximum 8 inches on center.
 - 4. Install glazing stops on secure side of frames.
- J. Louvers:
 - 1. Manufacturer's standard, inverted "Y" blade type.

2. Frames: Minimum 20 gage steel.
3. Blades: Minimum 24 gage steel.
4. Weld blades to frame with one molding integral with louver.
5. Install loose molding on secure side of door.

A. Design Clearances:

1. Between door and frame: Maximum 1/8 inch.
2. Between meeting edges of pairs of doors:
 - a. Non-fire rated doors: 3/16 inch plus or minus 1/16 inch.
 - b. Fire-rated doors: 1/8 inch plus or minus 1/16 inch.
3. Undercut:
 - a. Non-fire rated doors: Maximum 3/4 inch.
 - b. Fire-rated doors: Comply with NFPA80.
4. Between face of door and stop: 1/16 to 3/32 inch.

2.2 Manufacturing Tolerances: In accordance with SDI-117.FINISHES

- A. Dress tool marks and surface imperfections to smooth surfaces.
- B. Clean and chemically treat steel surfaces.
- C. Touch up damaged metallic coatings.
- D. Apply manufacturer's standard rust inhibiting primer paint, air-dried or baked on, meeting requirements of ANSI/SDI A25010.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI A250.11.
- B. Set plumb and level.
- C. Secure to adjacent construction using fastener type best suited to application.
- D. Install glass as specified in Section 08 8000.
- E. Install hardware in accordance with Section 08 7100.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions in primer paint to match factory finish.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood veneer faced flush doors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.
 - 3. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. Architectural Woodwork Institute/Architectural Woodwork Manufacturers of Canada/Woodwork Institute (AWI/AWMAC/WI) - Architectural Woodwork Standards.
- B. ASTM International (ASTM) E90 - Standard Test Method for Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- C. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.
- D. National Fire Protection Association (NFPA) 80 - Standard for Fire Doors and Fire Windows.
- E. Underwriters Laboratories (UL):
 - 1. 10B - Standard for Fire Tests of Door Assemblies.
 - 2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.
- F. Window and Door Manufacturers Association (WDMA) - I.S.1A - Industry Standard for Architectural Flush Wood Doors.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, elevations, dimensions, fire ratings, and preparation for hardware.
 - 2. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Manufacturer's certification that doors comply with specified acoustical requirements.

1.4 QUALITY ASSURANCE

- A. Fire Door Construction: Conform to UL 10B.
- B. Installed Fire Rated Door Assembly: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

SECTION 08 1416 – Page 2 of 3

- A. Package doors in heavy plastic with identifying marks; slit plastic wrap on site to permit ventilation, but do not remove from plastic until ready to install.
- B. Store doors flat and level, fully supported with spacers between doors to allow for air circulation, in protected, dry area.
- C. Environmental Requirements: Maintain following conditions in building for minimum 7 days prior to, during, and after installation of doors:
 - 1. Temperature: 60 to 80 degrees F.
 - 2. Humidity: 25 to 55 percent.

1.6 WARRANTIES

- A. Furnish manufacturer's warranty providing coverage against defects in materials and workmanship and warpage beyond specified amount.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Algoma Hardwoods, Inc. (www.algomahardwoods.com)
 - 2. Eggers Industries. (www.eggersindustries.com)
 - 3. Marshfield DoorSystems, Inc. (www.marshfielddoors.com)
 - 4. Oshkosh Door Co. (www.oshkoshdoor.com)
 - 5. VT Industries, Inc. (www.vtindustries.com)
- B. Substitutions: Allowable with prior approval. Submit data guaranteeing equivalency.

2.2 MATERIALS

- A. Flush Wood Doors:
 - 1. AWI/AWMAC/WI Architectural Woodwork Standards, Section 9.
 - 2. Core type:
 - a. Solid, fire rated: Fire-Resistant Composite Core.
 - b. Solid, non rated: Particleboard or Medium Density Fiberboard.
 - 3. Wood veneers faces:
 - a. Birch species, rotary cut, of quality suitable for stained finish.

2.3 FABRICATION

- A. Fabricate doors in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 9.
 - 1. Grade: Premium.
 - 2. Performance Level: Heavy Duty.
 - 3. Edge Type: Solid wood.
 - 4. Number of plies: Minimum 3.
- B. Premachining: Machine doors at factory to receive hardware specified in Section 08 7100.

PART 3 EXECUTION

3.1 PREPARATION

- A. Condition doors to average humidity that will be encountered after installation.

3.2 INSTALLATION

- A. Install doors in accordance with WII/AWMAC/WI Architectural Woodwork Standards.
- B. Install doors plumb and level.
- C. Field Fitting to Frames:
 - 1. Fire rated doors:
 - a. Width: Cut lock edge only; 3/16 inch maximum.
 - b. Height: Cut bottom edge only; 1 inch maximum.
 - 2. Non-rated doors:
 - a. Width: Cut hinge and lock edges equally.
 - b. Height: Cut bottom edge only; maximum 3/4 inch.
 - 3. Edge clearances:
 - a. Jambs and head: 1/8 inch maximum between door and frame.
 - b. Sills without thresholds: 1/8 inch maximum between door and top of finish floor.
 - c. Sills with thresholds: 1/4 inch maximum between door and top of threshold.
- D. Seal field cut surfaces with same finish as door faces.
- E. Install door hardware in accordance with Section 08 7100.
- F. Installation Tolerances:
 - 1. Warp: Maximum 1/8 inch in any 3'-0" x 7'-0" portion of door, measured with taut string or straight edge on concave face of door.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum entrance doors and frames.
 - 2. Aluminum framed glazed storefronts.
 - 3. Glass infill panels.
 - 4. Door hardware.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.
 - 3. Section 08 7100 - Door Hardware.
 - 4. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 3. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 5. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- B. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.3 - Exit Devices.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. E283 - Standard Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
 - 4. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors under the Influence of Wind Loads.
 - 5. E331 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and Curtain Walls by Uniform Static Air Pressure Differential.
 - 6. E547 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and Curtain Walls by Cyclical Static Air Pressure Differential.
 - 7. E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - 8. E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

- E. Underwriters Laboratories (UL) 305 - Safety Panic Hardware.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design exterior systems to withstand:
 - 1. Design wind pressure in accordance with the International Building Code, with maximum allowable deflection of L/175 tested in accordance with ASTM E330.
 - 2. Movement caused by an ambient temperature range of 120 degrees F and a surface temperature range of 160 degrees F.
- B. Performance Requirements:
 - 1. Air infiltration, tested to ASTM E283.
 - a. Entrances:
 - 1) Single door: Maximum 0.5 CFM per minute per linear foot of perimeter crack, at static pressure differential of 6.24 PSF.
 - 2) Pairs of doors: Maximum 1.0 CFM per minute per linear foot of perimeter crack, at static pressure differential of 1.567 PSF.
 - b. Storefront: 0.06 CFM per square foot of fixed area at static pressure differential of 6.24 PSF.
 - 2. Water infiltration: No uncontrolled water leakage, tested to ASTM E331/ E547 at minimum test pressure of 6.24 PSF for inswing doors and 8.0 15.0 PSF for outswing doors and storefront.
 - 3. Uniform structural loading: No glass breakage or permanent damage to fasteners or system components, tested to ASTM E330 at 1.5 times design pressure.
 - 4. Thermal transmittance due to conduction (Uc): Maximum 0.60 tested to AAMA 1503 on two 6'-0" x 6'-0" units with 1 inch clear insulating glass.
 - 5. Condensation resistance factor (CRF): Minimum 50 tested to AAMA 1503.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, trim, sealers, hardware, and accessories.
- B. Quality Control Submittals:
 - 1. Test Reports: Certified results of previous tests by a recognized independent laboratory substantiating compliance with specified design and performance criteria, current within past 5 years.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Conform to ADA and ANSI 117.1 accessibility codes for locating hardware and for door opening force requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. EFCO Corporation. (www.efcocorp.com)

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

SECTION 08 4113 Page 3 of 4

2. Kawneer Co., Inc. (www.kawneer.com)
3. Oldcastle BuildingEnvelope. (www.oldcastlebe.com)
4. Tubelite, Inc. (www.tubeliteinc.com)
5. YKK AP America, Inc. (www.ykkap.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Aluminum:
1. Extrusions: ASTM B221, 6063-T5 alloy and temper.
 2. Sheet: ASTM B209, alloy and temper best suited to application.

2.3 COMPONENTS

- A. Storefront: Flush glazing system designed to receive 1 inch insulating glass panels, by means of elastomeric gaskets; 2 and 4 inch face width x 4-1/2 inch depth, center glass application, thermally broken.
- B. Entrance Doors: Wide-stile configuration with nominal 5 inch vertical stiles and top rail and 10 inch bottom rail to comply with ADA requirements. Provide heavy duty continuous piano hinge attached to door jamb face.

A. Door Hardware: Specified in Section 08 7100 and Door Schedule on Drawings.

1.2 ACCESSORIES

- A. Fasteners:
1. Series 300 stainless steel for wet locations and exposed fasteners.
 2. Stainless or fluoropolymer coated steel for other locations.
- B. Joint Sealers: Specified in Section 07 9200.
- C. Glass and Glazing Accessories: Specified in Section 08 8000.
- D. Weatherstripping: Replaceable, nonporous synthetic wool pile type or resilient bulb type.

1.3 FABRICATION

- A. Fabricate with minimal clearances and shim spaces around perimeter.
- B. Accurately fit and secure joints and intersections. Make joints flush, hairline, and weathertight.
- C. Fabricate in largest practical units.
- D. Conceal fasteners and attachments from view.
- E. Fabricate aluminum components with integral low conductance thermal barrier located between exterior and interior exposed components that eliminates metal-to-metal contact.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

SECTION 08 4113 Page 4 of 4

- F. Doors:
 - 1. Through-bolted construction.
 - 2. Fabricate stiles and rails of minimum 0.125 inch thick extrusions and glass stops from minimum 0.050 inch thick extrusions.
 - 3. Provide weatherstripping at door head, jambs, meeting stiles, and sills.
 - 4. Prepare with internal reinforcements for door hardware.

1.4 FINISHES

- A. Aluminum: AAMA 611, Architectural Class II anodized to 0.0004 inch minimum thickness, clear finish.

PART 2 EXECUTION

2.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Install components plumb and level, in proper plane, free from warp and twist.
- C. Anchor to supporting construction.
- D. Set thresholds and sill members exposed to weather in mastic and secure.
- E. Install hardware using templates provided by manufacturer.
- F. Install glass and accessories in accordance with Section 08 8000.
- G. Installation Tolerances:
 - 1. Maximum variation from plumb or level: 1/8 inch in 3 feet or 1/4 inch in any 10 feet, whichever is less.
 - 2. Maximum misalignment of members abutting end to end: 1/32 inch.
 - 3. Sealant space between framing members and adjacent construction: 1/2 inch plus or minus 1/8 inch.

2.2 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust doors to operate with maximum opening forces in accordance with applicable accessibility code:
 - 1. Interior doors: 5.0 pounds in accord with ADA requirements.
 - 2. Exterior doors: 8.5 pounds in accord with ADA requirements.
- C. Touch up minor scratches and abrasions to match original finish.
- D. Adjust weatherstripping to contact appropriate surfaces and form weather seal.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hardware for steel and wood doors.
 - 2. Weatherstripping and thresholds.
 - 3. Sound and smoke seals.
 - 4. Hardware for other sections referencing this section.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. ELECTRICAL Section: Conduit and wiring between strike hardware and power supply and security system.

1.2 REFERENCES

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
 - 1. A156.1 - Butts and Hinges.
 - 2. A156.2 - Bored and Preassembled Locks and Latches.
 - 3. A156.3 - Exit Devices.
 - 4. A156.4 - Door Controls - Closers.
 - 5. A156.5 - Auxiliary Locks and Associated Products.
 - 6. A156.13 - Mortise Locks and Latches.
 - 7. A156.18 - Materials and Finishes.
 - 8. A156.31 - Electric Strikes.
- B. National Fire Protection Association (NFPA):
 - 1. 80 - Standard for Fire Doors and Windows.
 - 2. 105 - Installation of Smoke Control Door Assemblies.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Schedule hardware by door type and location; show door size, hand, thickness, edge bevel, hardware components and quantities, keying, and finishes.
 - 2. Product Data: Manufacturer's descriptive data for each component.
 - 3. Samples: One sample of lockset. Sample will be returned for installation on Project.
 - 4. Warranty: Sample warranty form.
- B. Closeout Submittals:
 - 1. Copy of approved hardware schedule.
 - 2. Keying list.
 - 3. Keys; tag with mark corresponding to keying schedule.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Provide hardware labeled by recognized independent testing laboratory and meeting requirements of NFPA 80 for fire rated doors.
- C. Provide smoke gasketing at fire rated doors in accordance with NFPA 105.

- D. Conform to ADA / ANSI 117.1 for locating hardware and for door opening force requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Pack hardware items separately, with fasteners, installation instructions, and templates.
- B. Mark containers with item number corresponding to hardware schedule.

1.6 WARRANTIES

- A. Furnish manufacturer's 10 year warranty for operation and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Butt Hinges:
1. Bommer Industries, Inc. (www.bommer.com)
 2. Hager Companies. (www.hagerco.com)
 3. McKinney Products Co. (www.mckinneyhinge.com)
 4. Stanley Hardware. (www.stanleyworks.com)
- B. Acceptable Manufacturers - Continuous Hinges:
1. Hager Companies. (www.hagerco.com)
 2. McKinney Products Co. (www.mckinneyhinge.com)
 3. Pemko Manufacturing Co. (www.pemko.com)
 4. Stanley Hardware. (www.stanleyhardware.com)
- C. Acceptable Manufacturers - Locksets, Latchsets, Deadbolts, and Cylinders:
1. Schlage Lock Co. (www.schlage.com) (no exceptions)
- D. Acceptable Manufacturers - Closers:
1. Corbin Russwin Architectural Hardware. (www.corbin-russwin.com)
 2. Dorma Door Controls, Ltd. (www.dorma-usa.com)
 3. LCN Closers. (www.lcnclosers.com)
 4. Sargent Mfg. (www.sargentlock.com)
 5. Yale Security, Inc. (www.yalelocks.com)
- E. Acceptable Manufacturers - Exit Devices:
1. Corbin Russwin Architectural Hardware. (www.corbin-russwin.com)
 2. Sargent Mfg. (www.sargentlock.com)
 3. Von Duprin. (www.vonduprin.com)
 4. Yale Security, Inc. (www.yalelocks.com)
- F. Acceptable Manufacturers - Door Seals:
1. Hager Companies. (www.hagerco.com)
 2. National Guard Products, Inc. (www.ngpinc.com)

3. Pemko Manufacturing Co. (www.pemko.com)
4. Reese Enterprises, Inc. (www.reeseusa.com)

G. Substitutions: Under provisions of Division 01.

H.

2.2 MANUFACTURED UNITS

A. Butt Hinges:

1. Description: ANSI/BHMA A156.1, full mortise type, five knuckle, non rising pin, hole in bottom tip for pin removal.
2. Exterior outswinging doors: Provide set screw in barrel making hinge non-removable when door is closed.
3. Weight: Normal weight.
4. Bearing type: Ball bearing.
5. Size: 4-1/2 x 4-1/2

B. Locksets, Latchsets, Deadbolts, and Cylinders:

1. Locksets and latchsets:
 - a. Type: ANSI/BHMA A156.13, Grade 2, lever handles.
 - b. Lever design: Equivalent to Schage AS Series "Saturn" design
2. Electromechanical locksets:
 - a. Same manufacturer and construction as locksets.
 - b. Solenoid activated locking device.
3. Strike plates: Curved lip, minimum lip projection necessary to protect door frame and trim and to conceal edges of strike cutout.
4. Strike boxes: Steel.
5. Cylinders: Six pin, solid brass, removable core type.
6. Keys: Solid brass or nickel silver.
7. Keying:
 - a. Construction key locks to be replaced
 - b. Master key locks in accord with master key system defined by Owner.
 - c. Key alike, cross key, or otherwise key as directed by Owner.
 - d. Provide four keys for each lock and 6 master keys [for each master key system].
 - e. Inscribe keys with lock manufacturer [and notation DO NOT DUPLICATE].

C. Electric Strikes:

1. Type: ANSI/BHMA A156.31.
2. Operation Options:
 - a. Fail safe: In locked position, strike is energized. Release occurs by switching device or power failure.
 - b. Fail secure: In locked position, strike is not energized. Release occurs by energizing switching device. *This method must be fed by emergency power at exit pathway doors.*

D. Closers:

1. Description: ANSI/BHMA A156.4, overhead exposed, metal cover, sized to door conditions.
2. Construction: Cast aluminum body, rack and pinion operation with compression spring, fully hydraulic.
3. Closing and latching speeds and backcheck: Controlled by independently adjustable concealed valves.
4. Mounting: Surface mounted, non handed with universal regular or parallel arm. Suitable for mounting on 1-3/4 inch minimum door top rail or transom bar without drop plate.
5. Adjustable opening force and delayed closing in accordance with ADA / ANSI accessibility codes.

- E. Exit Devices:
 - 1. Description: ANSI/BHMA A156.3, Grade 1, crash bar type.
 - 2. Type: Rim.
 - 3. Cylinders: Same as specified above for locksets.
- F. Door Stops: Wall or Floor (as best suited) mounted housing with resilient bumper.
- G. Push - Pull Plates: 16 gage, square edges, 4 x 16 inches, secured with through bolts.
- H. Door Pulls: Wire profile, 12 inches center-to-center of mounting holes.
- I. Kick Plates:
 - 1. Type: 16 gage, square edges, secured with flathead countersunk screws.
 - 2. Size: 8 inches high x door width less 2 inches.
- J. Flush Bolts: With dustproof strike.
- K. Silencers: At all door frames
- L. Weatherstripping: Head and jambs: At exterior doors
- M. Threshold: At exterior doors.
- N. Rain Drip: Not required.

2.3 FINISHES

- A. Finishes: To ANSI/BHMA A156.18.
- B. Door Closers: Finish No. 689
- C. Hinges: US26D
- D. Thresholds and Door Seal Housings: Clear anodized.
- E. Locksets and Lever Handles: US26D

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install hardware in accordance with approved hardware schedule and manufacturer's instructions.
- B. Install mortise items flush with adjacent surfaces.
- C. Install locksets, closers, and trim after finish painting.
- D. Set thresholds in mastic and secure.
- E. Mount closers so that closers and closer arms are not visible on corridor or public side of doors or on exterior of building.

- F. Mounting Heights - Finished Floor to Center Line of:
 - 1. Locksets: 40 inches.
 - 2. Push and pull plates: 42 inches.
 - 3. Dead locks: 48 inches.
 - 4. Push pad exit devices: 40 inches.
 - 5. Cross bar exit devices: 40 inches.
 - 6. Top hinge: Maximum 10 inches from frame head.
 - 7. Bottom hinge: Maximum 12-1/2 inches from floor.
 - 8. Intermediate hinges: Equally spaced.
- G. Connect electric hardware to power supply and security system as specified in ELECTRICAL Section.
- H. Set key cabinet in place, place keys in cabinets, label and index.

3.2 PROTECTION

- A. Remove or protect hardware until painting is completed.

3.3 ADJUSTING

- A. Test and adjust hardware for quiet, smooth operation, free from binding and rattling.
- B. Adjust doors to operate with maximum opening forces in accordance with ADA / ANSI 117.1 accessibility codes.
 - 1. Interior non-fire rated doors: 5.0 pounds.
 - 2. Interior fire-rated doors: 15.0 pounds.
 - 3. Exterior doors: 8.5 pounds.
 - 4. Minimum closing speed: 5 seconds (90 degrees to 12 degrees open)

3.4 DOOR HARDWARE SCHEDULE SHOWN ON DRAWINGS.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass for other sections referencing this Section.
 - 2. Framed mirrors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) 800 - Voluntary Specifications and Test Methods for Sealants.
- B. American National Standards Institute (ANSI) Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 2. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 3. C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 4. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 5. C1036 - Standard Specification for Flat Glass.
 - 6. C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT, Coated and Uncoated Glass.
 - 7. C1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
 - 8. C1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 9. C1184 - Standard Specification for Structural Silicone Sealants.
 - 10. C1281 - Standard Specification for Preformed Tape Sealants for Glazing Applications.
 - 11. C1294 - Standard Test Method for Compatibility of Insulating Glass Edge Sealants with Liquid-Applied Glazing Materials.
 - 12. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 13. E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
 - 14. E152 - Standard Test Method for Fire Test of Door Assemblies.
 - 15. E163 - Standard Test Method for Fire Tests of Window Assemblies.
 - 16. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 17. E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
 - 18. E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 19. F1233 - Standard Specification for Security Glazing Materials and Systems.
- E. Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- F. Glass Association of North America (GANA):
 - 1. Engineering Standards Manual.

- 2. Glazing Manual.
- 3. Laminated Glass Design Guide.
- G. Insulating Glass Manufacturers Alliance (IGMA):
 - 1. IGMA TB-3001 - Sloped Glazing Guidelines.
 - 2. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.
- H. National Fenestration Rating Council (NFRC):
 - 1. 100 - Procedure for Determining Fenestration Product Thermal Properties.
 - 2. 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
 - 3. 300 - Procedures for Determining Solar Optical Properties of Simple Fenestration Products.
- I. Underwriters Laboratories (UL) 752 - Standard for Safety Bullet-Resisting Equipment.

1.3 SYSTEM DESCRIPTION

- A. Glass Thicknesses:
 - 1. Indicated thicknesses are minimums; select actual glass thicknesses by analyzing loads and conditions.
 - 2. Size glass to withstand positive and negative wind pressure acting normal to plane in accordance with the International Building Code as measured in accordance with ASTM E330.
 - 3. Provide glass in thicknesses and strengths to meet or exceed following criteria:
 - a. Comply with ASTM E1300.
- B. Thermal and Optical Performance Properties: Provide glass meeting specified performance properties, based on manufacturer's published test data for units of thickness indicated:
 - 1. U-factor: Per NFRC 100 expressed as Btu/square foot x hour x degree F.
 - 2. Solar heat gain coefficient: Per NFRC 200.
 - 3. Solar optical properties: Per NFRC 300.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Descriptive data and performance attributes for insulated glass.
 - 2. Samples: 12 x 12 inch glass samples.
 - 3. Warranty: Sample warranty form.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Regulatory Requirements:
 - 1. Provide safety glass for locations subject to human impact as required by The International Building Code.
 - 2. Safety glass: Tested and labeled to CPSC 16 CFR 1201.
- C. Fire Rated Glass Assemblies: Conform to ASTM E119, E152, E163.
- D. Bullet Resistant Glass: UL 752, Level 4.
- E. Laminated Safety Glass: ASTM C1172 and ANSI Z97.1

1.6 PROJECT CONDITIONS

- A. Perform glazing when ambient temperature is above 40 degrees F.
- B. Perform glazing on dry surfaces.

1.7 WARRANTIES

- A. Insulating Glass Units: Provide manufacturer's 20 year warranty against material obstruction of vision through unit due to:
 - 1. Intrusion of dust or moisture.
 - 2. Internal condensation.
 - 3. Film formation on internal glass surfaces caused by failure of hermetic seal except failure caused in whole or in part by breakage or fracturing of any portion of glass surface.
- B. Glass Coatings: Provide manufacturer's 20 year warranty against peeling, cracking, or deterioration of coating under normal conditions.
- C. Laminated Safety Glass Units: Provide manufacturer's 20 year warranty against manufacturing defects resulting in edge separation, delamination, or material obstruction of vision through glass surface
- D. Mirrors: Provide manufacturer's 10 year warranty against silver spoilage resulting from manufacturing defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Glass:
 - 1. Guardian Industries Corp. (www.guardian.com)
 - 2. Oldcastle BuildingEnvelope. (www.oldcastlebe.com)
 - 3. Pilkington Architectural. (www.pilkington.com)
 - 4. PPG Industries, Inc. (www.ppgglazing.com)
 - 5. Viracon, Inc. (www.viracon.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS - GLASS

- A. Clear Tempered Glass: ASTM C1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind FT fully tempered.
- B. Tinted Tempered Glass:
 - 1. Type: ASTM C1048, Type 1 transparent flat, Class 2 tinted heat absorbing and light reducing, Quality q3 glazing select, Kind FT fully tempered.
 - 2. Color: As selected from manufacturer's solar heat reducing selection.

- C. Patterned Safety Glass: ASTM C1048, Kind FT fully tempered, Condition A uncoated surfaces, Type II - patterned glass, flat, Class 1 - clear, Quality q8 - glazing, Form 3 - patterned, Finish patterned one side, Pattern 516.(Furnished and installed by Door Manufacturer)
- D. Mirror Glass: ASTM C1036, Type I transparent flat, Class 1 clear, Quality q2 mirror.

2.3 ACCESSORIES

- A. Setting Blocks: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone; 80 to 90 Shore A durometer hardness.
- B. Spacers: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone; 50 to 60 Shore A durometer hardness.
- C. Glazing Gaskets:
 - 1. Dense compression gaskets: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone or thermoplastic polyolefin rubber, molded or extruded shape to fit glazing channel retaining slot; black color.
 - 2. Soft compression gaskets: ASTM C509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal; black color.
- D. Butt Joint Glazing Sealant: ASTM C920, Type S, Grade NS, Class 25; single component silicone, low modulus type, non sag, black or neutral color.
- E. Glazing Sealant: ASTM C920, Type S, Grade NS, Class 25; single component silicone, low modulus, non sag, black or neutral color.
- F. Sealant Backing: ASTM C1330, Type O, size and density to control glazing sealant depth and produce optimum glazing sealant performance.
- G. Primer: As recommended by glazing sealant manufacturer.
- H. Glazing Tape: ASTM C1281 and AAMA 800; butyl based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for installation.

**** OR ****

- I. Glazing Tape: AAMA 800; closed cell polyvinyl chloride foam, maximum 2 percent water absorption by volume, designed for 25 percent compression percent for air barrier and vapor retarder seal, black color, coiled on release paper over adhesive on two sides; widths required for installation.
- J. Mirror Frame: Roll formed stainless steel channel, satin finish, 1/2 x 1/2 inch, 18 gage, mitered corners. Size as shown on Toilet Room Accessories and Drawings.

2.4 FABRICATION

- A. Annealed Glass: Comply with ASTM C1036.

- B. Tempered Glass:
 - 1. Comply with ASTM C1048.
 - 2. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
- C. Sealed Insulating Glass:
 - 1. Comply with ASTM E2190.
 - 2. Fabricate spacer bar frame of tubular aluminum filled with desiccant.
 - 3. Bond spacer bar frame to glass panes with twin primary seals.
 - 4. Fill space outside frame to glass edge with elastomeric sealant.
- D. Laminated Safety Glass:
 - 1. Comply with ASTM C1172 and ANSI Z97.1.
 - 2. Laminate glass with laminating film by manufacturer's standard heat and pressure process.
 - 3. Cut glass to required size at factory.
 - 4. Discard glass with voids, delamination, or entrapped dirt or foreign matter.
- E. Bullet-Resisting Glass:
 - 1. Comply with UL 752. Level 4.
 - 2. Laminate glass with laminating film by manufacturer's standard heat and pressure process.
 - 3. Cut glass to required size at factory. Treat edges to prevent moisture intrusion.
 - 4. Discard glass with voids, delamination, or entrapped dirt or foreign matter.
 - 5. Discard glass with voids, delamination, or entrapped dirt or foreign matter.
- F. Low-E Coated Glass: Apply low-emissivity coating to scheduled glass surface.
- G. Reflective Coated Glass: Apply selected metallic-based optical coating to scheduled glass surfaces.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean glazing rabbets; remove loose and foreign matter.
- B. Remove protective coatings on metal surfaces.
- C. Clean glass just prior to installation.

3.2 INSTALLATION - GENERAL

- A. Install glass in accordance with glass manufacturer's instructions.
- B. Maintain manufacturer's recommended edge and face clearances between glass and frame members.

3.3 INSTALLATION - SILICONE GLAZING METHOD

- A. Mask both sides of joint for full length.
- B. Install temporary glass retainers to align faces of glass.
- C. Provide temporary joint backing for one side of joint.

- D. Apply sealant to completely fill spaces; tool to smooth, slightly concave surface.
- E. Allow sealant to cure minimum time required by manufacturer. Remove temporary backing and fill voids with additional sealant.

3.4 INSTALLATION - GASKET GLAZING METHOD

- A. Fabricate gaskets to fit openings; allow for stretching of gaskets during installation.
- B. Set soft compression gasket against fixed stop or frame with bonded miter cut joints at corners.
- C. Set glass centered in openings on setting blocks.
- D. Install removable stops and insert dense compression gaskets at corners, working toward centers of glass, compressing glass against soft compression gaskets to produce weathertight seal.
- E. Seal joints in gaskets.
- F. Allow gaskets to protrude past face of glazing stops.

3.5 INSTALLATION - MIRRORS

- A. Support mirrors on concealed hanger brackets. Anchor rigidly to wall construction.
- B. Place plumb and level without distortion.

3.6 PROTECTION

- A. After installation, mark glass with an 'X' using removable plastic tape.

3.7 SCHEDULE

- A. Exterior Insulating Storefront Glass: Vitro / PPG SOLARBAN 70 OPTIGRAY

- 1. Description:
 - a. Outboard lite: 1/4 inch thick Solarban 70 OPTIGRAY
 - b. Inboard lite: 1/4 inch thick clear glass
- 2. Total unit thickness: 1" inch.
- 3. Performance characteristics:
 - a. Visible transmittance: 46 percent.
 - b. SHGC:.23
- 4. Locations: Aluminum-framed storefront and storefront windows

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal stud interior partition framing.
 - 2. Metal interior wall furring.
 - 3. Suspended metal channel interior ceiling framing.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications.
 - 2. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 3. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 - 4. C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
 - 5. C754 - Standard Practice for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wall board, Backing Board, or Water-Resistant Backing Board.
- B. Gypsum Association (GA) GA-600 - Fire Resistance Design Manual.
- C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate framing types, gages, and locations.

1.4 QUALITY ASSURANCE

- A. Fire Resistance Ratings:
 - 1. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable or referenced GA or UL design number.
 - 2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.
- B. Deflection Limits:
 - 1. Limit deflection of partitions to following limits, based on 5 PSF uniform design load.
 - a. Interior partitions: L/240.
 - b. If partition height exceeds stud manufacturer's limiting height for applicable loading and deflection, install bracing above ceiling, decrease stud spacing, or increase stud gage.
 - 2. Limit deflection of ceilings to L/360.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. California Expanded Metal Company. (www.cemcosteel.com)
 - 2. ClarkDietrich Building Systems. (www.clarkdietrich.com)
 - 3. Marino Ware Industries. (www.marinoware.com)

- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Steel: ASTM A1003/1003M, Class G40 hot dip galvanized.

2.3 COMPONENTS

- A. Provide components in accordance with ASTM C645.
- B. Studs: Non-load bearing rolled steel, channel shaped, punched for utility access.
- C. Top and Bottom Runners:
 - 1. Same material and finish as studs, channel shaped.
 - 2. Deflection compensating top runners: Deep leg runners with slotted screw holes; permit plus or minus 1/2 inch movement of overhead structure without damage to partition.
- D. Suspended Ceiling Framing:
 - 1. Runner channels: 1-1/2 inches deep, cold rolled, channel shaped, 16 gage core steel.
 - 2. Furring channels: Hat shaped, 7/8 inch deep, 16 gage core steel.
- E. Suspended Soffit Framing:
 - 1. Runner channels: 1-1/2 inches deep, cold rolled, 16 gage core steel.
 - 2. Furring channels: 3/4 inch deep, cold rolled, 16 gage core steel.
- F. Resilient Channels: 1/2 inch deep x 2-1/2 inches wide, Z-shaped 25 gage core steel.
- G. Wall Furring Channels: Hat shaped, 3/4 inch deep, 25 gage core steel.

2.4 ACCESSORIES

- A. Fasteners: 3/8 inch long pan head screws.
- B. Wire: ASTM A 641, galvanized steel.
 - 1. Hanger wire: 8 gage.
 - 2. Tie wire: 18 gage, soft annealed.
- C. Wall Furring Brackets: Galvanized steel, two piece adjustable type.
- D. Furring Channel Clips: Galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION OF PARTITION AND CEILING SOFFIT FRAMING

- A. Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Attach top and bottom runner channels at ends and 24 inches on center maximum.

- C. Position studs vertically in runners, spaced maximum 16 inches on center unless indicated otherwise.
- D. Install deflection compensating top runner at partitions extending to structure. Cut studs 1/2 inch shorter than required length and fit into top runner. Fasten studs to top runner in manner permitting runner movement.
- E. Locate studs maximum 2 inches from door frames and abutting construction.
- F. Use double studs on both sides of openings in partitions.
- G. Install horizontal runner as header above openings in partitions. Install studs from header to top runner.
- H. Brace furred partitions with adjustable bracket located at mid height.
- I. Provide wood or metal bracing in partitions to receive and support fixtures, trim, accessories and other applied items.
- J. Brace ceiling height partitions to structure at 48 inches on center maximum.

3.2 INSTALLATION OF WALL FURRING

- A. Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Space channels 24 inches on center maximum and within 3 inches of corners; secure at maximum 24 inches on center with fasteners staggered on alternating flanges.
- C. Nest channels minimum 8 inches at splices; secure with two fasteners in each flange.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical insulation.
 - 2. Gypsum board.
 - 3. Cementitious panels.
 - 4. Taping and bedding of gypsum board.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A108.11 - Interior Installation of Cementitious Backer Units.
 - 2. A118.9 - Test Methods and Specifications for Cementitious Backer Units.
- B. ASTM International (ASTM):
 - 1. C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. C514 - Standard Specification for Nails for the Application of Gypsum Wallboard.
 - 3. C665 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Wood Frame and Light Construction Buildings.
 - 4. C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Board.
 - 5. C1047 - Standard Specifications for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 6. C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
 - 7. C1396 - Standard Specification for Gypsum Board.
 - 8. C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
 - 9. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- C. Gypsum Association (GA):
 - 1. GA-214 - Levels of Gypsum Board Finish.
 - 2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
 - 3. GA-600 - Fire Resistance Design Manual.
- D. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Illustrate panel product types, thicknesses, and locations; acoustical insulation; and accessories.

1.4 QUALITY ASSURANCE

- A. Fire Resistance Ratings:
 - 1. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable and referenced GA or UL design number.

SECTION 09 2900 – Page 2 of 4

2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.

1.5 PROJECT CONDITIONS

- A. Do not install gypsum board until building is substantially weathertight.
- B. Maintain temperature in spaces in which work is being performed above 50 degrees F during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Gypsum Panels:
 1. CertainTeed Gypsum, Inc. (www.certainteed.com)
 2. GP Gypsum Corporation. (www.gp.com)
 3. National Gypsum Co. (www.nationalgypsum.com)
 4. Temple-Inland. (www.templeinland.com)
 5. USG Corporation. (www.usg.com)
- B. Acceptable Manufacturers - Cementitious Panels:
 1. James Hardie Building Products, Inc. (www.jameshardie.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS - GYPSUM PANELS

- A. Regular Gypsum Board: ASTM C1396; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge.
- B. Fire Resistant Gypsum Board: ASTM C1396, Type X; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge; apply to fire rated assemblies.
- C. Gypsum Backing Board:
 1. ASTM C1178, fiberglass mat faced; 48 inches wide x 5/8 inch thick, maximum practical length, water resistant; apply to walls to receive tile at janitor closets and toilet rooms.
 2. Mold resistance: Minimum 10, tested to ASTM D3273.

2.3 ACCESSORIES

- A. Fasteners: ASTM C1002, Type S screws.
- B. Acoustical Insulation:
 1. ASTM C665, Type I, glass fiber composition, unfaced.
 2. Free from urea-formaldehyde resins, phenol, acrylics, and artificial colors.
- C. Adhesive:
 1. Type recommended by gypsum panel manufacturer.
 2. Maximum volatile organic compound (VOC) content: 50 grams per liter.

- D. Trim Accessories: ASTM C1047.
 - 1. Material: Formed steel, minimum 26 gage core steel, hot dip galvanized finish, expanded flanges or extruded PVC, perforated flanges.
 - 2. Corner reinforcement: GA-216, Type CB-100 x 100.
 - 3. Casing: GA-216, Type LC.
 - 4. Control joint.
- E. Acoustical Sealer: Specified in Section 07 9200.
- F. Joint Treatment Materials:
 - 1. Reinforcing tape and joint compound; ASTM C475.
 - 2. Joint compound; maximum volatile organic compound (VOC) content: 250 grams per liter.

PART 3 EXECUTION

3.1 INSTALLATION OF GYPSUM PANELS

- A. Install panels and accessories in accordance with ASTM C754, GA-216, and manufacturer's instructions.
- B. Accurately cut panels to fit around openings and projections. Do not tear face paper or break gypsum core.
- C. Apply panels in most economical layout, with all ends and edges occurring over supports.
- D. Apply panels at fire-rated assemblies as required by design assembly.
- E. Stagger joints on opposite sides of partitions.
- F. Do not locate joints to align with edges of openings unless a control joint is installed.
- G. Mechanically fasten[single layer panels to framing. Place fasteners minimum 3/8 inch from edges of panels; drive heads slightly below surface. Stagger fasteners at abutting edges.
- H. Apply face layer of double layer applications with joints offset from those in base layer; secure with mechanical fasteners to framing or with adhesive to base layer.
- I. At deflection compensating head tracks, cut panels 1/2 inch short of structure at head; do not secure panels to top runner channel.
- J. Treat cut edges and holes in moisture resistant gypsum board with joint sealer.
- K. Where recessed items occur in fire rated partitions, box item on all sides with gypsum board as required to maintain continuity of fire rating.

3.2 INSTALLATION OF ACOUSTICAL PARTITIONS

- A. Extend acoustical partitions past intersecting non-acoustical partitions.
- B. Install acoustical insulation:
 - 1. Butt to framing members and adjacent construction.
 - 2. Carry around pipes, wiring, outlets, and other construction without voids.
 - 3. Press against one gypsum board surface to form slight air space on opposite side.

- C. Seal acoustical partitions at perimeter and around penetrations:
 - 1. Apply continuous bead of sealer between gypsum panel edges and adjacent construction.
 - 2. Seal space between gypsum panels at control joints, prior to installing metal control joint.
 - 3. Apply sealer to penetrations through partitions.

3.3 INSTALLATION OF CEMENTITIOUS PANELS

- A. Install in accordance with ANSI A108.11 and manufacturer's instructions.
- B. Apply panels horizontally, with ends occurring over supports. Stagger end joints in adjacent rows.
- C. Cut panels to fit around openings and projections.
- D. Mechanically fasten panels to framing at maximum 12 inches on center.

3.4 INSTALLATION OF ACCESSORIES

- A. Install in accordance with manufacturer's instructions.
- B. Install corner reinforcement at outside corners. Use single lengths where length of corner does not exceed standard length.
- C. Install casings where indicated and where gypsum board abuts dissimilar materials or stops with edge exposed.
- D. Install control joints at ceilings:
 - 1. At maximum 50 feet on center.
 - 2. Where ceiling framing changes direction.
- E. Install control joints at walls and partitions:
 - 1. At changes in backup material.
 - 2. At maximum 30 feet on center.
 - 3. Above one jamb of openings in partitions.

3.5 JOINT TREATMENT

- A. Treat joints and fasteners in gypsum board in accordance with GA-214.
- B. Levels of Finish:
 - 1. Covered Surfaces to receive tile or wood wainscot: **Level 2** finish.
 - 2. All Other Surfaces: **Level 5** finish.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceramic, Porcelain, Quarry tile floor and wall finishes.
 - 2. Marble thresholds.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A108/A118/A136.1 - American National Standard for Installation of Ceramic Tile.
 - 2. A137.1 - Specifications for Ceramic Tile.
- B. ASTM International (ASTM):
 - 1. A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. A185/A185M - Standard Specification for Welded Steel Wire Reinforcement, Plain, for Concrete.
 - 3. C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 4. C150 - Standard Specification for Portland Cement.
 - 5. C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 - 6. C847 - Standard Specification for Metal Lath.
 - 7. C1028 - Standard Test Method for Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - 8. D226 - Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
 - 9. D227 - Standard Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing.
 - 10. D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - 11. D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications.
- C. Tile Council of North America (TCNA) - Handbook for Ceramic Tile Installation.
- D. Resilient Floor Covering Institute (RFCI) - FloorScore Certification Program.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's installation, cleaning, and maintenance instructions.
 - 2. Samples:
 - a. Tile: Two Full size samples in each color.
 - b. Grout: 1/2 x 1/2 x 3 inch long actual samples showing available colors.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Tile and Trim Units: Meet ANSI A137.1, Standard Grade.
- C. Static Coefficient of Friction for Floor Tile: Minimum 0.60, tested to ASTM C1028 in dry condition.
- D. Mockup:
 - 1. Size: 2 x 4 feet.
 - 2. Show: Tile colors and patterns, joint profile, and control joint.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver mortar, adhesive, and grout containers bearing hallmark certifying compliance with reference standards.
- B. Protect adhesive containers from freezing and overheating according to manufacturer's instructions.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain minimum ambient temperature of 50 degrees F during and after installation.

1.7 MAINTENANCE

- A. Extra Materials: 2 % of each tile.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Tile:
 - 1. American Marazzi Tile, Inc. (www.marazzitile.com)
 - 2. American Olean Tile Co., Inc. (www.aotile.com)
 - 3. Dal-Tile Corp. (www.daltileproducts.com)
 - 4. Florida Tile Industries, Inc. (www.floridatile.com)
 - 5. Interceramic USA. (www.interceramicusa.com)
 - 6. Summitville Tiles, Inc. (www.summitville.com)
 - 7.
- B. Acceptable Manufacturers - Setting and Grouting Materials:
 - 1. BASF Corporation. (www.buildingsystems.basf.com)
 - 2. Bostik, Inc. (www.bostik-us.com)
 - 3. Laticrete International, Inc. (www.laticrete.com)
 - 4. Mapei Corporation. (www.mapei.us)
 - 5. TEC. (www.tecspecialty.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIAL

A. Ceramic Tile Basis of Design:

Floor and Wall Tile: DalTile "Volume1.0" - 12X24, 6X6.

Tile Grout: Mapei, 1/4" grout joint.

Colors to be selected.

2.3 ACCESSORIES

A. Grout:

1. ANSI A118.6, polymer modified dry set type, sanded.
2. Color: To be selected from manufacturer's full color range.

B. Joint Sealers: Specified in Section 07 9200.

C. Joint Tape: Waterproof, perforated bedding tape.

D. Thresholds: Class A white marble, honed finish, beveled both sides, radiused from bevels to vertical planes, one piece for full width of door or opening. Comply with ADA/ANSI accessibility requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to remove loose and foreign matter that could impair adhesion.

B. Remove ridges and projections. Fill voids and depressions with patching compound compatible with setting materials.

C. Allowable Substrate Tolerances:

1. Thin set method:
 - a. Maximum variation in substrate surface: 1/8 inch in 8 feet.
 - b. Maximum height of abrupt irregularities: 1/32 inch.

D. Test concrete substrate to ASTM D4263; do not install tile until surfaces are sufficiently dry.

3.2 INSTALLATION

A. Minimize pieces less than one half size. Locate cuts to be inconspicuous.

B. Lay tile to pattern shown on Drawings furnished by Architect. Do not interrupt tile pattern through openings.

C. Joint Widths: Large size ceramic and ceramic mosaic tile: 3/8 inch.

SECTION 09 3000 – Page 4 of 4

- D. Make joints watertight, without voids, cracks, excess mortar, or excess grout. Align joints in wall and floor of same-sized tile.
- E. Fit tile around projections and at perimeter. Smooth and clean cut edges. Ensure that trim will completely cover cut edges.
- F. Install Trim:
 - 1. Inside corners: Cove units.
 - 2. Outside corners: Bead units.
 - 3. Base: Base units.
 - 4. Exposed tile ends: Bullnose units.
- G. Allow tile to set for a minimum of 48 hours before grouting.
- H. Grout tile joints in accordance with ANSI A108.10 without excess grout.
- I. Control Joints:
 - 1. Provide control joints at:
 - a. Changes in backup material.
 - b. Changes in plane.
 - c. Over joints in substrate.
 - d. Maximum 24 feet on center at interior locations except maximum 12feet at surfaces exposed to direct sunlight.
 - e. Maximum 16 feet on center at exterior locations.
 - 2. Form joints per TCNA Method EJ-171.
 - 3. Install joint backing and joint sealer as specified in Section 07 9200.

3.3 ADJUSTING

- A. Remove and replace pieces that have been damaged during installation.

3.4 PROTECTION

- A. Provide protection for completed work using nonstaining sheet coverings.
- B. Prohibit traffic on tile floors for minimum 3 days after installation.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal ceiling grid system.
 - 2. Acoustical panels.
 - 3. Vinyl Faced ceiling panels.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 3. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 4. E1264 - Standard Classification of Acoustical Ceiling Products.
- B. Ceiling and Interior Systems Construction Association (CISCA) - Ceiling Systems Handbook.
- C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - a. Manufacturer's Literature and cut sheets
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that acoustical panels meet fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Fire Hazard Classification: Not rated

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: Install in approximately same conditions of temperature and humidity as will prevail after installation.

1.6 MAINTENANCE

- A. Extra Materials: One unopened carton of each acoustical panel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Suspension System:
 - 1. Chicago Metallic Corporation. (www.chicago-metallic.com)
 - 2. USG Corporation. (www.usg.com)
- B. Acceptable Manufacturers - Acoustical Units:
 - 1. Certainteed Corporation (www.certainteed.com)
 - 2. USG Corporation. (www.usg.com)
 - 3. Armstrong W.I. (www.armstrong.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Suspension Grid System (Steel):
 - 1. ASTM C635, intermediate duty, die cut, interlocking ends.
 - 2. Grid type: Exposed T.
 - 3. Material: Galvanized steel.
 - 4. Runners: 1-1/2 inches high, 15/16 inch exposed width, flush profile.
 - 5. Perimeter molding: Angle shape.
 - 6. Finish: Factory applied enamel paint, sprayed and baked, white color to match acoustical panels
 - 7. Accessories: Stabilizer bars, clips, splices.
- B. Suspension Grid System (Aluminum):
 - 1. ASTM C635, intermediate duty, die cut, interlocking ends.
 - 2. Grid type: Exposed T.
 - 3. Material: Extruded aluminum for damp areas where indicated.
 - 4. Runners: 1-1/2 inches high, 15/16 inch exposed width, flush profile.
 - 5. Perimeter molding: Angle shape.
 - 6. Finish: Factory applied enamel paint, sprayed and baked, white color to match acoustical panels
 - 7. Accessories: Stabilizer bars, clips, splices.
 - 8.
- C. Acoustical Panels: Basis of Design: USG 86785
 - 1. Size: 24 x 24 inches x 3/4 inch thick.
 - 2. Surface Texture: Fine Textured Stipple.
 - 3. Edge configuration: Square Reveal (FL)
 - 4. Color: White
 - 5. Performance requirements: Tested in accordance with ASTM E1264.
 - 6. Max NRC: .70.
 - 7. Class A
- D. Vinyl Faced Panels: Basis of Design: USG 3260
 - 1. Size: 24 x 24 inches x 1/2 inch thick.
 - 2. Surface Texture: Smooth
 - 3. Edge configuration: Square
 - 4. Color: White
 - 5. Performance requirements: Tested in accordance with ASTM E1264.
 - 6. Class A

2.3 ACCESSORIES

- A. Support Channels: Galvanized steel; size and type to suit application.
- B. Security hold-down panel clips for Vinyl Faced Panels in Toilet Rooms.
- C. Hanger Wire:
 - 1. ASTM A641, minimum 12 gage minimum galvanized steel.
- D. Touch-Up Paint: Color to match acoustical panels and suspension grid.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install ceilings in accordance with ASTM C636 and CISCA Handbook.
- B. Minimize panels less than one half size.
- C. Install molding around perimeters and abutting surfaces. Miter molding at exterior corners; cut flanges and bend web to form interior corners.
- D. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment. Support recessed light fixtures at all 4 corners.
- E. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.
- F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.
- G. Where ducts or other equipment prevent regular spacing of hangers:
 - 1. Reinforce nearest related hangers to span extra distance, or:
 - 2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.
- H. Install main tees at maximum 48 inches on center.
- I. Install cross tees to form 24 x 24 inch modules. Lock cross tees to main tees.
- J. Support ends of tees on flange of perimeter molding.
- K. Place acoustical panels with edges resting flat on suspension grid.
- L. Cutting Acoustic Units:
 - 1. Cut to fit irregular grid and perimeter edge trim and around penetrations.
 - 2. Locate cuts to be concealed.
 - 3. Cut and field paint exposed edges of reveal edge units to match factory edge.
- M. Installation Tolerances: Ceilings level to 1/8 inch in 12 feet measured in any direction.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient wall base.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) F1861 - Standard Specification for Resilient Wall Base.
- B. Resilient Floor Covering Institute (RFCI) - FloorScore Certification Program.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Samples: 2x4 inch long samples.

1.4 MAINTENANCE

- A. Extra Materials: Minimum 50' of roll goods, or one box 48" length of each profile and color.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Base:
 - 1. Allstate Rubber Corp. (www.allstaterubber.com)
 - 2. Armstrong World Industries. (www.armstrong.com)
 - 3. Burke Flooring. (www.burkeflooring.com)
 - 4. Johnsonite, Inc. (www.johnsonite.com)
 - 5. Roppe Corp. (www.roppe.com)
- B. Acceptable Manufacturers – Installation Materials:
 - 1. BASF Corporation. (www.buildingsystems.basf.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Resilient Base:
 - 1. Type: ASTM F1861, thermoplastic rubber.
 - 2. Thickness: 0.125 inch.
 - 3. Profile: Coved.
 - 4. Height: 4 inches.
 - 5. Length: Continuous rolls.
 - 6. Color: To be selected from manufacturer's full color range.
 - 7. Finish: Matte.
 - 8. End units and outside corners: Preformed; profile, size, and color to match base.

2.3 ACCESSORIES

- A. Adhesive:
 - 1. Water based, waterproof, recommended by base manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare surfaces to receive base:
 - 1. Remove materials that could interfere with adhesion.
 - 2. Fill low spots with patching compound; finish flush with adjacent surface.
 - 3. Remove high spots, ridges and nibs.

3.2 INSTALLATION

- A. Apply adhesive continuously to back of base.
- B. Maintain top edge true to line and bottom edge in continuous contact with floor. Butt joints tight; butt base tight to adjacent construction.
- C. Do not install pieces less than 24 inches long.
- D. Miter and butt inside corners.
- E. At outside corners install preformed corner pieces.
- F. At exposed ends, install premolded units.
- G. Scribe to door frames and other interruptions.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
RESILIENT TILE FLOORING**

SECTION 09 6519 – Page 1 of 4

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient tile flooring.
 - 2. Resilient stair treads and risers.
 - 3. Reducers.
 - 4. Grounding tape.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - 2. E648 - Standard Test Method for Flooring Radiant Panel Test.
 - 3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 4. F970 - Standard Test Method for Static Load Limit.
 - 5. F1066 - Standard Specification for Vinyl Composition Tile.
 - 6. F1344 - Standard Specification for Rubber Floor Tile.
 - 7. F1700 - Standard Specification for Solid Vinyl Floor Tile.
 - 8. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 9. F2195 - Standard Specification for Linoleum Floor Tile.
- B. Resilient Floor Covering Institute (RFCI) - FloorScore Certification Program.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Provide data on specified products, describing physical and performance characteristics.
 - 2. Samples:
 - a. Flooring: 6 x 6 inch samples in each color and pattern.
 - b. Stair treads and risers: 6" long samples in each color.
 - c. Reducers: 4 inch long samples in each color.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that flooring meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years experience in work of this Section.
- B. Fire Hazard Classification: Class I rated, tested to ASTM E648. Flame spread 0-25, smoke developed less than 450.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
RESILIENT TILE FLOORING**

SECTION 09 6519 – Page 2 of 4

- C. Static Coefficient of Friction: Minimum 0.5 tested to ASTM D2047.

1.5 PROJECT CONDITIONS

- A. Maintain temperature in spaces to receive flooring between 70 and 90 degrees F for 24 hours before, during, and for minimum 48 hours after installation.
- B. Maintain minimum temperature of 55 degrees F after flooring is installed, except as otherwise specified.

1.6 MAINTENANCE

- A. Extra Materials: One unopened carton of each color and pattern.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Vinyl Composition Tile:
1. Armstrong World Industries. (www.armstrong.com)
 2. Azrock. (www.azrock.com)
 3. Mannington Resilient Floors. (www.mannington.com)
 4. Tarkett, Inc. (www.tarkett.com)
- B. Acceptable Manufacturers – Luxury Vinyl Tile
1. Mohawk Group (www.mohawkgroup.com) No substitution.
- C. Acceptable Manufacturers - Stair Treads and Risers:
1. Armstrong World Industries. (www.armstrongfloors.com)
 2. Azrock. (www.azrock.com)
 3. BurkeMercer Flooring Products. (www.burkemercer.com)
 4. Endura Rubber Flooring. (www.endura-flooring.com)
 5. Johnsonite, Inc. (www.johnsonite.com)
 6. Roppe Corp. (www.roppe.com)
- D. Acceptable Manufacturers - Installation Materials:
1. BASF Corporation. (www.buildingsystems.basf.com)
- E. Substitutions: No Substitution on Luxury Vinyl Tile.

2.2 MATERIALS

- A. Vinyl Composition Tile:
1. ASTM F1066, Class 2 - Through Pattern.
 2. Size: 12 x 12 inches x 1/8 inch thick.
 3. Color: To be selected from manufacturer's standard colors.
 4. Static load limit: Minimum 125 PSI, tested to ASTM F970.
- B. Stair Treads:
1. Type:
 2. Composition: Rubber.
 3. Thickness: 3/16 inch.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
RESILIENT TILE FLOORING**

SECTION 09 6519 – Page 3 of 4

- 4. Color: To be selected from manufacturer's full color range.
- C. Stair Risers:
 - 1. Composition: Rubber.
 - 2. Profile: Smooth, coved at bottom edge.
 - 3. Thickness: 0.125 inch.
 - 4. Color: To be selected from manufacturer's full color range.
- D. Luxury Vinyl Tile:
 - 1. Mohawk Hot & Heavy Collection COO89 Lineate Color to be selected.

2.3 ACCESSORIES

- A. Reducer Strips: Solid thermoplastic rubber composition, 1 inch wide by flooring thickness, tapered, color to match tile or wall base. ADA compliant.
- B. Leveling Compound: White, premixed, latex based.
- C. Adhesive:
 - 1. Water based, waterproof, recommended by flooring manufacturer.
 - 2. Maximum volatile organic compound (VOC) content: 50 grams per liter.
- D. Grounding Tape: 1/2 inch wide copper tape.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete floors have cured a minimum 28 days and do not exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION

- A. Clean substrate; remove loose and foreign matter that could impede adhesion or performance of flooring.
- B. Fill cracks, voids, and depressions in substrate with leveling compound.
- C. Grind off high spots and projections in substrate; leave smooth and level to 1/8 inch in 10 feet.
- D. Test substrate for moisture content to ASTM F1869; do not install flooring until moisture emission level is acceptable to flooring manufacturer.

3.3 INSTALLATION OF TILE

- A. Install in accordance with manufacturer's instructions.
- B. Mix materials from multiple containers to ensure shade variations are consistent when flooring is placed.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
RESILIENT TILE FLOORING**

SECTION 09 6519 – Page 4 of 4

- C. Spread only enough adhesive to permit installation of flooring before initial set.
- D. Lay flooring with joints parallel to building lines to produce symmetrical pattern.
- E. Install flooring to pattern indicated. Allow minimum half-size units at room or area perimeter.
- F. Set flooring in place; press with heavy roller to attain full adhesion.
- G. Scribe flooring to walls, columns, cabinets, and other appurtenances to produce tight joints. Ensure that base, trim, plates, or escutcheons will completely cover cut edges.
- H. Extend flooring into recesses and under equipment.
- I. Terminate flooring directly under closed door at openings where adjacent floor finish is dissimilar.
- J. Install grounding tape at static-dissipating flooring in accordance with manufacturer's instructions. Ground to building ground system.

3.4 INSTALLATION OF REDUCER STRIPS

- A. Install where tile stops with edge exposed; set in adhesive.
- B. Center strips under closed doors where flooring terminates at door openings.
- C. Install in longest practical lengths; butt ends tight.
- D. Scribe to abutting surfaces.

3.5 INSTALLATION OF STAIR TREADS AND RISERS

- A. Apply adhesive uniformly over substrate; remove adhesive that has dried or filmed over.
- B. Accurately cut to required sizes and profiles without gaps.
- C. Fit tight to treads, risers, and stringers.

3.6 ADJUSTING

- A. Correct tiles that are not seated; replace damaged tiles.

3.7 CLEANING

- A. Clean flooring, wax, and machine buff in accordance with manufacturer's instructions.

3.8 PROTECTION

- A. Do not allow traffic on flooring until adhesive has set.
- B. Cover areas subject to traffic with protective covering.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tile carpeting.
 - 2. Edgings and Cap strips.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. D2859 - Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
 - 2. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
 - 3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 4. E648 - Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 5. E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 6. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- B. Carpet and Rug Institute (CRI):
 - 1. 104 - Standard for Installation Specification of Commercial Carpet.
 - 2. Indoor Air Quality Testing Program.
- C. National Fire Protection Association (NFPA) 253 - Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate carpet tile locations, dye lot limitations, direction of carpet tile in each room or area, and type and location of edgings.
 - 2. Samples:
 - a. Carpet tile: Full size samples in each color and pattern.
 - b. Edgings: Cap strips: 4 inch long samples showing available colors.
 - 3. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that carpet tiles meet fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Fire Hazard Classification: Class I rated, tested to NFPA 253, ASTM E648.
- C. Fire Hazard Classification: Maximum smoke density rating of 450, tested to ASTM E662.

1.5 PROJECT CONDITIONS

- A. Do not begin installation until painting and finishing work have been completed.
- B. Environmental Requirements:
 - 1. Temperature of spaces and subfloor between 65 and 90 degrees F.
 - 2. Humidity in spaces to receive carpet tiles between 20 and 65 percent.

1.6 WARRANTIES

- A. Furnish manufacturer's / applicator's 10 year warranty providing coverage against defective materials and workmanship.

1.7 MAINTENANCE

- A. Extra Materials: 2% of each color and pattern.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Interface, Inc. (www.interfaceinc.com)
- B. Acceptable Manufacturers – Installation Materials:
 - 1. BASF Corporation. (www.buildingsystems.basf.com)
- C. Substitutions: Carpet Substitution Not Permitted

2.2 MATERIALS

- A. Carpet Tiles: Interface Style: Earth Color: Plateau

2.3 ACCESSORIES

- A. Adhesive:
 - 1. Waterproof, latex based cement formulated specifically for installing carpet tiles; recommended by carpet tile manufacturer.
 - 2. Maximum volatile organic compound (VOC) content: 50 grams per liter.
- B. Edgings: Preformed rubber, profile required to suit conditions, color to be selected from manufacturer's full color range.
- C. Cap Strip: Preformed rubber profile required to suit conditions, color to be selected from manufacturer's full color range.
- D. Leveling Compound: Premixed, latex based.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete floors have cured a minimum 28 days and do not exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION

- A. Clean substrate; remove loose and foreign matter that could impede adhesion or performance of flooring.
- B. Fill cracks, voids, and depressions with leveling compound.
- C. Grind ridges and high spots smooth.
- D. Test substrate for moisture content to ASTM F1869; do not install carpet tiles until moisture emission level is acceptable to carpet tile manufacturer.

3.3 INSTALLATION OF CARPET TILES

- A. Install in accordance with CRI 104.
- B. Install carpet tile and adhesive in accordance with manufacturers' instructions.
- C. Blend carpet tiles from different cartons to ensure minimal variation in color match.
- D. Lay out each room or area to minimize tiles less than one half size.
- E. Cut tile clean. Fit tiles tight to intersection with vertical surfaces without gaps.
- F. Lay carpet tile to aligned pattern, with tile direction alternating to next unit, set parallel to building lines.
- G. Locate change of color or pattern between rooms under door centerline.
- H. Fully adhere carpet tiles to substrate.
- I. Bind cut edges where not concealed by edge strips.

3.4 INSTALLATION OF EDGINGS

- A. Install strips where carpet tiles abut dissimilar flooring materials; secure to subfloor.
- B. Center strips under doors where carpet tiles terminate at door openings.
- C. Install in longest practical lengths; butt ends tight.
- D. Scribe to abutting surfaces.

3.5 CLEANING

- A. Clean spots as recommended by carpet tile manufacturer.
- B. Cut off loose threads flush with top surface.
- C. Clean with commercial vacuum cleaner.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl wall coverings.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's descriptive data for each wall covering.
 - 2. Samples: 24 x 24 inch wall covering samples in each color and pattern.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that wall covering meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Fire Hazard Classification: Tested to ASTM E84 and NFPA 265 with following results:
 - 1. Flame spread: Maximum 25.
 - 2. Smoke density: Maximum 450.
- C. Mockup:
 - 1. Size: 6 feet wide x full height.
 - 2. Show: Wall covering color and pattern. Include one seam.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in clean, dry storage area at minimum 40 degrees F and normal humidity.
- B. Do not store rolls in upright position.

1.6 PROJECT CONDITIONS

- A. Maintain minimum temperature of 50 degrees F in areas to receive wall covering for three days prior to, during, and after installation.

1.7 MAINTENANCE

- A. Extra Materials: 5 percent of each color and pattern.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. MDC Interior Solutions www.mdcwall.com
- B. Substitutions: Not Permitted

2.2 MATERIALS MDC MODERN INDUSTRY GUNMETAL 3063MI / 4131

- 1. Type II Commercial Contract grade.
- 2. Weight: 20 ounces minimum per linear yard.
- 3. Color: To be selected from manufacturer's full color range.
- 4. Content: Fabric-backed vinyl
- 5. Backing: Osnaburg
- 6. Width: 54 inches.
- 7. Fire Rating Class A: Flame Spread 15, Smoke Developed 10.

2.3 ACCESSORIES

- A. Sealer: Type recommended by wall covering manufacturer.
- B. Adhesive:
 - 1. Type recommended by wall covering manufacturer; water based, mildew resistant.
 - 2. Maximum volatile organic compound (VOC) content: 50 grams per liter.
- C. Patching Compound: White latex type.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare substrate to receive wall covering:
 - 1. Remove high spots.
 - 2. Fill holes, cracks, and depressions with patching compound; sand smooth and flush.
 - 3. Remove loose and foreign matter that could impair adhesion.
 - 4. Apply sealer as recommended by wall covering manufacturer.
- B. Remove wall covering from packaging, place in installation area, and allow to acclimatize for minimum 24 hours prior to installation.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install panels vertically.
- C. Do not locate joints within 6 inches of corners. Horizontal joints not permitted.
- D. Smooth wall covering to eliminate bubbles and ensure adhesion. Remove excess adhesive from seams immediately.
- E. Use panels in exact order they are cut from roll. Reverse every other panel of non matching patterns.
- F. Fill in above and below openings with panels cut in consecutive order from roll.
- G. Install wall covering free from bubbles, wrinkles, open or loose seams, and other visible defects.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Surface preparation and field application of paints.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. D4442 - Standard Test Method for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
 - 2. D6886 - Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography.
- B. Green Seal, Inc. (GS) 11 - Standard for Paints and Coatings.
- C. Master Painters Institute (MPI) - Architectural Painting Specification Manual.
- D. Society for Protective Coatings (SSPC) - Painting Manual.
- E. South Coast Air Quality Management District (SCAQMD) Rule 1113 - Architectural Coatings.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Manufacturer's data on materials proposed for use including:
 - a. Product designation and grade.
 - b. Product analysis and performance characteristics.
 - c. Standards compliance.
 - d. Material content.
 - e. Mixing and application procedures.
 - 2. Samples:
 - a. 12 x 12 inch texture samples on gypsum board backing.
 - 3. Paint Schedule: Indicate types and locations of each surface, paint materials, and number of coats to be applied.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 10 years documented experience in work of this Section.
- B. Materials, Preparation, and Workmanship: Conform to MPI Painting Manual.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage rates, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

- B. Paint Materials: Store at ambient temperature from 45 to 90 degrees F in ventilated area, or as required by manufacturer's instructions.

1.6 PROJECT CONDITIONS

- A. Do not apply materials when surface and ambient temperatures or relative humidity are outside ranges required by paint manufacturer.
- B. Maintain ambient and substrate temperatures above manufacturer's minimum requirements for 24 hours before, during, and after paint application.
- C. Do not apply materials when relative humidity is above 85 percent or when dew point is less than 5 degrees F different than ambient or surface temperature.
- D. Provide minimum lighting level of 30 footcandles at substrate surface.

1.7 MAINTENANCE

- A. Extra Materials: 5 gallons of each color and sheen.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Sherwin Williams. (www.sherwin-williams.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Paints:
 - 1. As scheduled at end of Section, or approved substitute.
 - 2. Free from all forms of lead and mercury.
- B. Maximum Volatile Organic Compound (VOC) Content for interior paints, coatings, and accessories, tested to ASTM D6886:
 - 1. Primers: 100 grams per liter.
 - 2. Flat paints and coatings: 50 grams per liter.
 - 3. Non-flat paints and coatings: 50 grams per liter.
 - 4. Rust preventative coatings: 100 grams per liter.
 - 5. Clear wood finishes: 275 grams per liter.
 - 6. Stains: 100 grams per liter.
 - 7. Dryfall coatings: 150 grams per liter.

2.3 ACCESSORIES

- A. Accessory Materials: Paint thinners and other materials required to achieve specified finishes; commercial quality.

- B. Patching Materials: Latex filler.
- C. Fastener Head Cover Materials: Latex filler.

2.4 MIXES

- A. Deliver paints pre-mixed and pre-tinted.
- B. Uniformly mix to thoroughly disperse pigments.
- C. Do not thin in excess of manufacturer's recommendations.
- D. Re-mix paint during application; ensure complete dispersion of settled pigment and uniformity of color and gloss.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Test shop applied primer for compatibility with subsequent coatings.
- B. Measure moisture content of surfaces using electronic moisture meter. Do not apply coatings unless moisture content of surfaces are below following maximums:
 - 1. Gypsum board: 12 percent.
 - 2. Masonry and concrete: 12 percent.
 - 3. Wood: 15 percent, measured to ASTM D4442.
 - 4. Concrete floors: 8 percent.

3.2 PREPARATION

- A. General:
 - 1. Protect adjacent and underlying surfaces.
 - 2. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
 - 3. Correct defects and clean surfaces capable of affecting work of this section.
 - 4. Seal marks that may bleed through surface finishes with shellac.
- B. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow to dry.
- C. Gypsum Board:
 - 1. Fill minor defects with filler compound. Spot prime defects after repair.
- D. Concrete and Masonry:
 - 1. Remove dirt, loose mortar, scale, salt and alkali powder, and other foreign matter.
 - 2. Remove oil and grease with solution of trisodium phosphate; rinse and allow to dry.
 - 3. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- E. Concrete Floors:
 - 1. Remove contamination, acid etch, and rinse floors with clear water. Allow to dry.
 - 2. Verify that required acid-alkali balance has been achieved.

- F. Galvanized Steel: SSPC Method SP1 - Solvent Cleaning.
- G. Uncoated Ferrous Metals: SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
- H. Shop Primed Ferrous Metals:
 - 1. SSPC Method SP2 - Hand Tool Cleaning or Method SP3 - Power Tool Cleaning.
 - 2. Feather edges to make patches inconspicuous.
 - 3. Prime bare steel surfaces.
- I. Interior Wood:
 - 1. Wipe off dust and grit.
 - 2. Seal knots, pitch streaks, and sappy sections with sealer.
 - 3. Fill nail holes and cracks after primer has dried; sand between coats.
- J. Exterior Cement Board:
 - 1. Remove dust, grit, and foreign matter.
 - 2. Seal knots, pitch streaks, and sappy sections.
- K. Existing Surfaces:
 - 1. Remove loose, flaking, powdery, and peeling paints.
 - 2. Lightly sand glossy painted surfaces.
 - 3. Fill holes, cracks, depressions and other imperfections with patching compound; sand flush with surface.
 - 4. Remove oil, grease, and wax by scraping; solvent wash and thoroughly rinse.
 - 5. Remove rust by wire brushing to expose base metal.

3.3 APPLICATION

- A. Apply paints in accordance with MPI Painting Manual, Premium Grade finish requirements.
- B. Apply primer or first coat closely following surface preparation to prevent recontamination.
- C. Do not apply finishes to surfaces that are not dry.
- D. Apply coatings to minimum dry film thickness recommended by manufacturer.
- E. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- F. Apply coatings to uniform appearance without laps, sags, curtains, holidays, and brush marks.
- G. Allow applied coats to dry before next coat is applied.
- H. When required on deep and bright colors apply an additional finish coat to ensure color consistency.
- I. Continue paint finishes behind wall-mounted accessories.
- J. Sand between coats on interior wood and metal surfaces.
- K. Match final coat to approved color samples.
- L. Where clear finishes are specified, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

- M. Prime concealed surfaces of exterior wood and interior wood in contact with masonry or cementitious materials with one coat primer paint.
- N. Mechanical and Electrical Components:
 - 1. Paint factory primed equipment.
 - 2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
 - 3. Paint exposed and insulated pipes, conduit, boxes, ducts, hangers, brackets, collars, and supports unless factory finished.
 - 4. Do not paint name tags or identifying markings.
 - 5. Paint exposed conduit and electrical equipment in finished areas.
 - 6. Paint duct work behind louvers, grilles, and diffusers flat black to minimum of 18 inches or beyond sight line.
- O. Do not Paint:
 - 1. Surfaces indicated on Drawings or specified to be unpainted or unfinished.
 - 2. Surfaces with factory applied finish coat or integral finish.
 - 3. Architectural metals, including brass, bronze, stainless steel, and chrome plating.

3.4 ADJUSTING

- A. Touch up or refinish disfigured surfaces.

3.5 CLEANING

- A. Remove paint from adjacent surfaces.

3.6 PAINT SCHEDULE

- A. Types of paint listed herein are set forth as standard of quality and type of coating required for each type of surface.
 - 1. Paint exposed surfaces of types listed in Paint Schedule.
 - 2. Paint other exposed surfaces not specifically listed with not less than two coats of appropriate type of coating.
- B. Prime coat may consist of touch up on shop primed and existing surfaces with intact coatings.

SUBSTRATE	MANUFACTURER	PRIMER	TOP COATS
Exterior Surfaces:			
Ferrous and Galvanized Metals		Exterior Alkyd Enamel Primer, 1 coat	Exterior Alkyd Industrial Enamel Semi-Gloss Finish, 2 coats
Cement Board, Opaque Finish		Exterior Latex Enamel Primer, 1 coat	Exterior Latex Enamel Semi-Gloss Finish, 2 coats

SHELBY COUNTY EMA & IT BUILDING PROJECT PAINTING

SECTION 09 9100 – Page 6 of 6

SUBSTRATE	MANUFACTURER	PRIMER	TOP COATS
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Interior Surfaces:

Gypsum Board, Latex
Enamel Finish

Interior Latex Gypsum
Board Primer, 1 coat

Interior Latex Enamel
Eggshell Finish, 2 coats

Gypsum Board,
Knock-down Finish

Interior Latex Gypsum
Board Primer, 1 coat

Interior Latex Enamel
Eggshell Finish, 2 coats

Ferrous and Galvanized
Metals

Exterior Alkyd Enamel
Primer, 1 coat

Exterior Alkyd Industrial
Enamel Semi-Gloss
Finish, 2 coats

Wood, Opaque, Latex
Enamel Finish

Interior Latex Wood
Primer, 1 coat

Interior Latex Enamel
Semi-Gloss Finish, 2
coats

Wood, Transparent
Finish

Wood Stain, 2 coats

Clear Polyurethane, 2
coats

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic interior panel signs.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include sign locations, sizes, mounting heights, and content.

1.3 QUALITY ASSURANCE

- A. Conform to ADA / ANSI 117.1 accessibility codes for sign design, construction, location, and mounting height.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Bell Company – www.bellcoinc.com – 205-702-6460
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Signs:
 - 1. Type: Melamine plastic laminate with contrasting color core, non static, fire retardant, self extinguishing, matte finish.
 - 2. Thickness: 1/8 inch.
 - 3. Face and core colors: To be selected from manufacturer's full color range.

2.3 ACCESSORIES

- A. Adhesive: Tape: Double sided, waterproof, pressure sensitive.

2.4 FABRICATION

- A. Fabricate signs by reverse engraving process to produce characters and graphics in contrasting color, raised 1/32 inch.

- B. Sign Size: 6" wide X 9" high.
- C. Characters:
 - 1. Height: 3/4 inch.
 - 2. Style: Sans serif style, upper case.
- D. Pictograms: Universal accessibility symbols, 6 inches high.
- E. Provide Braille indications for each character.
- F. Corners: 1/2 inch radius.
- G. Edges: Square.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces of loose and foreign matter.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Locate signs on wall adjacent to scheduled doors.
 - 1. Horizontal: 9" centerline sign to door leaf edge
 - 2. Vertical: Fit sign between 48" and 60" above floor plane.

3.3 SCHEDULE

LOCATION	SIGN SIZE	CONTENT
Men's Toilets	6X9 inches	"MEN" and male pictogram
Women's Toilets	6X9 inches	"WOMEN" and female pictogram
Unisex Toilets	6X9 inches	Male and Female pictogram

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Indicate profiles, accessories, and attachments.

1.3 QUALITY ASSURANCE

- A. Corner Guards in Fire Rated Partitions: Tested and approved by recognized independent testing laboratory with fire resistance rating equivalent to partition construction.

1.4 PROJECT CONDITIONS

- A. Do not install guards until after painting and finishing work is completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Balco, Inc. (www.balcousa.com)
 - 2. Construction Specialties, Inc. (www.c-sgroup.com)
 - 3. Inpro Corporation. (www.inprocorp.com)
 - 4. Pawling Corp. (www.pawling.com)
- B. Substitutions: Under provisions of Division 01.

2.2 COMPONENTS

- A. Corner Guards:
 - 1. Type: Surface mounted, rigid vinyl, colored polycarbonate.
 - 2. Attachment: Countersunk fasteners
 - 3. Size: 2 inches X 2 inches x 72 inches high.
 - 4. Color: To be selected from manufacturer's full color range.

2.3 ACCESSORIES

Fasteners: Type best suited to application, exposed heads of same material and finish as guards.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure metal retainers to framing.
- C. Install closure pieces at top of corner guards.
- D. Place vinyl guards securely into retainer.
- E. Set plumb, level, and rigid.
- F. Install only at Corridors, outside corners.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Toilet, bath, and shower accessories.
 - 2. Framed mirrors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 10 2116 – Plastic Toilet Compartments

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 2. C1036 - Standard Specification for Flat Glass.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Schedule accessories by room; show plans and elevations, and identify room name and number, type and quantity of accessories, and mounting heights.
 - b. Include manufacturer's brochures showing sizes, details of function, finishes, and attachment methods.
 - 2. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Strictly conform to ADA and ANSI 117.1 requirements for locating accessories.

1.5 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage against mirror silver spoilage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. A and J Washroom Accessories. (www.ajwashroom.com)
 - 2. American Specialties, Inc. (www.americanspecialties.com)
 - 3. Bobrick Washroom Equipment, Inc. (www.bobrick.com)
 - 4. Bradley Corp. (www.bradleycorp.com)
 - 5. GAMCO. (www.gamcousa.com)
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Stainless steel fabricated toilet accessories.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TOILET ACCESSORIES**

SECTION 10 2813 – Page 2 of 4

- B. Mirror Glass: ASTM C1036, Type I, Class 1, Quality q1, 3/16 inch thick.

2.3 ACCESSORIES

- A. Fasteners: Stainless steel where exposed, hot dip galvanized where concealed; type best suited to substrate conditions.

2.4 FABRICATION

- A. Use stainless steel for exposed surfaces; galvanized steel may be used in concealed locations.
- B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.
- C. Weld joints of fabricated components and grind smooth.
- D. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.
- E. Provide hangers, adapters, anchor plates, and accessories required for installation.
- F. Key locks on dispensers alike; furnish six keys.
- G. Mirrors:
 - 1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered.
 - 2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
 - 3. Backing: Galvanized steel sheet.
 - 4. Isolate glass from frame and backing with resilient, waterproof padding.
- H. Shop assemble units and package complete with anchors and fittings.

2.5 FINISHES

- A. Stainless Steel: No. 4 satin.
- B. Galvanizing: ASTM A123/A123M to 1.25 ounces per square foot.
- C. Chrome Plating: ASTM B456, Type SC 2.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set plumb, level, square, and rigid.
- C. Install wiring between power supply and accessories.

3.2 SCHEDULE

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TOILET ACCESSORIES**

SECTION 10 2813 – Page 3 of 4

MARK	DESCRIPTION	MANUFACTURER	MODEL NO.
A	Paper Towel Dispensers	Furnished by Owner and installed by Contractor	
B	Toilet Tissue Dispenser	Furnished by Owner and installed by Contractor	
C	Soap Dispenser	Disposable units Furnished by Owner	
D	Framed Mirrors	ASI	0600-1836
E	Grab Bars	ASI	3801 series
F	Robe Hooks	ASI	0751 series
G	Mop Holder	See Plumbing Drawings	
H	Towel Bars	ASI	7355 series
		Satin Stainless Steel 18" or 24" see dwgs.	

ACCESSIBLE SHOWER

Shower Rod: ASI 1204-2 60" long 1 1/4" dia. 18 ga. stainless steel Shower

Rod Flanges: ASI 1204-1

Shower Curtain: ASI 1200-V72 72" W. X 72" H. 10 ga. white vinyl Shower

Curtain Hooks: ASI 1200-SHU, 12 hooks

ADA shower seat: ASI 8203-33

ADA shower threshold: Zero #8452A or equal. Compressible neoprene dome gasket on aluminum base, 1" H. X 1.75" W.

GLASS SHOWER ENCLOSURE (NON-ADA)

36"X36" Tempered Pattern Glass Enclosure with Aluminum Frame

By Aquatic Bath or approved equivalent

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portable fire extinguishers.
 - 2. Cabinets.
 - 3. Brackets.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops.
- B. National Fire Protection Association (NFPA) 10 - Portable Fire Extinguishers.
- C. Underwriters Laboratories (UL):
 - 1. 299 - Dry Chemical Fire Extinguishers.
 - 2. 711 - Rating and Fire Testing of Fire Extinguishers.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate cabinet locations and mounting heights.
 - 2. Product Data: Include data on extinguishers and cabinets, cabinet dimensions, operational features, materials, finishes, and anchorage.
- B. Closeout Submittals:
 - 1. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

- A. Provide fire extinguishers complying with UL 711 and International Building Code.
- B. Cabinets in Fire Rated Partitions: Tested in accordance with ASTM E814 with fire resistance rating equivalent to adjacent construction.
- C. Conform to applicable accessibility code for locating extinguishers.

1.5 PROJECT CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ansul Incorporated. (www.ansul.com)
 - 2. JL Industries. (www.jlindustries.com)
 - 3. Larsen's Mfg. Co. (www.larsensmfg.com)
 - 4. Potter Roemer. (www.potterroemer.com)
- B. Substitutions: Under provisions of Division 01.

2.2 COMPONENTS

- A. Extinguishers:
 - 1. Multi-purpose dry chemical type, UL 299, cast steel tank, Class 4A:80B:C, 10 pound nominal capacity.
- B. Cabinets:
 - 1. Formed galvanized steel sheet, 18 gage minimum.
 - 2. Configuration: Semi-recessed, sized to accommodate extinguishers.
 - 3. Trim: Flat trim. Returned to wall surface.
 - 4. Door:
 - a. Vertical glass style, equipped with recessed pull handle, latch, and keyed lock. Key locks alike; furnish six keys.
 - b. Hinge doors for 180 degree opening with continuous piano hinge.
 - c. Glazing: Clear tempered glass.
 - d. Graphics: Letter FIRE EXTINGUISHER vertically on door in red die-cut vinyl pressure sensitive letters.
 - e.
- C. Brackets: Formed galvanized steel, sized to accommodate extinguisher.

2.3 ACCESSORIES

- A. Mounting Hardware: Type best suited to application.

2.4 FINISHES

- A. Cabinet: Interior: Baked enamel, color to be selected from manufacturer's standard colors.
- B. Brackets: Baked enamel, black color.
- C. Extinguishers: Baked enamel, red color.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install cabinets and brackets in accordance with manufacturer's instructions.
- B. Set plumb, level, and rigid.
- C. Mounting heights in strict accord with ADA and ANSI 117.1 accessible height requirements.
- D. Place an extinguisher in each cabinet and on each bracket.

END OF SECTION

PART 1 - GENERAL

1.01 Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to work specified in this section.

1.02 General Description of Work

A. Work in this section shall include design, fabrication and installation of a complete aluminum sunshade system in accordance with the drawings and this specification.

1.03 References

- A. Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.
- B. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- C. American Architectural Manufacturers Association (AAMA)
- D. American Society for Testing and Materials (ASTM)

1.04 Related Sections

- A. Concrete Work - Section 03300
- B. Masonry Work - Section 04200
- C. Miscellaneous Metals - Section 05500
- D. Flashing and Sheet Metal - Section 07600
- E. Sealants - Section 07900

1.05 Submittals

- A. Product Data: Submit manufacturer's product information, specifications and installation instructions for components and accessories.
- B. Shop Drawings: Submit complete erection drawings showing attachment system, column and gutter beam framing, transverse cross sections, covering and trim details, and optional installation details to clearly indicate proper assembly of components, sealed by a State Registered Structural Engineer in the state in which the work is being performed.
- C. Calculations: Submit complete structural design calculation sealed by State Registered Structural Engineer registered in the state in which the work is being performed.
- D. Design and engineering of attachment surfaces are not covered in this specification and scope of work.

E. Quality Assurance

A. Codes and standards: Comply with provisions of the following except as otherwise indicated: Local building codes including the 2003 International Building Code, latest addition with amendments, if any. AWS (American Welding Society) standards for structural aluminum welding.

B. Manufacturer: Obtain aluminum sunshade system from only one (1) manufacturer, although several may be indicated as offering products complying with requirements.

C. Installer Qualifications: Firm with not less than three (3) years experience in installation of aluminum walkway covers of type, quantity and installation methods similar to work of this section.

D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting of work.

E. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway system (sidewalk, curbs, building fascias, etc.).

1.06 Warranty

A. Provide manufacturer's standard one-year warranty that shall include, but not limited to, coverage for structural, water tightness and finish beginning the day of Substantial Completion of Installation.

PART 2 - PRODUCT

2.01 Manufacturers

A. Contract documents are based on products manufactured by:

- **Tennessee Valley Metals, Inc.,
190 Industrial Park Road, Oneonta, AL 35121
205.274.9500, fax 205.274.9501
800.551.2579,
sales@tvmetals.com , www.tvmetals.com**

B. Interested manufacturers will be considered for substitution only when the following conditions are met: Complete details, including sizes of all members and structural calculations showing loads applied in accordance with the specification must be submitted to the architect for review. Submit complete details with structural properties (moment of inertia, section modulus, modulus of elasticity, etc.) for all proposed sections (bents, columns, decking and other structural members).

2.02 Materials

- A. Aluminum Extrusions: All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper.
- B. Finishes: For factory baked enamel finish, specify AAMA 603.8 standard or custom color.

For fluoropolymer (Kynar) finish, AAMA 605.2, two or three coats.

For satin anodized finish, specify 204.R1 meeting Aluminum Association specification AA-M-10C-22A21.

2.03 Components

- A. Supports: Aluminum plates or tubing of size and shape as indicated on drawings. (Rod and clevis is available as an option.)
- B. Deck: Deck shall be extruded aluminum airfoil blades or "Z" louvers of size as indicated on drawings. (Tubular shapes are available as an option).
- C. Fascia: Fascia shall be extruded aluminum gutter or tubing. Size as indicated on drawings.
- D. Flashing: Flashing shall be .032" aluminum (min.). All thru-wall flashing is completed by others.
- E. Fasteners: All exposed fasteners shall be stainless steel.

2.04 Fabrication

- A. Deck Construction: Deck shall be manufactured of extruded material.

PART 3 - EXECUTION

3.01 Preparation

- A. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 Cleaning

- A. All protective cover components shall be cleaned promptly after installation.

3.03 Protection

- A. Extreme care shall be taken to protect materials during and after installation.

PART 1 GENERAL

1.1 SUMMARY

A. Responsibilities:

1. Refrigerator: Furnished and Installed by Contractor
2. Range: Furnished and Installed by Contractor
3. Range Hood: Furnished by Owner, Installed by Contractor.
4. Ice Machine: Furnished and Installed by Contractor.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.
2. PLUMBING and ELECTRICAL sections.

1.2 DELIVERY, STORAGE AND HANDLING

- A.** Receive and store appliances and equipment with manufacturer's protective coverings in place; do not remove until just prior to installation.

PART 2 EXECUTION

2.1 INSTALLATION

- A.** Install appliances and equipment in accordance with manufacturer's instructions.
- B.** Set plumb, level, and aligned.
- C.** Connect to domestic water.
- D.** Connect to power supply.

2.2 ADJUSTING

- A.** Adjust for proper operation.

APPLIANCE DESCRIPTION	MANUFACTURER	MODEL	FINISH
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Contact Owner for all
appliance specifications prior
to installation.

END OF SECTION

PART 1 GENERAL

SECTION 12-2413 PAGE 1 OF 2

1.1 SUMMARY

A. Section Includes:

Manually operated window shades.

B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. National Fire Protection Association (NFPA) 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.3 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings:

- a. Show locations, sizes, relationship to adjacent construction and other pertinent information.
- b. Use same room designations as indicated on Drawings.

2. Product Data: Indicate components, materials, finishes, attachment, and operation.

3. Samples:

- a. Min. 6X6 inch shade cloth samples showing available colors.

4. Warranty: Sample warranty form.

B. Closeout Submittals:

1. Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 2 years documented experience in work of this Section.

B. Fabric: Pass NFPA 701 small and large-scale vertical burn tests.

1.5 PROJECT CONDITIONS

A. Verify dimensions at site prior to fabrication of shades.

B. Do not install shades until painting and finishing work is complete and ambient temperature and humidity conditions are maintained at occupancy levels.

1.6 WARRANTIES

A. Furnish manufacturer's warranties providing coverage for:

1. 10 years against deterioration, sag, and warp of shade cloth.
2. 10 years against defective hardware.
3. 5 years against defective motors and controllers.
- 4.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. MechoShade Systems, Inc. (www.mechoshade.com)
2. SWF Contract (www.swfcontract.com)
3. Solarfective Products Limited. (www.solarfective.com)
4. Solar Shading Systems. (www.solarshadingsystems.com)

B. Substitutions: Under provisions of Division 01.

C. Basis of Design: MechoShade 5X manual roller shade with 3X3 standard bracket and fascia.

2.2 MANUFACTURED UNITS

A. Window Shades:

1. Operation: Offset side mounted chain operator.
2. Shadecloth orientation: Regular rolling with shade cloth falling on window side of roller.
3. Mounting: Wall or window frame.
4. Head tube: Extruded aluminum.
5. Fascia: Extruded aluminum.
6. Blackout channels (only if noted on drawings): Extruded aluminum; side, center, and sill.

B. Shade Cloth:

1. Fabric hem pocket with RF-welded seams and hem weights concealed in continuous sealed hem pocket.
2. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling.
3. Provide battens when required to ensure proper tracking and uniform rolling of shade cloth.
4. Fabricate shade cloth to completely fill openings from head to sill and jamb-to-jamb, unless otherwise indicated.
5. Fabricate shade cloth to hang flat without buckling and distortion.

2.3 FINISHES

A. Fabric: Medium basket weave, Poly/VoP material, 3% percent openness factor, color to be selected from manufacturer's full color range.

B. Aluminum: Baked enamel, color to be selected from manufacturer's full color range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide adequate clearances to allow for proper operation.

C. Place units to locate shade cloth minimum 2 inches from interior face of glass.

3.2 ADJUSTING

A. Adjust shades for smooth, quiet operation.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE:

- A. Provisions of this Section apply to all Fire Protection work.
- B. Include the provisions of General Conditions as part of this Section.
- C. Provide all labor, materials, equipment, and services necessary for the completion of all Fire Protection work shown or specified, complete and ready for operation, consisting in general of the following:
 - 1. Provide wet automatic sprinkler system coverage for the building as shown on drawings.
 - 2. Provide pre-action automatic sprinkler system coverage for the building as shown on drawings.
 - 3. Provide clean agent fire suppression system as shown on drawings.
- D. Give required notices, file drawings, obtain and pay for permits, deposits and fees necessary for the installation of the Fire Protection work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.
- E. Permitting is required for sprinkler system flush-out water discharged to surface waters.

The State Contact:
Alabama Department of Environmental Management
Attn: Water Division
Post Office Box 301463
Montgomery, Alabama 36130-1463
Telephone Number: (334) 271-7823
Fax Number: (334) 279-3051
E-Mail: H2omail@adem.state.al.us
- F. "Provide" means to furnish and install, complete and ready for operation.

1.2 DRAWINGS:

- A. Fire Protection Drawings are diagrammatic and subject to requirements of Architectural Drawings and conditions existing in the field. Fire Protection Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work.
- B. Follow the drawings closely, coordinate dimensions with Architectural Drawings and field conditions. DO NOT scale Fire Protection drawings for location of system components.
- C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or miss-located work in proper manner.

- D. DO NOT scale drawings to locate sprinkler heads. COORDINATE with lighting and ceiling grids. Contractor for Fire Protection work is responsible for coordinating with all trades.

1.3 APPLICABLE CODES AND STANDARDS:

- A. Comply with the current editions of the following Codes and Standards:
1. ANSI/B31.9 - Code for Building Services Piping
 2. NFPA 13 – Standard for the Installation of Sprinkler Systems
 3. NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems
 4. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
 5. NFPA 25 – Standard for Inspection, Testing, and Maintenance of Water-based Fire Protection Systems.
 6. 2023 NFPA 70 - National Electrical Code
 7. NFPA 101 - Safety to Life from Fire in Buildings and Structures
 8. Other standards as referenced in other sections of Division 210000
 9. 2024 International Building Code
 10. 2024 International Mechanical Code

1.4 QUALIFICATIONS OF SUBCONTRACTOR:

- A. The Fire Protection sub-contractor shall meet the following minimum qualifications:
1. He shall have been in business as a Contractor for Fire Protection work continuously, for at least 3 years prior to the date of opening bids for this project.
 2. He shall have a satisfactory experience record with Fire Protection installations of character and scope comparable with this project and shall have completed three such installations in the past three years.
 3. He shall be qualified, certified and licensed by the State of **Alabama** Fire Marshal. He shall meet all laws pertaining to fire protection in the Code of **Alabama** 1975 and any amendments of same.

1.5 CONFLICTS AND INTERFERENCES:

- A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.7 COOPERATION:

- A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.8 VISITING SITE:

- A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

1.9 MATERIALS:

- A. **Unless otherwise noted, provide new, standard, first-grade materials throughout. Unless otherwise noted, all products and materials shall be manufactured in the U.S.A. This shall include but not limited to: Pipe, fittings, hangers, valves, switches, gauges, sprinklers, pumps and all other associated equipment.**
- B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the estimate, without substitution, and shall be furnished under the contract unless requests for equivalents are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.
- C. Equivalents will be considered only if written request for approval has been received by the Architect (from a general contract bidder) 10 days prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which an equivalent is proposed and a complete description of the proposed equivalent including drawings, cuts, performance and test data, and deviation from the specification and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the equivalent may require shall be included. The burden of proof of the merit of the proposed equivalent is upon the proposer. The Architect's decision of approval or disapproval of a proposed equivalent is final.
- D. If the Architect approves any proposed equivalent prior to receipt of Proposals, approval will be set forth in an Addendum. **DO NOT RELY UPON APPROVALS MADE IN ANY OTHER MANNER.**
- E. No proposed equivalent will be considered after the Contract has been executed, except as described in the General Conditions.
- F. Within 45 days of execution of contract and before ordering materials or equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Submit PDF format files for approval. Provide PDF files of approved data for project close-out.
- G. All pressure vessels shall be constructed and tested in accordance with applicable ASME codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.
- H. Similar items of equipment shall be the product of the same manufacturer.

1.10 SHOP DRAWINGS:

- A. Before starting work, submit and obtain approval of detailed drawings of the following, fully dimensioned (including elevations of piping) and drawn to 1/4" to 1'-0" scale.
- B. Submit pdf of working shop drawings, material data, and hydraulic calculations. Shop drawings shall include drain locations, pipe slopes down to drains, piping elevations, piping connection details, and a list of piping materials. All shop drawings shall be produced using AutoCad and a copy of the shop drawing files shall be provided in pdf format for shop drawing review. A thumb-drive with a copy of all approved shop drawings shall be provided for project closeout.
 - 1. Complete Fire Protection equipment plans showing location of equipment, conduit stubs for motors, floor drains, and equipment pads and foundations.
 - 2. Equipment piping.
- C. Thirty days before starting work, submit Fire Protection shop drawings bearing seals of approval of Owner's Underwriters and all Governmental Agencies having jurisdiction. Complete shop drawings are required to be submitted at one time. (See Section 214000.)
- D. Engineers' CAD/electronic drawings files will be available upon request for the convenience of the contractor and for use in preparation of shop drawings. A service fee of \$100.00 per drawing sheet file shall be remitted to the Engineer prior to delivery of CAD/electronic drawing files along with a signed agreement between the Engineer and Contractor.

1.11 RECORD DRAWINGS:

- A. When work starts the Architect will furnish two complete sets of white prints of the Fire Protection Drawings. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection.
- B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this contract.
 - 1. Accurately show location, size and elevation of new exterior utility work and its relationship to any existing utilities, obstructions, etc., contiguous to the area of work.
 - 2. Block out areas modified by change-order & identify them by change-order number.
 - 3. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.
- C. When work is completed, the Engineers' CAD/electronic drawing files will be made available upon request for the convenience to the contractor for a service fee of \$100.00 per CAD/electronic drawing sheet file and for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the CAD files, removing all superseded data in order to show the actual completed conditions. Include the contract drawings equipment schedules, details, and sections, edited to show actual completed conditions. When record drawings are complete, provide 2 sets of bond prints, and one complete set of AutoCAD drawing files (AutoCAD 2016 format) and one set of PDF drawing files on CD-ROM disks.
- D. Fire Protection Drawings shall be a set of CAD shop drawings, up-dated to show actual conditions at completion of work. Include the contract drawings equipment schedules and details edited to show actual completed conditions.

1.12 PROTECTION OF EQUIPMENT:

- A. During construction, protect Fire Protection piping and equipment damage or deterioration and prevent water, dust, etc. from entering the equipment.
- B. During construction, keep all openings of piping and equipment securely covered to prevent entry of water or dust.
- C. When installation is complete, clean piping and equipment and make ready for painting.

1.13 INSTALLATION OF EQUIPMENT:

- A. Install equipment to provide normal service access to all components.
- B.** Where drawings show sufficient space for removing components, install equipment to provide such clearance. ***Provide space at all equipment power and control panels as required by local codes.***
- C. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with contract documents, obtain Architect's decision before proceeding.
- D. All equipment shall be firmly fastened in place:
 - 1. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

1.14 EQUIPMENT SUPPORTS:

- A. Provide supports for piping and equipment. Hot dip galvanize after fabrication all supports, etc., located outdoors. Where noted provide 304 stainless steel supports. At the Contractor's option, all supports, etc. located outdoors may be 304 stainless steel instead of hot dip galvanized.

1.15 SLEEVES:

- A. For pipe through floors inside fire rated chases or through non-fire-rated walls: 20 gauge galvanized steel, 1" larger than pipe or pipe covering.
- B. For pipe through concrete beams: schedule 40 black steel pipe, 1" larger than pipe or pipe covering.
- C. For pipe passing through floors outside fire rated chases and fire rated wall and partitions, provide 20 gauge steel sleeve leaving the annular space between pipe or pipe covering as required by UL systems. Where pipe is insulated, insulation shall be continuous thru sleeve. Refer to Section Through-Penetration Firestop Systems where included in the contract documents. Otherwise, seal between sleeve and pipe or pipe covering with 3M Brand Fire Barrier CP 25WB caulk, Flamestop V, Specified Technologies, Inc. "Spec Seal Sealant", Rectorseal Corp. Metacaulk 950 or Hilti FSTONE bearing UL listing for actual conditions of installation, thickness and application in strict accord with UL reference for each type installation. Any equivalents must meet the 10 day prior approval provision and must show UL approval for all conditions, bare pipe, insulated pipe, etc. For plastic piping material submittal must show UL approval for each application and if caulk comes in direct contact with pipe, it must be compatible and not injurious to the pipe.
- D. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.

- E. Extend floor sleeves 1-1/2" above finish floor in areas where floor is subject to being wet during normal usage (mechanical rooms, etc.).
- F. Where exposed pipes pass through walls and partitions in finished spaces, provide chrome plated F & C plates or escutcheons.

1.16 VALVE TAGS:

- A. 2" X 3" laminated plastic with 1/2" numbers engraved at top, leaving space for further engraving by others. Secure tags with chains to valve yoke or stem, not handles.
- B. Valve tag colors:
 - 1. Fire Protection: White tags with red numbers.
- C. Valve tag locations: At all valves on mains, risers and branches (not equipment service valves).
- D. Valve tag numbers: Starting with Number 1, number tags in sequence from the lowest point to the highest point in the building. In existing buildings extend existing sequences.

1.17 VALVE CHARTS:

- A. In all mechanical rooms, provide charts showing number and locations of all labeled valves, type of service, etc. Laminate in heavy plastic and provide brass grommets for attaching to wall. Attach to wall with anchors and brass screws.

1.18 EQUIPMENT IDENTIFICATION:

- A. Provide 2" x 3" or larger laminated plastic nameplates with 1/2" numbers and letters in colors specified below. Screw tags to equipment in obvious locations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tag, leaving lower half of tag for future engraving by Owner.
- B. Provide similar nameplates for motor starters furnished under this division.
- C. Secure nameplates with acorn head screws.
- D. Colors:
 - 1. Equipment connected to utility power only - black letters on white nameplates.
 - 2. Equipment connected to emergency power - red letters on white nameplates.

1.19 ACCESS DOORS:

- A. Furnish and install access doors for valves, fire dampers, dampers, controls, air vents, and other items located above non-liftout ceilings or behind partitions or walls. Doors in non-fire rated walls and ceilings: 16-gauge steel with hinges and screwdriver latches. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Doors in security ceilings to be 10 ga. steel panels, white powder coat, 2" x 2" x 3/16" steel angle frame heavy duty butt hinges with security screws. Provide door styles compatible with adjoining surfaces as selected by Architect. Size doors to permit removal of equipment and/or maintenance. Doors: Bar-Co, Nystrom, Williams Bros., or equal.

- B. Mark lay-in ceilings with colored vinyl self adhering disc stuck on grid adjacent to maintenance access points.

1.20 TESTS, CLEANING & ADJUSTMENTS:

- A. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 72 hour notice is required prior to performance of test.
- B. After systems have been installed complete, adjust and test systems for proper operation. ***All instruments used for testing work shall have been calibrated within 6 months and checked for accuracy prior to start of work.***
- C. Perform all tests as required by local codes. Contractor shall furnish testing equipment. ***All piping pressure tests shall be hydrostatic tests.***
- D. If local codes are more stringent than the following, local codes shall govern.

1.21 WARRANTY & INSTRUCTIONS:

- A. See General Conditions - One-Year Warranty.
- B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one year after date of substantial completion of the Contract. Should any defects in material, workmanship, or equipment be made known to Contractor within the one-year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.
- C. After completion of the work, Contractor shall operate the equipment which he installs for a period of (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment.
- D. Provide PDF of manufacturer's operating and maintenance manuals and parts lists for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency thereof. Include all warranty dates on equipment and guarantees.

1.22 PROJECT CLOSE-OUT:

- A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
 - 1. Record drawings - Fire protection systems: PDF files and CAD files.
 - 2. Equipment Submittal Data PDF files.
 - 3. Equipment operating and maintenance manuals PDF files.
 - 4. Maintenance schedule.
 - 5. Equipment warranty dates and guarantees.
 - 6. List of Owner's Personnel who have received maintenance instructions.
 - 7. Test results of fire protection systems and names of those witnessing test. (See Section 21 4000

and NFPA 25 for testing requirements.)

8. Install valve charts in Mechanical Rooms.

1.23 TRAINING OF OWNER PERSONNEL:

- A. The General Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
- B. The Engineer shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
 1. The Fire Protection Engineer shall determine the special needs and areas where training will be most valuable. The Owner and Engineer shall decide how rigorous the training should be for each piece of commissioned equipment. The Fire Protection Engineer shall communicate the results to the Subs and vendors who have training responsibilities.
 2. Each Sub and vendor responsible for training shall submit a written training plan to the Fire Protection Engineer for review and approval prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - i. Instructor and qualifications
 3. The General Contractor shall develop an overall training plan and shall coordinate and schedule, with the Subcontractors and other consultants, the overall training for the commissioned systems. The Engineer will recommend approval of the training to the Owner upon satisfactory completion using a standard approval form. The Owner and Contractors sign the approval form.
 4. Video taping of the training sessions will be provided at the Owners request.
- C. Fire Protection Contractor. The Fire Protection Contractor shall have the following training responsibilities:
 1. Provide the Fire Protection Engineer and Owner with a training plan two weeks before the planned training.
 2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.
 3. Training shall normally start with classroom 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.

4. 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 will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The training sessions shall 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.
7. Training shall include:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. 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 and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
 - g. Discussion of any peculiarities of equipment installation or operation.
 - h. Classroom sessions shall include the use of overhead projections, slides, video/audio- taped material as might be appropriate.
8. The Fire Protection contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls.
9. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.
10. Minimum Duration of Training. The Fire Protection contractor shall provide training on each piece of equipment according to the following schedule.

<u>Hours</u>	<u>System</u>
.5	Piping Systems
1	Fire Protection System
.5	Fire Sprinklers

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 21 0500 - "General Provisions – Fire Suppression" shall apply to and become part of this Section.

PART 2 - MATERIALS: Unless otherwise noted, provide new, standard, first-grade materials throughout. Unless otherwise noted, all products and materials shall be manufactured in the U.S.A. This shall include but not limited to: Pipe, fittings, hangers, valves, switches, gauges, sprinklers, pumps and all other associated equipment.

2.1 PIPE HANGERS:

- A. General: Pipe hangers, Anvil, PHD, Michigan Hanger, B-Line or Elcen. Anvil figure numbers are given for reference.
- B. Equip pipe hangers with vibration isolators as specified under Vibration Isolators.
- C. Pipe hangers for lines 3" and smaller: adjustable wrought ring hangers, Anvil Fig. 97 or 69 or wrought clevis hangers.
- D. Pipe hangers for piping 4" and larger: adjustable wrought clevis hangers.
- E. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.
- F. Beam Clamps: Anvil Fig. 92.
- G. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Anvil Fig. 282.
- H. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (powder driven anchors are not acceptable).
- I. Size rods for pipe hangers per NFPA 13.
- J. Space pipe hangers per NFPA 13.

2.2 GAUGES:

- A. Install 4-1/2" dial pressure gauges per NFPA 13. Gauges shall have bronze or stainless steel bourdon tubes, 316 stainless steel movement, aluminum or polypropylene solid front cases, adjustable micrometer pointer and accuracy Grade 2A not less than 1/2% of full scale over the entire range, without mounting flange. Gauges shall be Ashcroft 1279, Marsh Series P01, Trerice 450-B, Weksler AA44-2 or U.S. Gauge 1980L with minimum bourdon tube diameter of 3". Provide ball valves for all pressure gauges. Provide siphons for steam gauges.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION:

- A. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.
- B. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.
- C. Install drains from low points and inspector's test in fire protection piping to approved points, whether shown or not.
- D. Run piping concealed, except where specifically shown or specified to be exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise.
- E. Lay underground fire protection piping so top of pipe is at least 30" below finished grade. Support all underground piping solidly along body of pipe. Strongly suspend other piping from building construction.
- F. Run no piping in direct contact with slag fill. Where necessary to pass through slag, protect piping with not less than two wrappings of polyvinyl chloride tape or equivalent protection approved by Architect.
- G. For pipe passing through floors outside fire rated chases and fire rated wall and partitions, provide 20 gauge steel sleeve leaving the annular space between pipe or pipe covering as required by UL systems. Where pipe is insulated, insulation shall be continuous thru sleeve. Refer to Section Through-Penetrations Firestop Systems where included in the contract documents, Otherwise, seal between sleeve and pipe or pipe covering with 3M Brand Fire Barrier CP 25WB caulk, bearing UL listing for actual conditions of installation, thickness and application in strict accord with UL reference for each type installation.
- H. The firestop systems provided shall resist the spread of fire, resist the passage of smoke and other gases.
- I. Provide U.L. classified through-penetration firestop system for each penetration in accordance with manufacturer's guidelines.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 21 0500 - "General Provisions - Fire Suppression" and Section 21 1000 - "Materials and Methods - Fire Suppression" shall apply to and become part of this Section.
- B. It is the Contractor's responsibility to verify flow test data prior to ordering any equipment. If results do not meet demand, he is to notify the Architect prior to preparing shop drawings. If the test is more than one year old, the Contractor shall have the system retested.

1.2 SHOP DRAWINGS:

- A. Hydraulic calculations and sprinkler shop drawings for building fire protection systems must be prepared under the supervision of an engineer licensed in the State of (**Alabama**). Layout to show precise locations and elevations of sprinkler heads and piping with sizes indicated. Coordinate location of piping and sprinkler heads with other work, including piping, ducts, diffusers and lighting fixture layout. When submitted to Architect, drawings and calculations shall bear the stamps of approval from Owner's Underwriter and local Fire Marshal's office.
- B. Prepare shop drawings: (**Shop drawings, hydraulic calculations and material data may be submitted in PDF format electronically by e-mail**)
- C. State on drawings: Hose threads match the Local Fire Department Equipment.

1.3 CODES:

- A. Provide all equipment, piping, valves, switches and complete operating system to standard of NFPA 13, and 20 in compliance with local, county and state authorities, Owner's Underwriter, and these Specifications.

1.4 SERVICE:

- A. Coordinate with Civil and provide for connection at approximately 5 feet outside of building.

1.5 HYDROSTATIC TESTING:

- A. Fire protection piping tests: Test in accordance with NFPA 13, and 25. Architect, Owner's Underwriters and local Fire Marshal shall witness tests. Provide certificate of inspection to the Architect including the names of those witnessing the test.
- B. In addition to the standard hydrostatic test, all dry piped systems shall require an air pressure leakage test at 40 psi to be conducted for 24 hours. Any leakage that results in a loss of pressure shall be corrected prior to performing the hydrostatic test.

- C. On completion of installation test all piping and attached appurtenances subjected to system working pressure at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, the system shall maintain that pressure for 2 hours. Pressure loss shall be determined by a drop in gauge pressure or visual leakage. The test pressure shall be read from one of the following, located at the lowest elevation of the system or the portion of the system being tested:
 - 1. A gauge located at one of the hydrant outlets
 - 2. A gauge located at the lowest point where no hydrants are provided
- D. To reduce the possibility of serious water damage in case of a break, pressure can be maintained by a small pump, the main controlling gate meanwhile being kept shut during the test.
- E. Hydrostatic tests should be made before the joints are covered so that any leaks can be readily detected.
- F. The test procedure is as follows: Apply additional pressure, by temporary pump or compressed air connection. The water pressure is to be increased in 50 psi increments until the test pressure described above is attained. After each increase in pressure, observations are to be made of the stability of the joints. These observations are to include such items as protrusion or extrusion of the gasket, leakage, or other factors likely to affect the continued use of a pipe in service. During the test, the pressure is not to be increased to the next increment until the joint has become stable. This applies particularly to movement of the gasket. After the pressure has been increased to the required maximum value and held for 1 hour, the pressure is to be decreased to 0 psi while observations are made for leakage. The pressure is again to be slowly increased to the value specified above and held for 1 more hour while observations are made for leakage.
- G. Loss shall be determined by a drop in gauge pressure or visual leakage.
- H. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

PART 2 - PRODUCTS Unless otherwise noted, provide new, standard, first-grade materials throughout. Unless otherwise noted, all products and materials shall be manufactured in the U.S.A. This shall include but not limited to: Pipe, fittings, hangers, valves, switches, gauges, sprinklers, pumps and all other associated equipment.

2.1 GENERAL:

- A. Refer to Electrical Drawings and Specifications for alarms, wiring of supervisory switches and related equipment.

2.2 FIRE PROTECTION PIPING:

- A. System shall comply with NFPA 13.
- B. All fire protection piping within building: black steel. All underground fire protection piping outside building: ductile iron. All fire protection piping above ground on outside of building: galvanized. **Use of CPVC fire protection piping is not approved and must be pre-approved for use by the Owner in writing. Any CPVC fire protection piping installed without pre-approval in writing will be replaced with specified material at contractor's expense.**

- C. Black steel pipe: schedule 40, ASTM A-53, A-106 or A-135. Fittings on piping 2" and smaller black malleable iron or cast iron 175 lb., screwed ANSI B 16.4 or B 16.3; piping fittings 2-1/2" and larger, welded fittings, ANSI B 16.9 or Victaulic, Anvil or Gustin Bacon fittings for roll grooved pipe, ASTM A-47. Where allowed by NFPA 13 and Owner's Underwriter, schedule 10 black steel pipe with roll groove may be substituted.
- D. In Pre-Action and Dry Pipe System, steel pipe must be internally galvanized.
- E. Ductile iron pipe: cement lined, ANSI A 21.50.
- F. Joints on black steel screwed piping: Make up with Teflon tape applied to male threads.
- G. Joints on black steel welded piping: Comply with ANSI standard. B 16.9 and B 16.25.
- H. Joints on black steel grooved piping: Victaulic, Anvil or Gustin Bacon couplings, ASTM-A-47. Note: Victaulic #920 or #922 Mechanical T's are approved for use only where connections to existing systems are required. All joints must be cut or roll grooved.
- I. Joints on ductile iron piping: standard mechanical joint ANSI A21.11. Provide retainer glands on all fittings. Provide concrete thrust block, minimum 1 cubic yard, at all fittings. Thrust block must bear against virgin soil.
- J. Arrange for connection to existing water main, backflow preventer as required by local utility, service line from main to building as required by local utility. Pay all charges, fees, temporary deposits, etc.

2.3 PIPE HANGERS:

- A. General: Pipe hangers, Anvil, PHD, Michigan Hanger, B-Line or Elcen. Anvil figure numbers are given for reference.
- B. Pipe hangers for lines 8" and smaller: Anvil Fig. 69.
- C. Trapezes where required to bridge between structural members, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze.
- D. Beam Clamps: Anvil Fig. 92.
- E. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Anvil Fig. 282.
- F. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (powder driven anchors are not acceptable).
- G. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe thru 3", 1/2" rods for 4", 5", 6" and 8", 5/8" rods for pipe 10" and larger.
- H. Pipe hanger spacing for screwed, cut or roll groove joint and welded piping in strict accord with NFPA 13. Install additional hangers at change of direction, valve clusters, and at ends of branch lines.

2.4 FIRE PROTECTION VALVES:

- A. Gate valves 2" and smaller: all bronze, 175 psig WP, UL listed, OS&Y, solid disc, Stockham B-133, Nibco T-104-0, Milwaukee Valve BB-SC100.

- B. Gate valve 2 1/2" and larger: iron body, bronze trim, flanged, 175 psig WP, UL listed, OS&Y, Stockham G-634, American Darling 55, Kennedy 68, Mueller A2073-6, Nibco F-607-0.
- C. Butterfly Valves: Central Figure 570 or 580 complete with supervisory switch for indoor or waterproof on exterior UL/FM approved.
- D. Check valves: iron body, bronze trim, 175 psig WP, UL listed, Stockham G-939, American Flow Control 50-SC, Kennedy 126, Mueller A2120-6, Nibco F-908-B.

2.5 SPRINKLER WATER FLOW INDICATOR AND SUPERVISORY SWITCHES:

- A. Underwriter approved paddle switch type water flow indicator, 120/1/60, two single pole, double throw contacts, one set for remote alarm, one set for alarm bell, complete with supervised cover on device. Automatic, Viking, or Anvil.
- B. Underwriter approved 6" electric bell, 120/1/60, or water motor alarm gong, paint exterior of bell as required by Architect.
- C. Supervisory switches, equal to Notifier Company Model NGV or SGV or Potter OSYSU-1 or -2 with NEMA 6P enclosure shall be used where subject to any condition where water is present, such as, in exterior vaults, complete with supervised cover on device. Potter waterproof switches must be used where installed outside building. All valves shall be supervised open. Provide with 2 sets of single pole double throw contacts.
- D. Verify location of any bells or alarms with Architect.

2.6 SPRINKLER HEADS:

- A. Sprinkler heads shall be **(Quick Response)** commercial type, U.L. listed by Reliable, Victaulic, Tyco, Viking, Globe or approved equal. **Sprinkler heads shall be centered both directions in ceiling tile, located symmetrically in rooms and centered in corridors. Location of sprinklers to be approved by Architect.**
- B. Submit sample of any proposed equivalents in sprinklers prior to bid date. See Substitutions Section.
- C. Sprinklers subject to mechanical injury shall be protected with listed guards.

2.7 SPARE SPRINKLERS:

- A. Provide sprinklers and all required items in cabinet per NFPA 13. Provide one sprinkler wrench for each type head.

PART 3 - EXECUTION

3.1 PIPING:

- A. Provide drain piping to approved locations for all low points. Provide inspectors test piping to the building exterior at approved locations. Provide splash blocks for all exterior drains. (All drain piping to be galvanized.)
- B. Install using tradesmen certified in sprinkler pipe and system installations.

- C. Fire protection piping may be factory cut to lengths, but field modifications will be required to coordinate with other trades.

3.2 PERIODIC INSPECTION:

- A. Make two periodic inspections within the first year after completion and acceptance of the work. Furnish a complete written report of each inspection to the Architect and the Underwriter.

END OF SECTION

PART 1 - GENERAL

1.1 FIRE SUPPRESSION SYSTEMS

- A. The design, equipment, installation, testing and maintenance of the Clean Agent System to comply and accordance with the applicable requirements set forth in the latest edition of the following codes, standards, and third-party approval agencies:

1. NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems
2. NFPA 72 – National Fire Alarm and Signaling Code
3. NFPA 70 – National Electric Code
4. FM 1-53 – FM Global Property Loss Prevention Data Sheet for Anechoic Chambers
5. FM Approvals
6. Underwriters Laboratory
7. Requirements of the Authority Having Jurisdiction (AHJ)

The standards listed, as well as all other applicable codes and standards, are to be used as "minimum" design standards. Also consider the requirements of the "Authority Having Jurisdiction" and good engineering practices.

- B. Server Room 160 shall include a turnkey clean agent suppression system, with detection system.
- C. The fire suppression system type shall incorporate an NOVEC-1230 suppression system utilizing FX-5-1-2 as the fire extinguishing agent with a minimum 4.2% design concentration. Provide an equally sized connected reserve supply of clean agent suppression agent as back-up.
- D. The control system shall be a Fike addressable Cheetah Xi control system UL Listed, FM Global approved for releasing services. **(Coordinate with Division 26 – Electrical.)**
- E. The detection system shall provide a minimum 3 programmable levels of alarm. **(Coordinate with Division 26 – Electrical.)**
- F. Arrange the Fire Suppression Systems for fully automatic and manually operated electric control operation, with operating controls of the enclosed release type to prevent accidental operation. **(Coordinate with Division 26 – Electrical.)**

- G. Electrical to provide alarm panel. The control panel to be monitored by the facility fire alarm system. This device monitors the condition of the electric actuator, detectors, warning devices, cylinder pressure, and any manual release and abort stations. All electric or electronic devices must connect to the control panel in order to function. **(Coordinate with Division 26 – Electrical.)**
- H. Server Room 160 shall be equipped with a manual release pull station and suppression discharge abort station located directly outside the room door. **(Coordinate with Division 26 – Electrical.)**
 - 1. The electric manual release switch shall be a dual action device which provides a means of manually discharging the NOVEC-1230 clean agent system when used in conjunction with the Fike Cheetah Xi Control System.
 - 2. The Abort Station shall be located adjacent to each manual station. The abort switch assembly is used to momentarily interrupt the release circuit signal when the control panel is in the alarm condition.
- I. Electrical to provide all required alarms, annunciation, and discharge warning devices. **(Coordinate with Division 26 – Electrical.)**
- J. Provide all appropriate and required caution/advisory signs in compliance with NFPA 2001 requirements. The caution lettering and backgrounds shall meet the requirements of ANSI Z535.
- K. The Fire Suppression Systems shall be placed in a location that does not obstruct the movement of test articles, or equipment, in and out of the chambers, or limit access to other chamber subsystems.
- L. The Fire Suppression Systems shall include a disable switch that allows to manually disable the system. These switches shall be in an Auxiliary Control Panel located adjacent to the clean agent releasing control panel in an independent. **(Coordinate with Division 26 – Electrical.)**
- M. The Fire Suppression Systems shall include air sampling smoke detection which monitors the smoke level inside the chamber's. **(Coordinate with Division 26 – Electrical.)**
- N. The Fire Suppression Systems shall include all plumbing necessary for dispersion of the fire suppression agent.
- O. Provide testing and commissioning of the completed system. Testing will include a pressure test of the system piping and a room integrity test (door fan) of the protected space.
- P. The Fire Suppression Systems shall have a schedule for testing and maintenance of the system provided.
- Q. The Fire Suppression Systems shall meet all local building code requirements

END OF SECTION

PART 1 - GENERAL:

Unless otherwise noted, provide new, standard, first-grade materials throughout. Unless otherwise noted, all products and materials shall be manufactured in the U.S.A. This shall include but not limited to: Pipe, fittings, hangers, valves, switches, gauges, sprinklers, pumps and all other associated equipment.

1.1 SCOPE:

- A. Refer to Sections 21 0500, 21 1000 and 21 4000 for related work.
- B. Refer to Electrical Division 26 for Electrical requirements.
- C. Electrical – Division 26: Supply and install 2 independent circuits, 120VAC, 15A 60Hz for the control panel and the air compressor inside the preaction cabinet. Both circuits shall be well identified and locked.

1.2 APPLICABLE CODES AND STANDARDS:

- A. Comply with the current editions of the following codes and standards:
 - 1. NFPA 13: Installation of Sprinkler Systems.
 - 2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
 - 3. NFPA 72: Standard for the installation, maintenance, and use of protective signaling systems.
 - 4. NFPA 72E: Standard on Automatic Fire Detectors.
 - 5. Local Building Code.
 - 6. Local Fire Code.
 - 7. Local Electrical Code.

1.3 SYSTEM DESCRIPTION:

- A. Supply and install an integrated fire protection system, preaction type, as indicated, including:
 - 1. Preaction cabinet
 - 2. Automatic sprinkler system
 - 3. Fire detection system

- B. All system components shall be compatible and UL listed or F.M. approved and shall be compatible with the building fire alarm system.

- 1. System Design:

- a. The system must be designed for:
 - 1) Occupancy hazard
 - 2) Area of sprinkler operation: See drawing.

1.4 DRAWINGS AND HYDRAULIC CALCULATION:

- A. The contractor must prepare and submit for engineer's approval all installation drawings and hydraulic calculations, as required by N.F.P.A. and local codes.

1.5 TECHNICAL DATA:

- A. Submit for engineer's approval an equipment manual which will include all technical data of each essential component for the system such as automatic sprinklers, electrical detectors, control system, etc.

1.6 MAINTENANCE & OPERATION MANUAL:

- A. Supply a maintenance and operation manual for the preaction system.
- B. This manual must include all necessary instructions to operate and maintain the system, and be explicit regarding the inter-action between the hydraulic aspect (deluge valve and trim) and the detection portion (control panel and detectors). Emergency procedures must form an integral part of the manual.

PART 2 - COMPONENTS:

2.1 PREACTION CABINET:

- A. Supply and install a preaction cabinet containing all hydraulic and electrical components required for the control of a preaction system. The cabinet shall include the following:
 - 1. Sturdy 14 gauge steel cabinet, measuring 72" x 36" x 20" for 2", 3" and 4" systems.
 - 2. Rust proof coating, inside and outside, fire red, oven baked polyester powder on phosphate base.
 - 3. Nema 12 construction.
 - 4. Individual access doors for the hydraulic and electrical section and the emergency release.
 - 5. Deluge Valve, complete with trim.
 - 6. Control panel, with batteries.
 - 7. Automatic air compressor of sufficient capacity to fill the system in prescribed time.
 - 8. Electrical junction box for connection of detection system, auxiliary contacts and air compressor.

- 9. Gauges to indicate water supply pressure, priming water pressure and air pressure of the system.
- 10. Schedule 40 steel pipe header with grooved ends to be connected to supply water.
- 11. Schedule 40 2" steel pipe header with grooved ends to be connected to the drain.
- B. All cabinet components must be compatible and be listed or approved for this use.
- C. The cabinet must be pre-assembled, pre-wired and tested, as a UL assembly.

2.2 DETECTION AND SIGNALING SYSTEM:

- A. Supply and install a complete electrical detection system including:
 - 1. System tubing, wiring, smoke detectors and signaling devices.
- B. The smoke detectors shall be wired as a single zone. This zone will consist of a combination of photoelectric and ionic detectors.
- C. The smoke detectors and the audible devices (bell and horn 24 VDC) must be compatible with the release control panel. The ionic and photoelectric detectors will be System Sensor, model 1451 and 2451, with base no. B401B. The bell and the horn should be installed near the Pre-action component cabinet system.

2.3 SYSTEM OPERATION:

- A. The activation of at least one electrical detector AND the opening of an automatic sprinkler are necessary to cause water discharge.
- B. The activation alone of an electrical detector will initiate the sounding of a warning device and the activation of alarm contact for remote transmission but will not cause the system to fill.
- C. The opening of an automatic sprinkler or damage to system piping will initiate the sounding of a warning device and the activation of alarm contact but will not cause the system to fill.
- D. The activation of at least one electrical detector AND the opening of an automatic sprinkler will cause water to discharge. The alarm signal will sound and an auxiliary contact for a water flow signal will be activated.

2.4 AIR SUPPLY

- A. The automatic sprinkler piping is air supervised from compressor in preaction cabinet.
- B. The air compressor must be of proper size to restore normal air pressure in the system within 30 minutes.

2.5 SPRINKLER HEADS:

- A. Sprinkler heads shall be **(Quick Response)** commercial type, U.L. listed by Reliable, Victaulic, Tyco, Viking, Globe or approved equal. **Sprinkler heads shall be centered both directions in ceiling tile.**
- B. Provide quick response brass upright sprinklers in areas without ceilings.

- C. Provide quick response recessed chrome plated pendent type sprinklers with chrome plated removable escutcheons in areas with ceilings.
- D. Provide quick response concealed style pendent sprinklers with white cover plates where required.
- E. Where sidewall sprinklers are used provide quick response type.
- F. Existing pipe and fittings may be reused but all sprinklers within the contract limits shall be new and new sprinklers shall be quick response type. Contractor to verify that existing sprinkler in the same compartment with the new work are quick response type. Where sprinklers are found to be standard response replace with quick response type sprinklers. Sprinklers to match existing in appearance, i.e. color and concealment.
- G. Submit sample of any proposed equivalents in heads prior to bid date. See Substitutions Section.

2.6 SPARE HEADS:

- A. Provide heads in cabinet per NFPA 13. Provide one sprinkler wrench for each type head.

2.7 PIPING:

- A. System piping and fittings shall be as recommended by NFPA 13 and the system manufacturer.

2.8 SYSTEM DRAIN:

- A. The drain collector of the TotalPac system shall be connected to an open drain, to Mechanical Room, MFD on floor below. The drain piping shall not be restricted or reduced.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. The installation must meet all established standards and be according to all laws, rules and codes in force.
- B. The proper operation and the coordination for system installation, including the automatic sprinkler system, detection system, signaling system and initial start-ups are the responsibility of the fire protection contractor.

3.2 TRAINING:

- A. The contractor must plan and organize a training session of at least two hours for the building maintenance staff, in the presence of building owner or his representative.
- B. The training session must include the normal operation, emergency procedures and system maintenance.

3.3 TESTS AND VERIFICATIONS:

- A. Hydrostatic tests must be performed on the entire sprinkler piping system, as required by NFPA 13.

- B. In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bars) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1-1/2 psi (0.1 bar) during the 24 hours shall be corrected.
- C. A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to make sure that no back pressure in drain piping exists, which could affect the proper operation of the preaction system.
- D. An air supply test must be performed, to confirm that normal air pressure can be restored within 30 minutes.
- E. The verification of the fire alarm system must be done in accordance with the NFPA 72.

3.4 REPORT & CERTIFICATE:

- A. An inspection report and certificate must be supplied to the engineer at the completion of the project.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE:

- A. Provisions of this Section apply to all Plumbing work.
- B. Include the provisions of General Conditions as part of this Section.
- C. Provide all labor, materials, equipment, and services necessary for the completion of all Plumbing work shown or specified, complete and ready for operation, consisting in general of the following:
 - 1. A system of sanitary drain, waste, and vent piping.
 - 2. A system of domestic water piping.
 - 3. A system of natural gas piping.
 - 4. Providing plumbing fixtures and equipment as shown on drawings.
- D. Give required notices, file drawings, obtain and pay for permits, deposits and fees necessary for the installation of the Plumbing work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.
- E. "Provide" means to furnish and install, complete and ready for operation.

1.2 DRAWINGS:

- A. Plumbing Drawings are diagrammatic and subject to requirements of Architectural Drawings and conditions existing in the field. Plumbing Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work.
- B. Follow the drawings closely, coordinate dimensions with Architectural Drawings and field conditions. DO NOT scale Plumbing drawings for location of system components.
- C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or mislocated work in proper manner.
- D. Contractor for Plumbing work is responsible for coordinating with all trades.

1.3 APPLICABLE CODES AND STANDARDS:

- A. Comply with the current editions of the following Codes and Standards:
 - 1. ANSI/B31.9 - Code for Building Services Piping
 - 2. ASME Boiler and Pressure Vessel Code

3. 2014 FGI “Guidelines for Design and Construction of Hospitals and Health Care Facilities”
4. Rules of Alabama State Board of Health, Division of Licensure and Certification, Chapter 420-5-2, Ambulatory Surgical Treatment Facilities, as amended February 19, 1997, effective March 27, 1997
5. NFPA 54 - National Fuel Gas Code
6. 2023 NFPA 70 - National Electrical Code
7. NFPA 90A – Installation of Air Conditioning and Ventilating Systems
8. NFPA 101 - Safety to Life from Fire in Buildings and Structures
9. NFPA 110 – Standard for Emergency and Standby Power Systems
10. Other standards as referenced in other sections of Division 22
11. 2024 International Building Code
12. 2024 International Plumbing Code
13. 2024 International Fuel Gas Code
14. 2024 International Mechanical Code
15. 2015 International Energy Conservation Code

1.4 QUALIFICATIONS OF SUBCONTRACTOR:

- A. The Plumbing Subcontractor shall meet the following minimum qualifications:
 1. He shall have been in business as a Plumbing Contractor for at least 3 years prior to the date of opening bids.
 2. He shall have a current Master Plumber's Certificate of competency issued by the State of **Alabama** and the City and County in which work occurs.
 3. He shall have a satisfactory experience record with Plumbing installation of character and scope comparable with this project and shall have completed three such installations in the past three years.
 4. He shall have held a license from the **Alabama** State Licensing Board for General Contractors for at least 3 years.
 5. If the Plumbing Subcontractor, with the Engineer's approval, uses a Sub-Subcontractor to provide another discipline that the Subcontractor does not normally furnish, that Sub-Subcontractor shall meet the same qualifications as the Subcontractor.

1.5 CONFLICTS AND INTERFERENCES:

- A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.6 WORKMANSHIP:

- A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.7 COOPERATION:

- A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.8 VISITING SITE:

- A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

1.9 MATERIALS:

- A. Unless otherwise noted, provide new, standard, first-grade materials throughout. **Unless otherwise noted, all pipe, fittings and valves shall be made in the United States of America.**
- B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the estimate, without substitution, and shall be furnished under the contract unless requests for equivalents are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.
- C. Equivalents will be considered only if written request for approval has been received by the Architect (from a general contract bidder) 10 days prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which an equivalent is proposed and a complete description of the proposed equivalent including drawings, cuts, performance and test data, and deviation from the specification and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the equivalent may require shall be included. The burden of proof of the merit of the proposed equivalent is upon the proposer. The Architect's decision of approval or disapproval of a proposed equivalent is final.
- D. If the Architect approves any proposed equivalent prior to receipt of Proposals, approval will be set forth in an Addendum. **DO NOT RELY UPON APPROVALS MADE IN ANY OTHER MANNER.**
- E. No proposed equivalent will be considered after the Contract has been executed, except as described in the General Conditions.
- F. Within 45 days of execution of contract and before ordering materials or equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Submit PDF format files for approval. Provide PDF files of approved data for project close-out.
- G. All pressure vessels shall be constructed and tested in accordance with applicable ASME codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.
- H. Similar items of equipment shall be the product of the same manufacturer.

1.10 SHOP DRAWINGS:

- A. Before starting work, submit and obtain approval of detailed drawings of the following, fully dimensioned (including elevations of piping) and drawn to 1/4" to 1'-0" scale.

Submit a minimum of 6 sets of bond shop drawings or PDF. All shop drawings shall be produced using AutoCad and a copy of the shop drawing files shall be provided in PDF format for shop drawing review. A thumb-drive with a copy of all approved shop drawings shall be provided for project closeout.

1. Complete Plumbing equipment plans showing location of equipment, floor drains, and equipment pads and foundations.
 2. Equipment piping.
 3. Plumbing piping.
- B. Engineers' CAD/electronic drawings files will be available upon request for the convenience of the contractor and for use in preparation of shop drawings. A service fee of \$100.00 per drawing sheet file shall be remitted to the Engineer prior to delivery of CAD/electronic drawing files along with a signed agreement between the Engineer and Contractor.

1.11 COORDINATION SHOP DRAWINGS:

- A. Coordination shop drawings (one set of mylar or paper sepias) will be required of the following areas, drawn to a scale not smaller than 1/4" = 1'-0":

1. Mechanical Room.

- B.** Start drawings with HVAC shop drawings.

- C. Engineers' CAD/electronic drawings files will be available upon request for the convenience of the contractor and for use in preparation of shop drawings. A service fee of \$100.00 per drawing sheet file shall be remitted to the Engineer prior to delivery of CAD/electronic drawing files along with a signed agreement between the Engineer and Contractor.

- D. Next, the Plumbing Contractor shall add all piping and plumbing to the drawings, indicating all equipment and piping. Indicate elevations of all piping. Draw sections as required to clarify congested situations.

- E. Next, the Fire Protection Contractor shall add all sprinkler heads and fire protection piping.

- F. Next, the Electrical Contractor shall add all electrical fixtures, conduit and equipment.

- G. Next, the drawings shall be submitted to the General Contractor for final coordination.

- H. Finally, after the General Contractor has approved the drawings they shall be submitted to the Architect for his review and comments.

1.12 RECORD DRAWINGS:

- A. When work starts the Architect will furnish two complete sets of white prints of the Plumbing Drawings. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection. When work starts the Architect will furnish two complete sets of white prints of the Plumbing Drawings. All corrections, variations, and deviations, including those required by change orders, if any, shall be recorded in colored ink or colored pencil at the end of each working day on these drawings. The contractor shall include the contract drawings schedules, details, sections, etc. marked as noted above to indicate changes. The marked prints shall be available at all times for the Architect's inspection.
- B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this contract.
 - 1. Accurately show location, size and elevation of new exterior utility work and its relationship to any existing utilities, obstructions, etc., contiguous to the area of work.
 - 2. Block out areas modified by change-order & identify them by change-order number.
 - 3. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.
- C. When work is completed, the Engineers' CAD/electronic drawing files will be made available upon request for the convenience to the contractor for a service fee of \$100.00 per CAD/electronic drawing sheet file and for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the CAD files, removing all superseded data in order to show the actual completed conditions. Include with the record drawings equipment schedules, details, sections, and controls edited to show actual completed conditions. When record drawings are complete, provide one set of mylar reproductions, 2 sets of bond prints, and one complete set of AutoCAD drawing files (AutoCAD 2016 format) and one set of PDF drawing files on CD-ROM disks.

1.13 PROTECTION OF EQUIPMENT:

- A. During construction, protect Plumbing equipment from damage or deterioration and prevent water, dust, etc. from entering the equipment.
- B. During construction, keep all openings in equipment securely covered to prevent entry of water or dust.
- C. When installation is complete, clean equipment and make ready for painting.

1.14 INSTALLATION OF EQUIPMENT:

- A. Install equipment to provide normal service access to all components.
- B. Where drawings show sufficient space for removing components, install equipment to provide such clearance. ***Provide space at all equipment power and control panels as required by local codes.***
- C. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with contract documents, obtain Architect's decision before proceeding.

D. All equipment shall be firmly fastened in place:

1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

1.15 EQUIPMENT SUPPORTS:

- A. Provide supports for piping and equipment. Hot dip galvanize after fabrication all grillage, supports, etc., located outdoors. Prime coat and paint all grillage, supports, etc. located indoors. Where noted provide 304 stainless steel supports. At the Contractor's option, all grillage, supports, etc. located outdoors may be 304 stainless steel instead of hot dip galvanized.
- B. Set floor-mounted equipment on concrete pads or platforms (as indicated) of height shown, but not less than 3-1/2" high. Chamfer pads 1". Extend pad 6" beyond equipment in all directions. Provide pads as follows:
 1. Water heaters: 6" high, No. 4 rebar 12" o.c. both ways.

1.16 FLASHING:

- A. General: Furnish all pitch cups, metal base flashing and counter flashing required for Plumbing Work. Installation of above items is specified in Roofing Section.
- B. Pitch Cups: 20 gauge galvanized steel, at least 8" deep, bases mitered and soldered and extending at least 4" horizontally.
- C. Metal Base Flashing: Galvanized steel for ferrous items, and stainless steel for stainless steel items. Minimum thickness 22 gauge (0.034") galvanized steel, 20 gauge (0.038") stainless steel, 0.032" aluminum. Bases mitered and soldered extending out at least 4" horizontally and 8" vertically.
- D. Metal Counter Flashing: Of material and gauges specified for base flashing, lapping base flashing at least 3".
- E. Vent Pipe and Roof Drain Flashing: Specified in "Roofing Section".
- F. Shower pans specified in another section. Securely clamp drain to pan under this section.

1.17 EXCAVATION & BACKFILLING:

- A. Include all excavation and backfilling required to bring the work to line and grade shown, including excavation of rock and all other materials which may be encountered.
- B. Excavate trenches wide enough for proper installation of work. Grade trench bottoms evenly. Provide bell holes as necessary to insure uniform bearing for pipes. Excavate minimum 6" below pipe. Refill cuts below required pipe grade with sand or compacted gravel. Support pipe continuously along its entire length. (Do not use piers to support piping.)
- C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel (89/10) in accordance with requirements of "Sitework" no less than 95% compactancy. Backfill paved areas with sand or fine gravel (89/10) compacted to meet

requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe. Restore or repair pavements and the like after backfilling, matching adjacent work.

- D. Resod grassed areas and replace bushes, etc.

1.18 MOTORS, STARTERS & ELECTRICAL EQUIPMENT:

- A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.
- B. Should the Contractor with the Architect's approval make changes in electrical equipment from that shown on the Electrical Drawings, the Contractor shall be responsible for the cost of required changes.
- C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.
- D. Motors: 1750 RPM open drip-proof construction unless otherwise shown or specified. Integral horsepower motors shall be of energy-efficient design with apparent efficiency (power factor x efficiency) not less than 75%, Allis-Chalmers, General Electric, Goulds, Louis Allis, Westinghouse.
- E. Where motors are shown or scheduled to be connected to a variable frequency drive, this motor shall be an inverter duty rated by the motor manufacturer and shall comply with NEMA MG1, Article 31.
- F. Where shown on Electrical Drawings, furnish increment wound motors for 2-step starting.
- G. Do not run motors until correct overload elements are installed in starters. Trading overload elements for elements of correct size for motors actually furnished shall be included in this Section.
- H. Unless otherwise shown or specified for single phase motors provide manual starters equal to Square D Class 2510. When installed in equipment rooms provide surface mounted enclosure, and when installed in finished walls outside equipment rooms provide flush mounted enclosure, key operated.
- I. All starters shall be the product of the same manufacturer.
- J. All control panels, electrical assemblies, etc. must bear a label from a recognized testing laboratory as an assembly, not as individual components.

1.19 SLEEVES:

- A. For pipe through floors inside fire rated chases or through non-fire-rated walls: 20 gauge galvanized steel, 1" larger than pipe or pipe covering.
- B. For pipe through concrete beams: schedule 40 black steel pipe, 1" larger than pipe or pipe covering.
- C. For pipe passing through floors outside fire rated chases and fire rated wall and partitions, provide 20 gauge steel sleeve leaving the annular space between pipe or pipe covering as required by UL systems. Where pipe is insulated, insulation shall be continuous thru sleeve. Refer to Section Through-Penetrations Firestop Systems where included in the contract documents, Otherwise, seal between sleeve and pipe or pipe covering with 3M Brand Fire Barrier CP 25WB caulk, Flamestop V, Specified Technologies, Inc. "Spec Seal Sealant", Rectorseal Corp. Metacaulk 950 or Hilti FSTONE bearing UL listing for actual conditions of installation, thickness and application in strict accord with UL reference for each type installation. Any equivalents must meet the 10 day prior approval provision and must show UL approval for all conditions, bare pipe, insulated pipe, etc. For plastic piping material submittal must show UL approval for each application and if caulk comes in direct contact with pipe, it must be compatible and not injurious to the pipe.

- D. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.
- E. Extend floor sleeves 1-1/2" above finish floor in areas where floor is subject to being wet during normal usage (Plumbing rooms, toilets, etc.).
- F. Where exposed pipes pass through walls and partitions in finished spaces, provide chrome plated F & C plates or escutcheons.

1.20 PAINTING:

- A. Refinish equipment damaged during construction to new condition.
- B. Paint all non-potable water pipe and insulation yellow in accordance with Plumbing Code using paint of type specified in Painting Section.
- C. Prime and paint all bare, exposed, exterior piping using type specified in Painting Section. Gas piping shall be painted yellow unless otherwise noted.
- D. Prime and paint all grillage, supports, etc. located indoors, except where noted to be galvanized.
- E. Other painting is specified in Painting Section, Finishes Division.

1.21 PIPE IDENTIFICATION:

- A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. (Markers on lines 8" OD and smaller shall be taped in place; on lines over 8" OD secure with spring clips.) Markers shall be equal to Craftmark, Brady, Seton or Brimar.
- B. Protect all factory identification tags, nameplates, model and serial numbers, stenciling, etc., during construction and replace if damaged.
- C. Label Spacing and Extent:
 - 1. On straight run of pipes: Above suspended ceilings space labels approximately 10 feet on center; elsewhere, 20 feet on center.
 - 2. Wherever a pipe enters or leaves a room or building.
 - 3. At change of direction.
 - 4. At main valves and control valves (not equipment valves).
 - 5. At manifolds.
 - 6. On risers, just above and below floors.
 - 7. All natural gas piping in the 2 psig system: label at the beginning, at all gas cocks, at ends and at 6'-0" intervals with labels reading "2 psig".

1.22 EQUIPMENT IDENTIFICATION:

- A. Provide 2" x 3" or larger laminated plastic nameplates with 1/2" numbers and letters in colors specified below. Screw tags to equipment in obvious locations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tag, leaving lower half of tag for future engraving by Owner.
- B. Provide similar nameplates for motor starters furnished under Division 26.
- C. Secure nameplates with acorn head screws.
- D. Colors:
 - 1. Equipment connected to utility power only - black letters on white nameplates.
 - 2. Equipment connected to emergency power - red letters on white nameplates.

1.23 ACCESS DOORS:

- A. Furnish and install access doors for valves, fire dampers, dampers, controls, air vents, and other items located above non-liftout ceilings or behind partitions or walls. Doors in non-fire rated walls and ceilings: 16-gauge steel with hinges and screwdriver latches. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Doors in security ceilings to be 10 ga. steel panels, white powder coat, 2" x 2" x 3/16" steel angle frame heavy duty butt hinges with security screws. Provide door styles compatible with adjoining surfaces as selected by Architect. Size doors to permit removal of equipment and/or maintenance. Doors: Bar-Co, Nystrom, Williams Bros., or equal.
- B. Mark lay-in ceilings with colored vinyl self adhering disc stuck on grid adjacent to maintenance access points.

1.24 TESTS, CLEANING & ADJUSTMENTS:

- A. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 72 hour notice is required prior to performance of test.
- B. After systems have been installed complete, adjust and test systems for proper operation and correct all noise or vibration conditions. Perform all tests as required by local codes. Contractor shall furnish testing equipment. All piping pressure tests shall be hydrostatic tests. ***All instruments used for testing and balancing work shall have been calibrated within six months and checked for accuracy prior to start of work.***
- C. If local codes are more stringent than the following, local codes shall govern.
- D. Domestic water piping: Test by applying pressure (by temporary pump or compressed air connection) to total hydrostatic pressure 1-1/2 times street pressure but not less than 150 psig for not less than 4 hours. Immediately and completely stop all leaks. On completion of roughing-in, cap all outlets, make connections with house supply line, and put under full water pressure. After testing, leave general pressure on until ready to install fixture (except when necessary to drain to avoid freezing during construction). After completion of all tests, repairs and installation of fixtures, flush all domestic hot and cold water piping with water to remove sediment and scale and then disinfect. Disinfect piping with hypochlorite solution of chlorine or compressed chlorine gas applied through an approved chlorinator. Operate valves and faucets several times to insure the chlorine reaches all parts of the system. Feed water and chlorination agent into the system at rates that will provide a residual chlorine content of not less than 50 ppm after a retention period of 6 hours. Upon completion of treatment, flush treated water

from each system until the water supply is satisfactory to the public health authority having jurisdiction. Provide Architect a certificate of compliance from the local Health Department as required.

- E. Natural Gas Piping Tests: After all piping is roughed in but before connection to main or to appliances or equipment, test piping for tightness as required by local gas company; or in the absence of such requirements, apply in Architect's presence an air pressure test equal to 25 psig, which piping shall maintain without pressure drop for at least four hours. Stop all leaks shown up by such test and repeat test until piping is airtight. Black steel piping below grade shall be Holiday tested prior to backfilling.
- F. Shower Floor:
 - 1. Test shower floors for tightness after membrane is installed and clamped to shower drain with 3" of water for 4 hours with no loss of water.
- G. Start-Up and Service:
 - 1. The Contractor and factory authorized service representative for the water heaters, shall place each item of such equipment into satisfactory operation with all automatic and safety devices. Further, all adjustment service required shall be performed during the warranty period.
 - 2. In addition, submit equipment manufacturers' start-up reports for items listed above. See Paragraph "Project Close-Out", below.
 - 3. The Contractor shall balance all hot water pumps and circuit setters to flow shown on drawings. Balancing shall not be started until 1) Systems have been completed, including leak testing and cleaning and until systems have been refilled, pumps are rotating correctly, and strainers have been cleaned and baskets used for the ultimate installation have been installed, and 2) Expansion tanks have been installed and correct system pressure is being maintained, and system has been vented and is free from air.
 - a. Adjust circuit setters to meet design GPM requirements. Measure and record GPM.
 - b. Produce a report documenting the measured flows and submit three (3) copies of the report to the Architect.

1.25 WARRANTY & INSTRUCTIONS:

- A. See General Conditions - One-Year Warranty.
- B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one year after date of substantial completion of the Contract. Should any defects in material, workmanship, or equipment be made known to Contractor within the one-year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.
- C. Provide PDF of manufacturer's operating and maintenance manuals and parts lists for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency thereof. Include all warranty dates on equipment and guarantees.
- D. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.
- E. Make available to the Owner, without additional cost, service and adjustment of the equipment for the guarantee period.

1.26 PROJECT CLOSE-OUT:

- A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
 - 1. Record drawings – plumbing: PDF files and CAD files.
 - 2. Equipment Submittal Data PDF files.
 - 3. Equipment operating and maintenance manuals PDF files.
 - 4. Maintenance schedule.
 - 5. Equipment warranty dates and guarantees.
 - 6. Pressure vessel certificates.
 - 7. Circulating hot water balance report.
 - 8. Certificate of disinfection of domestic water lines as required by local authority.
 - 9. List of Owner's Personnel who have received maintenance instructions.
 - 10. Install valve charts in Mechanical Rooms.
 - 11. Submit factory start-up reports for:
 - a. Water heaters
 - 12. Include with insulation material submittal letters from the insulation material manufacturer certifying that the insulation material does not contain asbestos in any shape, form or quantity.

1.27 TRAINING OF OWNER PERSONNEL:

- A. The General Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
- B. The Engineer shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
 - 1. The Plumbing Engineer shall determine the special needs and areas where training will be most valuable. The Owner and Engineer shall decide how rigorous the training should be for each piece of commissioned equipment. The Plumbing Engineer shall communicate the results to the Subs and vendors who have training responsibilities.
 - 2. Each Sub and vendor responsible for training shall submit a written training plan to the Plumbing Engineer for review and approval prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives

- e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - i. Instructor and qualifications
3. The General Contractor shall develop an overall training plan and shall coordinate and schedule, with the Subcontractors and other consultants, the overall training for the commissioned systems. The Engineer will recommend approval of the training to the Owner upon satisfactory completion using a standard approval form. The Owner and Contractors sign the approval form.
4. Video taping of the training sessions will be provided at the Owners request.
- C. Plumbing Contractor. The Plumbing Contractor shall have the following training responsibilities:
- 1. Provide the Plumbing Engineer and Owner with a training plan two weeks before the planned training.
 - 2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.
 - 3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, power failure, etc.
 - 4. 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 will be repaired or adjusted as necessary and the demonstration repeated.
 - 5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
 - 6. The training sessions shall 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.
 - 7. Training shall include:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. 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 and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.

- f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
 - g. Discussion of any peculiarities of equipment installation or operation.
 - h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
- 8. Hands-on training shall include start-up, operation in all modes possible, including manual, start-up shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
 - 9. The Plumbing contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls.
 - 10. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.
 - 11. Minimum Duration of Training. The Plumbing contractor shall provide training on each piece of equipment according to the following schedule.

Hours	System
4	Hot Water Heaters

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 22 0500 - "General Provisions - Plumbing" shall apply to and become part of this Section.

PART 2 - MATERIALS: (Unless otherwise noted, all pipe, fittings and valves shall be manufactured in the United States of America)

NOTE: All materials used in systems that may be used for potable water shall meet the Reduction of Lead in Drinking Water Act.

2.1 SANITARY, WASTE, AND VENT PIPING:

- A. Piping below slab (all sizes):
 - 1. Solid wall, Schedule 40, PVC-DWV with solvent welded joints.
- B. Piping below slab (high temperature wastes, 120 deg F or higher)
 - 1. Service weight, hub and spigot cast iron, epoxy lined, with compression gaskets
- C. Piping above slab (all sizes), branches, mains and stacks:
 - 1. Solid wall, Schedule 40, PVC-DWV with solvent welded joints.
- D. Piping connections between equipment and branches, mains and stacks:
 - 1. No hub cast iron with heavy duty shielded couplings
 - 2. DWV Copper with low lead solder joints
 - 3. Solid wall, schedule 40, PVC DWV with solvent welded joints.
- E. Equipment drain piping, terminating indirectly:
 - 1. Pipe sizes up to NPS 1: Type M copper with low lead solder joints
 - 2. Pipe sizes NPS 1-1/4 and larger: DWV Copper with low lead solder joints
 - 3. High Temperature (above 120°F): schedule 10 stainless steel
- F. The use of Foam Core / Cellular Core PVC is strictly prohibited!
- G. DWV copper pipe: copper drainage tube DWV meeting ASTM B 306 with cast bronze solder joint drainage fittings, ANSI B-16-23.

- H. Type M copper: ASTM B-88, hard temper, wrought copper fittings, long radius, ANSI B16.18 or B16.22, for pipe sizes 1" and smaller.
- I. PVC-DWV plastic pipe: PVC-DWV, ASTM D-2665 shall not be used in ceiling plenum return. Solid core only permitted. Cell core not allowed. Provide PVC to cast iron adaptors below slab on grade for caulking or compression joint. No hub bands are not allowed. As an alternative provide coupling equal to Mission Heavyweight at the finish floor.
- J. Joints for cast iron piping: compression gasket especially made for cast iron soil pipe, ASTM FC-564-85.
- K. Joints for no-hub cast iron piping: no-hub neoprene gasket and stainless steel coupling CISPI Standard 310 & ASTM C1277. Joints for 4" and larger shall be 4-band heavy-weight equal to Husky. No hub bands are not allowed below slab on grade.
- L. Joints in galvanized pipe: screwed with Teflon tape applied to male threads.
- M. Joints in ductile iron pipe: push on joints applied as directed by manufacturer meeting ANSI/AWWA C111/A21.11 requirements.
- N. Joints for PVC-DWV plastic pipe: solvent welded cement, ASTM D-2564, made in accord with ASTM D-2855. Provide cast iron to PVC adaptors, for caulking or compression joint when connecting to a cast iron drain or when converting from cast iron to PVC.
- O. Install vent stacks through roof. Terminate 6" above finish roof or according to local code. Flashing is specified under Roofing Section.
- P. Connect to City sanitary sewer as required by local authority. Verify exact location and invert prior to installing any pipe.

2.2 DOMESTIC WATER PIPING:

- A. Domestic Water piping within building: copper tube. Water piping outside building 3" and larger: ductile iron; smaller than 3": copper tube.
- B. Copper tube, ASTM B-88, copper water tube, type "L" hard temper inside building, type "K" outside building. Fittings: wrought copper water tube fittings, ANSI B 16.18 or B 16.22. For pipe 4" and larger: Victaulic copper fittings may be substituted for soldered joints.
- C. Ductile iron pipe, cement lined, ANSI A21.50.
- D. Joints on copper tube: soldered as recommended by manufacturer, using 95-5 solder. Lead free solder, flux, etc. is required. For pipe 4" and larger: Victaulic style 606 couplings may be used. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation. All joints created in this manner shall be brazed in compliance with code and in accordance with manufacturer's recommendation. Soft solder joints are prohibited. Installation shall be performed by certified T-Drill crafts people.
- E. Joints on ductile iron pipe: Standard mechanical joint, ANSI A21.11. Provide retainer glands on all fittings meeting ANSI A21.11. Provide concrete thrust block, minimum one cubic yard, at all fittings. Thrust blocks shall bear against virgin soil.
- F. Arrange with local utility to connect to existing water service, service to meter, meter vault, water meter, backflow preventer as required by local utility. Pay all fees, temporary deposits, etc. Any existing service serving the present site, which must be killed, must be included.
- G. Provide temporary construction water at site as required.

2.3 PLUMBING VALVES:

- A. Supply water piping valves as specified. All valves shall meet the Reduction of Lead in Drinking Water Act.
1. Gate valves 2" and smaller: All bronze, 125 psig WSP, solid wedge, Nibco S-113-LF, Milwaukee, or Watts.
 2. Gate valves 2-1/2" and larger: Iron body, bronze trim, 200 psi WOG/125 psi WSP, wedge disc, Nibco F-619-RW, Milwaukee, or Watts.
 3. Outside water main valves: Iron body, bronze trim, 200 psig WOG, solid wedge disc, non-rising stem, parallel seat, American Darling 55, Kennedy 571X, M&H 67-01 or Mueller A2380-20. Provide cast or ductile iron access to grade with tee handle wrench.
 4. Ball valves: (2" and smaller) all bronze, 600 psig WOG, 150 psig WSP, stainless ball and stem, full port, Teflon seats, stem packing seal and thrust washer. Nibco T585-66-LF or S-585-66-LF, Watts, Apollo, Milwaukee or Josam. Provide extension stem capable of clearing 2" insulation, with memory stop, when operated will not disturb vapor seal of insulation.
 5. Ball valves: (2-1/2" thru 6") Watts G-4000, Conbraco IBV-125, Josam, or Kitz 90 cast- iron flanged valve, stainless steel stem and ball, full port.
 6. Butterfly Valves 2-1/2" and larger: Butterfly shall have a ductile iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure with downstream flange removed. The body material shall meet ASTM A 536, ductile iron. Nibco LD2000 or equal by Watts or Bray.
 7. Check valves 2" and smaller: All bronze, 125 psig WSP, swing check, Nibco S-413-Y-LF, Milwaukee or Watts.
 8. Check valves 2 1/2" and larger: Iron body, bronze trim, swing check, 125 psig WSP, Kitz 78, Nibco F-918-B, Milwaukee F-2974-A Domestic or Watts F-511.
 9. Water pressure reducing valves: For low flow Watts LFU5B; higher capacity Watts Series LF115, or Wilkins, Conbraco or Cash Acme, complete with inlet strainer, unions and inlet and outlet pressure gauges.
 10. Calibrated balancing valves ("Circuit Setter"): 125 psig WP, 2" and smaller bronze, screwed; 2-1/2" and larger IBBM, flanged plug valves. All with indicator for angular position of valve, meter connections with positive shut-off valves and internal seals to prevent leakage around stem. Valves should have a locking device to prevent opening past preset position. For each valve provide a flow vs. differential pressure vs. angular position calibration chart and pre-formed foam insulation suitable for temperatures from 35 to 250F. Nibco 1810LF (small) or 737 (large), Armstrong, B&G, Taco or equal.
 11. Flow Splitter: Lead free brass, female NPT connections with quarter-turn ball valves, maximum operating temperature of 194°F, Kemper #651 Series.
- B. Natural gas valves: Plug cocks – 2-1/2" and larger, Resun R-1431, AGA seal of approval, 175 psi; 2" and smaller, Milwaukee BB2-100, Nibco FP-600, Conbraco GB-10/11, GB-50 series, Kitz 58 or Resun R-1430 with CSA seal of approval, 175 psi.

2.4 PIPE HANGERS:

- A. General: Pipe hangers, Anvil, PHD, Michigan Hanger, B-Line or Elcen. Anvil figure numbers are given for reference. Provide copper clad or plastic coated hangers on bare copper lines.
- B. Equip pipe hangers with vibration isolators as specified under Vibration Isolators.
- C. Pipe hangers for lines 3" and smaller: adjustable wrought ring hangers, Anvil Fig. 97 or 69 or wrought clevis hangers.
- D. Pipe hangers for piping 4" and larger: adjustable wrought clevis hangers.
- E. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.
- F. Provide riser clamps on pipe risers on each floor. Clamps in contact with copper or plastic pipe, plastic coated.
- G. Beam Clamps: Anvil Fig. 228.
- H. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Anvil Fig. 282.
- I. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (powder driven anchors are not acceptable).
- J. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8", 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.
- K. Support plumbing water, medical gas and vacuum piping within stud partitions with brackets as manufactured by P&M Bracket Company, Sumner Products, B-Line Ruff-in or Holdrite. Wire is expressly prohibited. Support horizontal plumbing soil and waste piping within stud partitions with Unistrut anchored to floor. Provide fire treated wood backing where required to anchor fixtures and brass securely.
- L. Space pipe hangers at maximum: 5' intervals for cast iron pipe. Pipe hanger spacing for screwed, solder joint and welded piping: 1/2" and 3/4", 6 ft.; 1" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3" and over, 12 ft. Install additional hangers at change of direction and valve clusters.
- M. Install pipe hangers on insulated pipe over pipe covering. Provide factory fabricated insulated pipe shields equal to Pipe Shields, Inc. "Thermal Hanger Shields" or Tru-Balance insulated saddles at hangers. Provide shield insulation of rigid calcium silicate indoors or rigid Perlite Silicate outdoors, the same thickness as adjacent pipe covering. (At Contractor's option, pipe shields may be field fabricated using rigid calcium silicate or foamglass insulation with ASJ and 20 gauge galvanized steel protector. Shield length: 1.5 times nominal pipe size but not less than 4".)

2.5 THERMOMETERS AND GAUGES:

- A. Non-mercury in glass blue reading separable socket industrial thermometers with die cast aluminum or high impact plastic casings of appropriate pattern for each installation, 9" scale lengths and ranges shown, Palmer, Trerice or Weksler. Install thermometers in brass or stainless steel wells. Equip thermometers installed in insulated lines with 1" extension stems or stems long enough to permit unions to clear insulation whichever is greater.
- B. Where shown install brass thermometer wells with screwed caps. Install wells at an angle to retain oil. Size well to fit thermometers specified.
- C. Enlarge pipe 2" and smaller to 2-1/2" at thermometers and thermometer wells.
- D. Install 4-1/2" dial pressure gauges where shown. Gauges shall have bronze or stainless steel bourdon tubes, 316 stainless steel movement, aluminum or polypropylene solid front cases, adjustable micrometer pointer and accuracy Grade 2A not less than 1/2% of full scale over the entire range, without mounting flange. Gauges shall be Ashcroft 1279, Marsh Series P01, Trerice 450-B, Weksler AA44-2 or U.S. Gauge 1980L with minimum bourdon tube diameter of 3". Provide ball valves for all pressure gauges. Provide siphons for steam gauges.
- E. Where shown, provide temperature and pressure measurement plugs and caps equal to Peterson Equipment Co., Inc. "Pete's plug with Nordel seats and seals". Provide one Pressure and Temperature Kit consisting of a 0-100 psi pressure gauge with adaptors, and two thermometers (25-125°F and 0-220°F), all in carrying cases. Provide nipples for Pete's plugs as required to extend through pipe insulation.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION:

- A. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.
- B. Slope Sanitary Drain Lines:
 - 1. 3" and larger: minimum 1/8" per 1'.
 - 2. Less than 3": minimum 1/4" per 1'.
- C. For glycol solutions, joints on black steel screwed pipe made up with thread sealant compatible with glycol; Rectorseal No. 7, or equal.
- D. Provide welding material and labor in accordance with the welding procedures of the Heating, Piping, and Air Conditioning Contractors' National Association or other approved procedure conforming to the requirements of ANSI B31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxyacetylene welding. Provide full perimeter welds at both face end and collar end of each slip-on flange.
- E. Install piping to allow for expansion. Make connections to plumbing fixtures and all equipment to eliminate undue strains in piping and equipment. Furnish necessary fittings and bends to avoid springing of pipes during assembly.

- F. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.
- G. Make horizontal water line size reductions using eccentric reducers (tops flat).
- H. Install 3/4" ball valve drains with hose adaptors at low points of water piping and at bases of all risers (where shown provide larger drains). Provide screwed caps with chains on hose adaptors.
- I. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment. Provide unions on all sides of control valves.
- J. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulating unions or couplings, equal to Victaulic style 47, "V-line" insulating couplings as manufactured by Lochinvar, thread to thread or CTS fabrication flange adaptors for flange connections.
- K. Near heating and air conditioning equipment requiring water provide valved and capped water outlets of sizes shown for connection to equipment, including reduced pressure principal backflow preventers. Make final connections under HVAC work. ***Note that all piping and insulation downstream from backflow preventer must be painted yellow.***
- L. Run piping concealed, except where specifically shown or specified to be exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise.
- M. Lay underground pressure piping so top of pipe is at least 18" below finished grade. Support all underground piping solidly along body of pipe. Strongly suspend other piping from building construction.
- N. Pipe shall be braced at flexible connections to prevent blowouts under operating conditions.
- O. Lay out and grade all gas piping so as to have a minimum of trapped lines. Where trapping of pipe is unavoidable, provide 4" to 6" scale pocket at low point, with removable cap fitting accessible for cleaning out pocket. Install 175 psig WP bronze cock and union at all connections to gas-fired equipment.
- P. Install no gas piping beneath interior slabs on grade. Where gas piping must be installed below slab on grade, pipe must be encased in steel pipe sealed and vented to exterior as shown on detail.
- Q. Run no piping or tubing in direct contact with slag fill. Where necessary to pass through slag, protect piping with not less than two wrappings of polyvinyl chloride tape or equivalent protection approved by Architect.
- R. Provide water hammer arrestors equal to Wilkins WH2950XL. Refer to drawings for location and P.D.I. size. Shock arrestors are required on all equipment with solenoid shutoff valves such as washing machines and dishwashers whether shown or not. Select WH2950XL for use with fixtures which may supply drinking water. Equal by Josam, J.R. Smith, Wade, or Sioux Chief is acceptable.
- S. All water piping shall be installed within the heated envelope of the building, or otherwise protected from freezing.

3.2 INSTALLATION OF VALVES:

- A. Provide shut-off valves in supply and return connections to each item of equipment. Locate valves to isolate each item to facilitate maintenance and/or removal.
- B. Provide check valve in discharge line adjacent to each pump.

- C. Locate valves in piping connections to heat exchangers, water heaters, etc., so heads and tube bundles can be removed without disconnecting equipment or piping other than union or flange connections immediately adjacent to the equipment.
- D. Provide sweat to screw adaptors where required.
- E. Install with valve stems upright or horizontal.

END OF SECTION

PART 1 - GENERAL

1.0 GENERAL:

- A. All insulation shall be installed by an insulation contractor in business a minimum of 3 years as an insulation contractor and has completed projects similar in scope to this project.

1.1 SCOPE:

- A. Section 22 0500 - "General Provisions – Plumbing" shall apply to and become part of this Section.
- B. Repair existing insulation at points of connection and/or alterations to existing work.
- C. "Exposed" is defined as: Exposed to view when construction is complete. (Items which are not "exposed" are considered "concealed".)
- D. The use of any material containing asbestos is strictly prohibited.
- E. Include with insulation material submittal letters from the insulation material manufacturer certifying that the insulation material does not contain asbestos in any shape, form or quantity.

1.2 INSULATION:

- A. Comply with NFPA 90A.
- B. Pipe hanger shields are specified in Section 22 1000 - "Materials and Methods - Plumbing."
- C. Use insulation and adhesives with Underwriter's Laboratories and ASTM E-84 flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding:
 - 1. 50 for pipe covering located in air ducts, plenum or casings.
 - 2. 150 for all other pipe and equipment insulation.

PART 2 - MATERIALS

2.1 FIBERGLASS PIPE COVERING:

- A. Snap-on glass fiber insulation minimum density 5#/cu. ft. maximum thermal conductivity at 75°F mean temperature 0.25 BTU/(hr)(sq. ft.)(°F/in) with UL rated vinyl coated and embossed vapor barrier laminate of aluminum foil and kraft reinforced with glass fiber yarns (ASJ). For domestic hot water circulating system, thermal conductivity shall be 0.27 BTU/(h)(sq.ft.)(°F/in.) at 75°F mean temperature.
- B. For all lines seal jacket with self sealing lap. Butt adjoining sections of insulation tightly and seal with self-adhering butt joint strips.

- C. Cover fittings to thickness of adjacent covering with factory pre-molded fitting covers. Cover flanged valve bodies and flanged unions. Do not cover screwed unions on hot lines. Finish concealed fittings with a skim-coat of mastic and when mastic is dry, fitting shall be covered with glass fab and vinyl acrylic mastic unless otherwise noted below. Zeston type fitting covers may be substituted for glass fab and final coat of mastic on concealed fittings provided fire and smoke ratings are met. Finish fittings exposed in equipment rooms, boiler room, and in finished spaces with vinyl acrylic mastic over glass fab over mastic.
- D. At contractor's option, concealed tees may be insulated with field fabricated tee covers consisting of straight pipe covering on run of tee with notch at branch together with pipe covering on branch contoured to fit notch. Glass fab over skim coat of mastic shall be applied around main, lapping contoured joint at branch by 2" minimum for the full 360° of joint. Cover entire fitting covering with vinyl-acrylic mastic over glass fab, 1/8" thick (dry) coat. Submit sample of fabricated tee covering to Architect for approval before work is begun.

PART 3 - INSTALLATION

3.1 PLUMBING PIPING:

- A. Bodies of floor drains and floor sinks serving refrigeration equipment, AC units and ice machines and traps and waste piping between such drains and waste stack: "Foamed plastic pipe covering", 1" thick.
- B. Domestic water piping exterior, above grade: "Cellular glass pipe covering, rigid," 1" thick. Include aluminum jacket and electric pipe line heaters.
- C. Cold water piping, interior, above grade: "Fiberglass pipe covering", 1" thick. Pipe insulation in partitions and chases may be 1/2" thick when needed for tight spaces.
- D. Hot water piping, interior, above grade: "Fiberglass pipe covering", 1" thick insulation for up to 1-1/4" pipe, and 1-1/2" thick insulation for 1-1/2" and larger pipe.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 22 0500 - "General Provisions - Plumbing" and Section 22 1000 - "Materials and Methods - Plumbing" shall apply to and become part of this Section.

PART 2 - PRODUCTS

2.1 DRAINS:

- A. See **Piping Specialties Connection Schedule – Non-Pressure** schedule on Sheet P0.01.

2.2 TRAP PRIMER:

- A. See **Plumbing Specialties Connection Schedule – Pressure** schedule on Sheet P0.01.

2.3 WALL HYDRANT:

- A. See **Plumbing Specialties Connection Schedule – Pressure** schedule on Sheet P0.01.

2.4 ROOF HYDRANT:

- A. See **Plumbing Specialties Connection Schedule – Pressure** schedule on Sheet P0.01.

2.5 CLEANOUTS:

- A. Furnish and install cleanouts where indicated on drawings and at all 90-degree bends, angles, upper terminals and not over 50' apart on straight runs. All cleanouts on cast iron piping to have bronze countersunk rectangular tapered slotted plugs. PVC or acid waste piping cleanouts shall be standard of piping system used. Flush-with-floor cleanout access covers shall have non-skid covers. All wall cleanout access covers shall have polished satin finish. All cleanouts shall be full size of pipe, 8" and less.
- B. Exposed Cleanouts: Cast brass plug type, J.R. Smith 4470T.
- C. Wall type cleanout plug and access covers, J.R. Smith 4472T. Cleanout plug must be within 1" of finish wall and must be tapped for access cover. On PVC plastic and acid waste pipe in wall: Cleanout access cover J.R. Smith 4710.

- D. Floor type cleanout access covers in unfinished areas: J.R. Smith 4239L/LXH-NB. Finished areas: J.R. Smith 4111L/LXH-NB. Plug must be within 3" of finished floor. Provide 4193L/LXH-NB covers where installed in terrazzo floors. Grout cleanout below access cover to seal watertight. Provide option 14 cleanout carpet markers where installed in carpeted floors.
- E. Floor type cleanouts for acid waste piping: Orion FCO-NB.
- F. **Coordinate the exact location of all cleanouts with the Architect.**

2.6 PLUMBING FIXTURES:

- A. Unless otherwise specified, all fixtures complete as catalogued, white color, exposed metal trim chromium plated. Fixtures shall be without discoloration, chips or flaws and shall be free from cracks. Warped or otherwise imperfect fixtures will not be acceptable.
- B. Clean all fixtures to a clean and sanitary condition.
- C. Fixtures and brass shall be securely anchored. Carriers shall be securely anchored to floor with lag bolts, as recommended by the manufacturer. Single water closet carriers shall include J.R. Smith M-51 rear anchor foot support. Do not conceal until Architect has observed anchors.
- D. Flush valve supports equal to Sloan "YJ" shall be installed 1" below vacuum breaker, on all flush valves. Flush valves on A.D.A. water closets must be set so that handle is to the wide side of the stall and handle is no more than 44" above finish floor. Urinal flush valves on A.D.A. urinals shall be no more than 44" above finish floor.
- E. Seal wall hung fixtures at wall with white caulk. Seal countertop fixtures with clear silicone sealant. Seal floor mounted fixtures at floor with grout.
- F. All fixtures noted to be A.D.A. approved must be set with great care to assure proper mounting height and proper distance from wall. Elevation of flush valves shall be coordinated with grab bars (see Architect). All shower control valves for ADA showers shall be set with centerline 44" above finish floor. Trip levers for tank type water closets shall be installed to the wide side of the stall.
- G. All supplies, stops, faucets, etc. on fixtures that could be used for drinking water shall meet the Reduction of Lead in Drinking Water Act.
- H. Contractor shall coordinate all sinks and faucets with casework/millwork shop drawings prior to purchase of sink/faucet. In particular, coordinate A.D.A. vs. non-A.D.A. fixtures with casework/millwork. Failure to do so will make contractor liable for incorrect fixtures.
- I. See Plumbing Fixture Connection and Description Schedule on Sheet P0.01.

2.7 PLUMBING EQUIPMENT:

- A. See plumbing equipment schedules on Sheet P0.01.

2.8 EQUIVALENT MANUFACTURERS:

- A. Where Zurn fixtures are listed above, Kohler, American Standard, or Toto may be utilized.

- B. Where Zurn flush valves are listed above, Sloan or Delaney may be utilized.
- C. Where Smith is listed above, Josam, Watts, Zurn or Wade may be utilized.
- D. Where Elkay water coolers are mentioned above, Halsey Taylor, Sunroc, or Oasis may be utilized.
- E. Where B&G is listed above, the equal of Armstrong, Taco, or Thrush may be utilized.
- F. Where Elkay sinks are listed above, Just may be utilized.
- G. Where Zurn water closet seats are listed above, Church, Beneke, Bemis, Centoco or Olsonite may be utilized.
- H. Where Lawler combination pressure balanced and thermostatic mixing valves are listed above, Powers, Symmons, or Leonard may be utilized.
- I. Where Weil is listed above, Chicago Pump Co., Enpo or Federal may be utilized.
- J. Where T&S Brass is listed above, Chicago Brass, Cambridge or Zurn may be utilized.
- K. Where T&S Brass is listed above, Chicago Brass, American Standard, Kohler, Zurn, Cambridge, Delta HDF or Speakman may be utilized provided that manufacturer can furnish all fixture brass specified.
- L. Where Delta is listed above, Moen, Symmons or Elkay may be utilized.
- M. Where A.O. Smith water heaters are listed above, Lochinvar, State or Bradford White may be utilized.
- N. Where Stern Williams is listed above, Fiat, or Zurn may be utilized.
- O. Where Zurn is listed above, the equal of McGuire, Watts, Dearborn or Brasscraft may be utilized.
- P. Where Navien is listed, Bosch may be utilized.
- Q. Where Eemax is listed, Chronomite or Stiebel may be utilized.
- R. Where Guardian is listed, Haws or Acorn may be utilized.
- S. Where Symmons is listed above, Zurn or Powers may be used.

PART 3 - EXECUTION:

3.1 MANUFACTURER'S INSTRUCTIONS:

- A. Install all plumbing equipment and fixtures as recommended by the manufacturer's recommendations.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE:

- A. Provisions of this Section apply to all Heating, Ventilating, and Air Conditioning (HVAC), Controls, and Test and Balance work.
- B. Include the provisions of General Conditions as part of this Section.
- C. Provide all labor, materials, equipment, and services necessary for the completion of all HVAC work shown or specified, complete and ready for operation, consisting in general of the following:
 - 1. Cassette Fan Coil four pipe system, air-cooled chiller and condensing fire tube boiler.
 - 2. Split system DOAS.
 - 3. Heat Recovery VRF System.
 - 4. RTU – DOAS and Ventilation System.
 - 5. Server Room CRAC Units.
- D. Give required notices, file drawings, obtain and pay for permits, deposits and fees necessary for the installation of the HVAC work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.
- E. "Provide" means to furnish and install, complete and ready for operation.

1.2 USE OF BUILDING SYSTEMS FOR TEMPORARY HEAT/AIR CONDITIONING DURING CONSTRUCTION:

- A. Building HVAC systems shall not be used during construction unless the following conditions are met:
 - 1. Equipment specified hereinafter to have factory supervised start-up shall have had such start-up.
 - 2. All return air and outside air openings shall have temporary filter media installed over inlet side of openings and secured air tight there-to.
 - 3. Air filters of quality specified for ultimate use shall be installed in the air handling units.
 - 4. Motors shall have correct overload elements installed in the starters.
 - 5. All safety controls shall be in operation.
- B. Contractor shall turn system over to Owner in condition equal to that which would have occurred if the systems had not been used during construction.

1.3 DRAWINGS:

- A. HVAC Drawings are diagrammatic and subject to requirements of Architectural Drawings and conditions existing in the field. HVAC Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work.
- B. Follow the drawings closely, coordinate dimensions with Architectural Drawings and field conditions. DO NOT scale HVAC drawings for location of system components.
- C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or miss-located work in proper manner.
- D. DO NOT scale drawings to locate ceiling diffusers. COORDINATE with lighting and ceiling grids. Contractor for HVAC work is responsible for coordinating with all trades.
- E. Drawings and specifications are complementary. Work shown or specified in one is binding as if shown or specified in both. Any discrepancies between the drawings and specifications shall be brought to the attention of the Consultant for clarification during the bidding period. No allowance shall be subsequently made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Consultant during the bidding period or by reason of any error on the Contractor's part.
- F. No attempt has been made to establish the required sections or splits of equipment relative to the size of access into the space, building, etc. Contractor shall establish all said splits, sections, etc. necessary to install equipment complete without undue disassembly of equipment or demolition of building parts at site of work.

1.4 APPLICABLE CODES AND STANDARDS:

- A. Comply with the current editions of the following Codes and Standards:
 - 1. ANSI/B31.9 - Code for Building Services Piping
 - 2. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration
 - 3. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality
 - 4. ASHRAE 90.1 – Energy Compliance
 - 5. NFPA 54 - National Fuel Gas Code
 - 6. 2023 NFPA 70 - National Electrical Code
 - 7. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
 - 8. NFPA 101 - Safety to Life from Fire in Buildings and Structures
 - 9. Other standards as referenced in other sections of Division 23
 - 10. 2024 International Building Code
 - 11. 2024 International Plumbing Code
 - 12. 2024 International Fuel Gas Code
 - 13. 2024 International Mechanical Code
 - 14. 2015 International Energy Conservation Code

1.5 QUALIFICATIONS OF SUBCONTRACTOR:

- A. The HVAC Subcontractor shall meet the following qualifications:

1. He shall have been in business as a HVAC contractor for at least 3 years prior to the date of opening bids, and shall have held a license from the **Alabama** State Licensing Board for General Contractors for at least 3 years.
2. He shall have a satisfactory experience record with HVAC installations of character and scope comparable with this project, and for at least 3 years prior to the date of opening bids shall have had an established service department capable of providing service inspection or full maintenance contracts.
3. If the HVAC subcontractor, with the Engineer's approval, uses a sub-subcontractor to provide another discipline that the subcontractor does not normally furnish, that sub-subcontractor shall meet the same qualifications as the subcontractor.

1.6 CONFLICTS AND INTERFERENCES:

- A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.7 WORKMANSHIP:

- A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.8 COOPERATION:

- A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.9 VISITING SITE:

- A. Visit site and become familiar with location and various conditions affecting work prior to bid. No additional allowance will be granted because of lack of knowledge of such conditions. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interferences shall be reported immediately to the Architect/Consultant.

1.10 MATERIALS:

- A. Unless otherwise noted, provide new, standard, first-grade materials throughout. **Unless otherwise noted, all pipe, fittings and valves shall be made in the United States of America.**
- B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the estimate, without substitution, and shall be furnished under the contract unless requests for equivalents are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.

- C. Equivalents will be considered only if written request for approval has been received by the Architect (from a general contract bidder) 10 days prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which an equivalent is proposed and a complete description of the proposed equivalent including drawings, cuts, performance and test data, and deviation from the specification and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the equivalent may require shall be included. The burden of proof of the merit of the proposed equivalent is upon the proposer. The Architect's decision of approval or disapproval of a proposed equivalent is final.
- D. If the Architect approves any proposed equivalent prior to receipt of Proposals, approval will be set forth in an Addendum. **DO NOT RELY UPON APPROVALS MADE IN ANY OTHER MANNER.**
- E. No proposed equivalent will be considered after the Contract has been executed, except as described in the General Conditions.
- F. Within 45 days of execution of contract and before ordering materials or equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Submit PDF format files for approval. Provide PDF files of approved data for project close-out.
- G. All pressure vessels shall be constructed and tested in accordance with applicable ASME codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.
- H. Similar items of equipment shall be the product of the same manufacturer.

1.11 SHOP DRAWINGS:

- A. Before starting work, submit and obtain approval of detailed drawings of the following, fully dimensioned (including elevations of ductwork and piping) and drawn to 1/4" to 1'-0" scale.

Submit a minimum of 2 sets of bond shop drawings or PDF format digital files of shop drawings. Piping shop drawings shall include drain and vent locations, pipe slopes down to drains and up to vents, piping elevations, piping connection details, and a list of piping materials. Ductwork shop drawings shall include elevations, construction methods, re-inforcements, gauges, and access door locations and sizes. Provide section drawings of locations where ducts cross or demonstrate with elevations that ducts will fit. All shop drawings shall be produced using AutoCad and a copy of the shop drawing files shall be provided in PDF format for shop drawing review. A thumb-drive with a copy of all approved shop drawings in CAD and PDF format shall be provided for project closeout. Shop drawings shall be received within 60 days of the execution of the contract and before consideration of a request for payment.

1. Ductwork (do not scale for diffuser locations, but coordinate with ceiling grids and lighting layout). See Section "Air Distribution". Shop drawings shall include material type (stainless steel, galvanized), finish (paint grip, etc.), actual sizes increased to allow for internal insulation and gauges along with fabrication section notes for individual sections. In addition, include elevations of bottom of duct above finished floor level. Show building sections through congested areas for coordination with structure and other disciplines. Provide joint details, duct seal methods, insulation type, etc.
2. Submit details of all apparatus casings and plenums.
3. Complete mechanical equipment and fan room plans showing location of equipment, conduit stubs for motors, floor drains, and equipment pads and foundations.

4. Equipment piping.
- B. Submit complete control and power wiring diagrams for approval before installing controls. See Controls Section.
- C. Engineers' CAD/electronic drawings files will be available upon request for the convenience of the contractor and for use in preparation of shop drawings. A service fee of \$100.00 per drawing sheet file shall be remitted to the Engineer prior to delivery of CAD/electronic drawing files along with a signed agreement between the Engineer and Contractor.

1.12 COORDINATION SHOP DRAWINGS:

- A. Coordination shop drawings (2 sets of bond and PDF digital format files) will be required of the following areas, drawn to a scale not smaller than 1/4" = 1'-0":
 1. Mechanical Room.
- B. Start drawings as HVAC shop drawings indicating all ductwork piping, equipment and locations of mechanical room floor drains, and electrical connections to motors. Indicate elevations of all ductwork and piping. Draw sections as required to clarify congested situations. **Indicate elevations of all ductwork and piping. Include walls, ceilings, structure, and lighting.**
- C. Engineers' CAD/electronic drawings files will be available upon request for the convenience of the contractor and for use in preparation of shop drawings. A service fee of \$100.00 per drawing sheet file shall be remitted to the Engineer prior to delivery of CAD/electronic drawing files along with a signed agreement between the Engineer and Contractor.
- D. Next, the Plumbing Contractor shall add all piping and plumbing to the drawings.
- E. Next, the Fire Protection Contractor shall add all sprinkler heads and fire protection piping.
- F. Next, the Electrical Contractor shall add all electrical fixtures, conduit and equipment.
- G. Next, the drawings shall be submitted to the General Contractor for final coordination.
- H. Finally, after the General Contractor has approved the drawings they shall be submitted to the Architect for his review and comments.

1.13 RECORD DRAWINGS:

- A. When work starts the Architect will furnish two complete sets of white prints of the HVAC Drawings. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection. When work starts the Architect will furnish two complete sets of white prints of the approved shop drawings for the heating, ventilating, air conditioning. All corrections, variations, and deviations, including those required by change orders, if any, shall be recorded in colored ink or colored pencil at the end of each working day on these drawings. The contractor shall include the contract drawings schedules, details, sections, etc. marked as noted above to indicate changes. The marked prints shall be available at all times for the Architect's inspection.

- B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this contract. Prior to examining any request for payment, the Architect shall review and approve the marked white prints at the site. HVAC white prints shall be approved shop drawings.
 - 1. Accurately show location, size and elevation of new exterior utility work and its relationship to any existing utilities, obstructions, etc., contiguous to the area of work.
 - 2. Block out areas modified by change-order & identify them by change-order number.
 - 3. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.
- C. When work is completed, the Engineers' CAD/electronic drawing files will be made available upon request for the convenience to the contractor for a service fee of \$100.00 per CAD/electronic drawing sheet file and for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the CAD files, removing all superseded data in order to show the actual completed conditions. Include with the record drawings equipment schedules, details, sections, and controls edited to show actual completed conditions. When record drawings are complete, provide one set of mylar reproducibles, 2 sets of bond prints, and one complete set of AutoCAD drawing files (AutoCAD 2016 format) and one set of PDF drawing files on CD-ROM disks.
- D. Ductwork and Control Drawings shall be a set of CAD shop drawings, up-dated to show actual conditions at completion of work. Include the contract drawings equipment schedules and details edited to show actual completed conditions.
- E. HVAC piping drawings may be prepared as noted above, or HVAC piping may be added to the ductwork shop drawings noted above.

1.14 PROTECTION OF ROTATING PARTS:

- A. For this paragraph only, "exposed" shall mean located in a casing or room or plenum with door large enough to admit a man.
- B. Equip exposed belt drives with belt guards with holes for measuring speeds of driven shafts.
- C. Equip propeller fan wheels with wheel guards.

1.15 PROTECTION OF EQUIPMENT:

- A. During construction, protect HVAC equipment and ductwork from damage or deterioration and prevent water, dust, etc. from entering the equipment or ductwork. Cover ends of ductwork before delivery to site with Duro-Dyne Dyn-O-Wrap. Cover all openings in equipment with Dyn-O-Wrap until ductwork is attached.
- B. During construction, keep all stored ductwork securely covered for protection from water and dust. Do not store directly on the floor. Immediately remove all ductwork that is wet or dirty from the job site.
- C. During construction, seal joints and seams in ductwork as it is installed.
- D. When installation is complete, clean equipment and make ready for painting.

1.16 INSTALLATION OF EQUIPMENT:

- A. Install equipment to provide normal service access to all components.
- B. Where drawings show sufficient space for removing components, install equipment to provide such clearance. Provide space at all equipment power and control panels as required by local codes.
- C. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with contract documents, obtain Architect's decision before proceeding.
- D. All equipment shall be firmly fastened in place:
 - 1. Roof curbs shall be secured to deck and structure and curb mounted items shall be secured to curbs.
 - 2. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
 - 3. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.
 - 4. Air devices connected by flexible duct shall be secured independently of all other building systems to prevent falling if grid shifts.

1.17 EQUIPMENT SUPPORTS:

- A. Provide supports for ductwork, piping and equipment. Hot dip galvanize after fabrication all grillage, supports, etc., located outdoors. Prime coat and paint all grillage, supports, etc. located indoors. Where noted provide 304 stainless steel supports. At the Contractor's option, all grillage, supports, etc. located outdoors may be 304 stainless steel instead of hot dip galvanized.
- B. Set floor-mounted equipment on concrete pads or platforms (as indicated) of height shown, but not less than 3-1/2" high. Chamfer pads 1". Provide pads and rails as follows:
 - 1. AHU – DOAS: 6" pad.
 - 2. Air-Cooled Condensers: 4" pad.
 - 3. Chiller: 4" pad.
 - 4. Outdoor Heat Pump: 4" pad.
 - 5. Boiler: 4" pad.
- C. Provide factory fabricated equipment roof supports with tops 16" above roof line for roof mounted items as shown. Curbs shall match roof slope as required so units are installed level. Supports shall have integral cants, pressure treated wood nailers, and counter flashing. Supports shall be galvanized steel, 18 gauge as required for loads, 18 gauge minimum.

1.18 CUTTING AND PATCHING AND INCIDENTAL WORK:

- A. Set sleeves and inserts and lay out and form openings in walls, beams, girders and structural floors in this Section.

- B. Cut, patch and repair as required to accomplish HVAC Work and finish to match adjacent work. Architect's approval required before cutting any part where strength or appearance of finished work is involved.
- C. Provide all motors incidental to the HVAC systems. Wiring of motors, switches and starters is included in "Electrical Sections".
- D. Do all control wiring required for HVAC work and all power wiring required by Control Panels, Control System, and Control Devices.
- E. Furnish motor starters as specified below.
- F. Final water connections to services are included in this Section.
- G. Permanent drain connections from AC units, etc., to nearest floor drain are included in this Section.
- H. Door louvers are not included in this Section.

1.19 FLASHING:

- A. General: Furnish all fan curbs, pitch cups, metal base flashing and counter flashing required for HVAC Work. Installation of above items is specified in Roofing Section.
- B. Fan curbs for power roof ventilators are specified with the fans.
- C. Pitch Cups: 20 gauge galvanized steel, at least 8" deep, bases mitered and soldered and extending at least 4" horizontally.
- D. Metal Base Flashing: Galvanized steel for ferrous items, and stainless steel for stainless steel duct items. Minimum thickness 22 gauge (0.034") galvanized steel, 20 gauge (0.038") stainless steel, 0.032" aluminum. Bases mitered and soldered extending out at least 4" horizontally and 8" vertically.
- E. Metal Counter Flashing: Of material and gauges specified for base flashing, lapping base flashing at least 3".

1.20 EXCAVATION & BACKFILLING:

- A. Include all excavation and backfilling required to bring the work to line and grade shown, including excavation of rock and all other materials which may be encountered.
- B. Excavate trenches wide enough for proper installation of work. Grade trench bottoms evenly. Provide bell holes as necessary to insure uniform bearing for pipes. Excavate minimum 6" below pipe. Refill cuts below required pipe grade with sand or compacted gravel. Support pipe continuously along its entire length. (Do not use piers to support piping.)
- C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel (89/10) in accordance with requirements of "Sitework" no less than 95% compactancy. Backfill paved areas with sand or fine gravel (89/10) compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe. Restore or repair pavements and the like after backfilling, matching adjacent work.
- D. Resod grassed areas and replace bushes, etc.

1.21 MOTORS, STARTERS & ELECTRICAL EQUIPMENT:

- A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.
- B. Should the Contractor with the Architect's approval make changes in electrical equipment from that shown on the Electrical Drawings, the Contractor shall be responsible for the cost of required changes.
- C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.
- D. Motors: 1750 RPM open drip-proof construction unless otherwise shown or specified. Integral horsepower motors shall meet NEMA premium efficiency levels as stated in the latest version of NEMA MG-1. Allis-Chalmers, General Electric, Goulds, Louis Allis, Westinghouse.
- E. Where motors are shown or scheduled to be connected to a variable frequency drive, this motor shall be an inverter duty rated by the motor manufacturer and shall comply with NEMA MG1, Article 31.
- F. Do not run motors until correct overload elements are installed in starters. Trading overload elements for elements of correct size for motors actually furnished shall be included in this Section.
- G. Furnishing all starters is included in this Section. Starter installation is specified under "Electrical Section". Starters shall be equipped with melting alloy thermal overload and phase loss protection, in all 3 phases.
- H. Starters for the following items are specified with the equipment:
 - 1. DOAS.
 - 2. Air-Cooled Condenser.
 - 3. Air-Cooled Chiller and Boiler.
 - 4. Outdoor Heat Pumps.
- I. Unless otherwise shown or specified for single phase motors provide manual starters equal to Square D Class 2510. When installed in equipment rooms provide surface mounted enclosure, and when installed in finished walls outside equipment rooms provide flush mounted enclosure, key operated.
- J. Provide H-O-A switches, fused control circuit transformers, auxiliary contacts, etc., as shown on control diagrams or required by control sequences (and/or arrange for these items to be furnished with the starters specified in Division 26, Electrical Work.)
- K. All starters shall be the product of the same manufacturer.
- L. All control panels, electrical assemblies, etc. must bear a label from a recognized testing laboratory as an assembly, not as individual components.

1.22 SLEEVES:

- A. For pipe through floors inside fire rated chases or through non-fire-rated walls: 20 gauge galvanized steel, 1" larger than pipe or pipe covering.

- B. For pipe passing through floors outside fire rated chases and fire rated walls and partitions, provide 20 gauge steel sleeve leaving the annular space between pipe or pipe covering as required by UL systems. Where pipe is insulated, insulation shall be continuous thru sleeve. Refer to Through-Penetration Firestop Systems where included in the contract documents. Otherwise, seal between sleeve and pipe or pipe covering with 3M Brand Fire Barrier CP 25WB caulk, Flamestop V, Specified Technologies, Inc. "Spec Seal Sealant", Rectorseal Corp. Metacaulk 950 or Hilti FSTONE bearing UL listing for actual conditions of installation, thickness and application in strict accord with UL reference for each type installation. Any equivalents must meet the 10 day prior approval provision and must show UL approval for all conditions, bare pipe, insulated pipe, etc. For plastic piping material submittal must show UL approval for each application and if caulk comes in direct contact with pipe, it must be compatible and not injurious to the pipe.
- C. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.
- D. Sleeves for ducts: see fire dampers (Section: Air Distribution).
- E. Extend floor sleeves 1-1/2" above finish floor in areas where floor is subject to being wet during normal usage (mechanical rooms, toilets, etc.).
- F. Where exposed ducts pass through walls and partitions, provide 4" wide 20 gauge galvanized steel closure plates except at grilles and registers. Fit closure plates snugly to duct and secure to wall. Grout around ducts and sound absorbers at equipment room walls.
- G. Where exposed pipes pass through walls and partitions in finished spaces, provide chrome plated F & C plates or escutcheons.

1.23 PAINTING:

- A. Refinish equipment damaged during construction to new condition.
- B. Paint all non-potable water pipe and insulation yellow in accordance with Plumbing Code using paint of type specified in Painting Section.
- C. Paint un-insulated duct surfaces visible through grilles and registers flat black.
- D. Prime and paint all bare, exposed, exterior piping using type specified in Painting Section.
- E. Prime and paint all grillage, supports, etc. located indoors except where noted to be galvanized.
- F. Other painting is specified in Painting Section, Finishes Division.

1.24 PIPE IDENTIFICATION:

- A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. (Markers on lines 8" OD and smaller shall be taped in place.) Markers shall be equal to Craftmark, Brady, Seton or Brimar.
- B. Protect all factory identification tags, nameplates, model and serial numbers, stenciling, etc., during construction and replace if damaged.

C. Label Spacing and Extent:

1. On straight run of pipes: Above suspended ceilings space labels approximately 10 feet on center; elsewhere, 20 feet on center.
2. Wherever a pipe enters or leaves a room or building.
3. At change of direction.
4. At main valves and control valves (not equipment valves).
5. At manifolds.
6. On risers, just above and below floors.

- D. The refrigerant piping identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For Group A2L and B2L refrigerants, the identification shall also include the following statement "WARNING-Risk of Fire. Flammable Refrigerant." For Group A2, A3, B2 and B3 refrigerants, the identification shall also include the following statement: "DANGER-Risk of Fire or Explosion. Flammable Refrigerant." For any Group B refrigerant, the identification shall also include the following statement: "DANGER-Toxic Refrigerant."

1.25 EQUIPMENT IDENTIFICATION:

- A. Provide 2" x 3" or larger laminated plastic nameplates with 1/2" numbers and letters in colors specified below. Screw tags to equipment in obvious locations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tag, leaving lower half of tag for future engraving by Owner.
- B. Provide similar nameplates for motor starters furnished under Division 23.
- C. Secure nameplates with acorn head screws.
- D. Colors:
1. Equipment connected to utility power only - black letters on white nameplates.
 2. Equipment connected to emergency power - red letters on white nameplates.

1.26 EXHAUST FAN IDENTIFICATION:

- A. 2" X 3" or larger laminated plastic nameplates with red letters and numbers on white background, identifying type of fan, number according to plans, and rooms served. Engrave on upper half of tag, leaving lower half for engraving by Owner. Fasten with acorn head screws.

1.27 ACCESS DOORS:

- A. Furnish and install access doors for valves, fire dampers, dampers, controls, and other items located above non-liftout ceilings or behind partitions or walls. Doors in non-fire rated walls and ceilings: 16-gauge steel with hinges and screwdriver latches. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Doors in security ceilings to be 10 ga. steel panels, white powder coat, 2" x 2" x 3/16" steel angle frame heavy duty butt hinges with security screws. Provide door styles compatible with adjoining surfaces as selected by Architect. Size doors to permit removal of equipment and/or maintenance. Doors: Bar-Co, Nystrom, Williams Bros., or equal.

- B. Mark lay-in ceilings with colored vinyl self adhering disc stuck on grid adjacent to maintenance access points.

1.28 TESTS, CLEANING & ADJUSTMENTS:

A. General:

1. All tests shall be witnessed by the Architect in addition to the authorities having jurisdiction. A minimum of 72 hours notice is required prior to performance of tests.
2. All air duct pressure tests are specified in Section Air Distribution.
3. All HVAC air and water balance work and HVAC equipment tests (other than hydrostatic tests) are specified in section 23 7000, "HVAC Testing & Balancing". Notify the Testing and Balancing Agency when systems are ready for balancing - see Section 23 7000, "HVAC Testing & Balancing".
4. Testing and Balancing other than that noted above is specified in Section "HVAC Testing & Balancing".
5. All instruments used for testing and balancing work shall have been calibrated within 6 months and checked for accuracy prior to start of work.
6. Cooperate in the execution of work specified in Section 23 7000 HVAC Testing and Balancing and provide assistance as noted in Section 23 7000.
7. Perform all tests as required by local codes. Contractor shall furnish testing equipment.
8. If local codes are more stringent than the following, local codes shall govern.

- B. Refrigeration System: When system is complete, but before the pipe covering has been installed, test components with dry nitrogen and make tight at equipment manufacturer's recommended test pressures. Then evacuate the system to 26" Hg. vacuum which the system shall hold for 24 hours. After passing the above tests, charge and leak test under operating conditions using electronic leak detector.

C. Air System:

1. Duct Cleaning:
 - a. Clean new duct system(s) and existing duct systems to be reused before testing, adjusting, and balancing.
 - b. Use service openings for entry and inspection.
 - 1) Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation as recommended by insulation manufacturer. Comply with Section 236000 "Air Distribution" for access panels and doors.
 - 2) Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3) Remove and reinstall ceiling to gain access during the cleaning process.
 - c. Particulate Collection and Odor Control:
 - 1) When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

- 2) When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
 - d. Clean the following components by removing surface contaminants and deposits:
 - 1) Air outlets and inlets (registers, grilles, and diffusers).
 - 2) Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3) Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4) Coils and related components.
 - 5) Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6) Supply-air ducts, dampers, actuators, and turning vanes.
 - 7) Dedicated exhaust and ventilation components and makeup air systems.
 - e. Mechanical Cleaning Methodology:
 - 1) Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2) Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3) Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4) Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - 5) Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 6) Provide drainage and cleanup for wash-down procedures.
 - 7) Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.
 2. When system has been completed, remove all trash and dirt, leave all balancing dampers open and install specified filters in all equipment. Check all fan motors for rotation. Provide all items as required for work specified in Section 237000 "HVAC Testing & Balancing".
- D. At the beginning of the first heating season, adjust and balance operating phases and repeat at the beginning of the first cooling season or vice-versa, as the case may be, all without charge.

E. Start-Up and Service:

1. The Contractor and factory authorized service representative for the variable frequency drives, shall place each item of such equipment into satisfactory operation with all automatic and safety devices. Further, all adjustment service required shall be performed during the warranty period. Adjustment services do not include lubricating fans or motors and does not include changing filters or adjusting belts.
2. In addition, submit equipment manufacturers' start-up reports for items listed above. See Paragraph "Project Close-Out", below.
3. Starting Systems:
 - a. Coordinate schedule for start-up of various equipment and systems.
 - b. Notify Owner seven days prior to start-up of each item and provide one copy of manufacturer's Operation and Maintenance instructions.
 - c. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
 - d. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - e. Verify wiring and support components for equipment are complete and tested.
 - f. Execute start-up under supervision of responsible (manufacturer's representative) (contractors' personnel) in accordance with manufacturers' instruction.
 - g. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - h. Submit a written report in accordance with Section that equipment or system has been properly installed and is functioning correctly.

- F. Compressor Test: The compressors shall have an oil acidity test performed in the presence of Engineer at the time of job completion. After units have operated for 30 days, the oil shall be tested again for acidity. If oil tests acid either time, it shall be drained and refilled with new and unused oil. Tests shall be repeated each 30 days and oil replaced until tests show neutral. Reports should be made in writing to the Architect.

1.29 WARRANTY & INSTRUCTIONS:

- A. See General Conditions - One-Year Warranty.
- B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one year after date of substantial completion of the Contract. Should any defects in material, workmanship, or equipment be made known to Contractor within the one-year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.
- C. All reciprocating and scroll refrigeration compressors shall bear 5-year non-pro-rated parts warranty.

- D. All gas fired air furnaces shall bear 10 year prorated heat exchanger warranties.
- E. After completion of the work, Contractor shall operate the equipment which he installs for a period of (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment.
- F. Provide PDF of manufacturer's operating and maintenance manuals and parts lists for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency thereof. Include all warranty dates on equipment and guarantees.
- G. Any work performed on new or existing air conditioning/refrigeration equipment, whether inside or out, that requires removing the refrigerant from the system will require the use of a recovery/recycling unit. Intentional release of the refrigerant, regardless of type, will not be allowed.
- H. Any refrigerant removed from a system that has been properly recycled and has not been exposed to "burn out" can and should be reused in the system. Refrigerant that has been contaminated and cannot be reused after being properly recycled shall be reclaimed by the contractor and returned to the proper company representative.
- I. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.
- J. Supply initial charges of refrigerant, refrigeration lubricating oil and anti-freeze necessary for the correct operation of the equipment. Maintain these charges during the guarantee period, with no additional cost to the Owner, unless loss of charge is the fault of the Owner.
- K. Make available to the Owner, without additional cost, warranty service and adjustment of the equipment for the guarantee period. Due to critical temperature guidelines Contractor shall respond to Owner's call for service within a 6 hour time period.

1.30 PROJECT CLOSE-OUT:

- A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
 - 1. A letter signed by the subcontractors for HVAC, electrical, temperature control work stating that they have jointly checked each power circuit and control circuit and mutually agree that each item is properly wired and that controls and power circuits will function properly.
 - 2. Record drawings - sheet metal work: PDF files and CAD files.
 - 3. Record drawings – piping: PDF files and CAD files.
 - 4. Record drawings - control systems: PDF files and CAD files.
 - 5. Control manufacturer's letter of certification.
 - 6. Air and water balance report PDF files. (See Section 23 7000 "HVAC Testing & Balancing").
 - 7. Equipment Submittal Data PDF files.
 - 8. Equipment operating and maintenance manuals PDF files.
 - 9. Maintenance schedule.

10. Equipment warranty dates and guarantees.
11. List of Owner's Personnel who have received maintenance instructions.
12. Letter certifying and signed by Owner or his representative that the Owner or his representative has received the spare filters for each HVAC system.
13. Submit factory start-up reports for:
 - a. VRF System
 - b. DOAS Units
 - c. Multi-Aqua System, air-cooled chiller and boiler.
 - d. Variable frequency drives
14. Include with insulation material submittal letters from the insulation material manufacturer certifying that the insulation material does not contain asbestos in any shape, form or quantity.

1.31 TRAINING OF OWNER PERSONNEL:

- A. The General Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
- B. The Engineer shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
 1. The HVAC Engineer shall determine the special needs and areas where training will be most valuable. The Owner and Engineer shall decide how rigorous the training should be for each piece of commissioned equipment. The HVAC Engineer shall communicate the results to the Subs and vendors who have training responsibilities.
 2. Each Sub and vendor responsible for training shall submit a written training plan to the HVAC Engineer for review and approval prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

i. Instructor and qualifications

3. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the HVAC or electrical training conducted by others.
4. The General Contractor shall develop an overall training plan and shall coordinate and schedule, with the Subcontractors and other consultants, the overall training for the commissioned systems. The Engineer will recommend approval of the training to the Owner upon satisfactory completion using a standard approval form. The Owner and Contractors sign the approval form.
5. Video taping of the training sessions will be provided at the Owners request.

C. HVAC Contractor. The HVAC Contractor shall have the following training responsibilities:

1. Provide the HVAC Engineer and Owner with a training plan two weeks before the planned training.
2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.
3. Training shall normally start with classroom 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.
4. 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 will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start- up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall 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.

8. Training shall include:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. 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 and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
 - g. Discussion of any peculiarities of equipment installation or operation.
 - h. The format and training agenda in The Commissioning Process, ASHRAE Guideline 0-2005.
 - i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
9. Hands-on training shall include start-up, operation in all modes possible, including manual, start-up shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 230500 - "General Provisions - HVAC" shall apply to and become part of this Section.

PART 2 - MATERIALS: (All pipe, fittings and valves shall be manufactured in the United States of America)

2.1 CHILLED WATER PIPING:

- A. Schedule 40 black steel pipe, ASTM A53 or A106, grade B. Fittings 2" and smaller, 150 psig WSP black malleable iron. Fittings 2-1/2" and larger, butt welding fittings. No mitering or notching for fittings permitted. Weldolets permitted where branch size is 2 pipe sizes smaller than main. 45 degree saddles permitted where shown.
- B. Unions 2" and smaller black malleable, ground joint, screwed. Union 2-1/2" and larger, flanged.
- C. All flanges shall be flat faced. Flange gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, minimum 1/16 in thickness, full face type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.1 Gaskets shall be Garlock Blue-Gard 3000 or approved equal.
- D. Coating for underground lines: Pipe coating: Pipe shall be mill-wrapped with fittings field-wrapped with PVC tape, same thickness as mill-wrapping. Mill wrapping shall be X-TRU-COAT. Coating shall be electrically inspected for holidays.
- E. At Contractor's option runouts to room fan-coil AC Units may be type L hard copper with wrought copper sweat fittings made with 95-5 solder. Install dielectric union at copper pipe connections to black steel pipe.
- F. Pipe connections to chillers shall be made with Victaulic Style 741 flange adapters or flexible couplings, coordinate with chiller manufacturer.

2.2 HVAC DRAIN PIPING:

- A. Provide drain traps for AC unit drain pans. Size traps as required to drain under operating conditions. See trap detail on drawings.

2.3 HOT WATER PIPING:

- A. Schedule 40 black steel pipe, ASTM A53 or A106, grade B. Fittings 2" and smaller, 125 psig W.P. cast iron screwed fittings. Fittings 2-1/2" and larger, butt welding fittings. No mitering or notching for fittings permitted. Weldolets permitted where branch size is 2 pipe sizes smaller than main. 45 degree saddles permitted where shown.
- B. Unions 2" and smaller black malleable, ground joint, screwed. Union 2-1/2" and larger, flanged.

- C. All flanges shall be flat faced. Flange gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, minimum 1/16 in thickness, full face type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.1 Gaskets shall be Garlock Blue-Gard 3000 or approved equal.
- D. Coating for underground lines: Pipe coating: Pipe shall be mill-wrapped with fittings field-wrapped with PVC tape, same thickness as mill-wrapping. Mill wrapping shall be X-TRU-COAT. Coating shall be electrically inspected for holidays.
- E. At Contractor's option runouts to room fan-coil AC Units may be type L hard copper with wrought copper sweat fittings made with 95-5 solder. Install dielectric union at copper pipe connections to black steel pipe.

2.4 REFRIGERATION PIPING:

- A. Type L hard drawn copper tubing with wrought copper sweat fittings. Joints: silfossed with continuous flow of dry nitrogen through lines.
- B. Size all lines per manufacturer's recommendations and requirements based on actual line lengths, distances, and elevations, so as to ensure oil return at minimum loading.
- C. Small lines 5/8" OD and smaller may be soft copper with flare fittings, provided that all joints are exposed for visual inspection.
- D. Refrigerant piping shall not be left open for a period longer than necessary to assemble the piping, provide nitrogen flow, and solder. In no case shall any piping assembled or stored be left open at the end of the day. Pipe that is assembled but not soldered is open. Piping that is stored shall not be used if it has lost the manufacturer's nitrogen charge.
- E. Refrigerant piping shall be protected against physical damage. Refrigerant piping installed in studs, joists, rafters or similar member spaces, and located less than 1-1/4 inches (32 mm) from the nearest edge of the member, shall be continuously protected by shield plates. Protective steel shield plates shall cover the area of the tube plus the area extending not less than 2 inches (51 mm) beyond both sides of the tube. Shield plates shall be of steel material having a thickness of not less than 0.0575 inch (1.46 mm) (No. 16 gage).

2.5 HVAC VALVES:

- A. Hot Water and Chilled Water Valves:
 - 1. Globe valves 2" and smaller: All bronze, 150 psig WSP, composition disc, rising stems, Nibco #T-235Y, Milwaukee #590T, or Watts B-4010-T.
 - 2. Globe valves 2-1/2" and larger: Iron bodies, brass trim, 125 psig WSP, flanged, Nibco #F-718B, Milwaukee #F-2981-A, or Watts F-501.
 - 3. Check valves 2" and smaller: 125 psig WSP, threaded ends, brass or bronze body, spring loaded, composition disc, Metraflex, Nibco #T-480Y, Watts #600, or Techno 5002-BR.

4. Check valves 2-1/2" and larger: 125 WSP, spring loaded, non-slam, center guide, globe check valves for installation between faces of 125# cast iron ASA 150 flanges, iron body, bronze seat and disc, stainless steel spring. Metraflex style 900, Nibco F-910, or equal by Keystone, Milwaukee, or Watts. Install a minimum of 5 pipe diameters from pump discharge.
 5. Ball valves for hot water: 600 psig WOG, screwed bodies, chrome plated bronze balls, full port, teflon packing, bronze stem and steel handle, suitable for 350°F operating temperature. Include valve handle extension to clear 2" insulation. Nibco Nib-Seal T585-70 (domestic), full port. Provide extension stem capable of clearing 2" insulation, with memory stop, when operated will not disturb vapor seal of insulation.
 6. Ball valves for chilled water: 600 psig WOG, screwed bodies, chrome plated, full port, bronze ball, TFE packing, bronze stem and extended handle to accommodate 2" of insulation. Nibco Nib-Seal, T585-70 (domestic), Apollo 77C with thermal seal handle, full port. Provide non-metallic extension stem capable of clearing 2" insulation, with memory stop, when operated will not disturb vapor seal of insulation.
 7. Butterfly valves: 200 psi WSP, designed for installation between ASA 150 flanges. Valves shall have ductile iron bodies with tapped lugs for independent bolting to upstream and downstream flanges, bubble tight (rated for bi-directional "dead end" service) under full-rated pressure with no flange on downstream side. Aluminum-Bronze discs, 416 stainless steel stems, EPDM seats and stem seals, extended neck at least 2" beyond OD of flanges, lever handles with infinite throttling and memory stops for valves 6" and smaller, gear operators with memory stops capability for valves 8" and larger. Valves shall be rated for 250°F operating temperature. Provide padlock connections for valves located outdoors. Nibco LD-2000, Demco - NEC5114351 or Dezurik - BG5XLIDIEBS2.
- B. For all valves over 7 feet above the floor, provide chain wheels with chains extending to 6-1/2 feet above the floor.
- C. Control valves: Specified in Control/BAS/DDC Section.

2.6 PIPE HANGERS:

- A. General: Pipe hangers, Anvil, PHD, Michigan Hanger, B-Line or Elcen. Anvil figure numbers are given for reference. Provide copper clad or plastic coated hangers on bare copper lines.
- B. Pipe hangers for lines 3" and smaller: adjustable wrought ring hangers, Anvil Fig. 97 or 69 or wrought clevis hangers.
- C. Pipe hangers for piping 4" and larger: adjustable wrought clevis hangers.
- D. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.
- E. Beam Clamps: Anvil Fig. 228.
- F. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Anvil Fig. 282.
- G. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8", 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.

- H. Space pipe hangers at maximum: Pipe hanger spacing for screwed, solder joint and welded piping: 1/2" and 3/4", 6 ft.; 1" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3" and over, 12 ft. Install additional hangers at change of direction, valve clusters, and at all duct and unit mounted coils.
- I. Install pipe hangers on insulated pipe over pipe covering. Provide factory fabricated insulated pipe shields equal to Pipe Shields, Inc. "Thermal Hanger Shields" or Tru-Balance insulated saddles at hangers. Provide shield insulation of rigid calcium silicate indoors or rigid Perlite Silicate outdoors, the same thickness as adjacent pipe covering. (At Contractor's option, pipe shields may be field fabricated using rigid calcium silicate or foamglass insulation with ASJ and 20 gauge galvanized steel protector. Shield length: 1.5 times nominal pipe size but not less than 4".)
- J. Wrap bare copper refrigerant lines with sheet lead or molded plastic sleeve at hangers.

2.7 THERMOMETERS AND GAUGES:

- A. Non-mercury in glass blue reading separable socket industrial thermometers with die cast aluminum or high impact plastic casings of appropriate pattern for each installation, 9" scale lengths and ranges shown, Palmer, Terice or Weksler. Install thermometers in brass or stainless steel wells. Equip thermometers installed in insulated lines with 1" extension stems or stems long enough to permit unions to clear insulation whichever is greater.
- B. Where shown install brass thermometer wells with screwed caps. Install wells at an angle to retain oil. Size well to fit thermometers specified.
- C. Enlarge pipe 2" and smaller to 2-1/2" at thermometers and thermometer wells.
- D. Install 4-1/2" dial pressure gauges where shown. Gauges shall have bronze or stainless steel bourdon tubes, 316 stainless steel movement, aluminum or polypropylene solid front cases, adjustable micrometer pointer and accuracy Grade 2A not less than 1/2% of full scale over the entire range, without mounting flange. Gauges shall be Ashcroft 1279, Marsh Series P01, Terice 450-B, Weksler AA44-2 or U.S. Gauge 1980L with minimum bourdon tube diameter of 3". Provide ball valves for all pressure gauges. Provide siphons for steam gauges.
- E. Where shown, provide temperature and pressure measurement plugs and caps equal to Peterson Equipment Co., Inc. "Pete's plug with Nordel seats and seals". Provide one Pressure and Temperature Kit consisting of a 0-100 psi pressure gauge with adaptors, and two thermometers (25-125°F and 0-220°F), all in carrying cases. Provide nipples for Pete's plugs as required to extend thru pipe insulation.

2.8 ELECTRIC PIPE LINE HEATERS:

- A. Electric heaters equal to Chemetron "Auto-Trace," Letco with "Self Regulator" or Chromolox "Self Regulating Rapid Trace" heating cable, 3.9 watts/foot to prevent freezing in 0°F ambient. Equip heaters with conduit connectors and outdoor thermostat set at 32°F.
- B. Extent:
 - 1. All chilled and hot water supply and return lines outdoors.
 - 2. Domestic water piping in unheated areas or exposed outdoors. Include aluminum jacket.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION:

- A. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.
- B. Provide welding material and labor in accordance with the welding procedures of the Heating, Piping, and Air Conditioning Contractors' National Association or other approved procedure conforming to the requirements of ANSI B31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxyacetylene welding. Provide full perimeter welds at both face end and collar end of each slip-on flange.
- C. Install piping to allow for expansion. Make connections to all equipment to eliminate undue strains in piping and equipment. Furnish necessary fittings and bends to avoid springing of pipes during assembly.
- D. Pitch air conditioning unit drain lines down in direction of flow 1/8" per foot of horizontal run. Grade chilled and hot water supply and return lines down to drains and up to air vents.
- E. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.
- F. Make horizontal water supply line size reductions using eccentric reducers (tops flat in water lines).
- G. Install 3/4" ball valve drains with hose adaptors at low points of water piping and at bases of all risers (where shown provide larger drains). Provide screwed caps with chains on hose adaptors.
- H. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment. Provide unions on all sides of control valves.
- I. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulating unions or couplings, equal to Victaulic style 47, "V-line" insulating couplings as manufactured by Lochinvar, thread to thread or CTS fabrication flange adaptors for flange connections.
- J. Near heating and air conditioning equipment requiring water provide valved and capped water outlets of sizes shown for connection to equipment, including reduced pressure principal backflow preventers. Make final connections under HVAC work. Note that all piping and insulation downstream from backflow preventer must be painted yellow.
- K. Run piping concealed, except where specifically shown or specified to be exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise.
- L. Lay underground pressure piping so top of pipe is at least 18" below finished grade. Support all underground piping solidly along body of pipe. Strongly suspend other piping from building construction.
- M. Pipe shall be braced at flexible connections to prevent blowouts under operating conditions.
- N. Run no piping or tubing in direct contact with slag fill. Where necessary to pass through slag, protect piping with not less than two wrappings of polyvinyl chloride tape or equivalent protection approved by Architect.

3.2 INSTALLATION OF VALVES:

- A. Provide shut-off valves in supply and return connections to each item of equipment. Locate valves to isolate each item to facilitate maintenance and/or removal.
- B. Provide check valve in discharge line adjacent to each pump.
- C. Locate valves in piping connections to coils, boilers, heat exchangers, refrigeration machine, etc., so heads and tube bundles can be removed without disconnecting equipment or piping other than union or flange connections immediately adjacent to the equipment.
- D. Provide sweat to screw adaptors where required.
- E. Install with valve stems upright or horizontal.

END OF SECTION

PART 1 - GENERAL

1.0 GENERAL:

- A. All external duct insulation and flexible duct shall be legibly printed or identified at intervals not greater than 36 inches with the name of the manufacturer, the thermal resistance R-value at the specified installed thickness and the flame spread and smoke-developed indexes of the composite materials.
- B. All insulation (except duct liner) shall be installed by an insulation contractor in business a minimum of 3 years as an insulation contractor and has completed projects similar in scope to this project. Submit insulation contractor qualifications.
- C. The installation of all insulation shall comply with the requirements of the contract documents unless specifically noted and approved in submittal document. Compliance with contract documentation shall be demonstrated by the insulation contractor as follows:
 - 1. Specific and random selections of the installed insulation shall be removed by the insulation contractor for observation by the owner's representative. The insulation samples removed shall be selected by the owner's representative.
 - 2. The insulation removed per observation selection shall not exceed 6 linear feet of piping insulation (including fittings) or 4 sq. ft. of ductwork or equipment insulation if the sample removed indicates compliance with the contract documents. If the sample removed does not indicate compliance with the contract documents, additional samples shall be removed for observation as directed by the owner's representative up to a total of 4 samples.
 - 3. The total number of observations shall not exceed 10 per project unless the installation of the insulation is found not to comply with the contract documents. Otherwise, the total number of observations shall be as required by the owner's representative to confirm compliance.
 - 4. If the insulation is found not to be installed as required by the contract documents, the insulation shall be removed and new insulation installed to comply with the specifications. After completion of the new insulation, the testing procedure noted above shall be repeated.

1.1 SCOPE:

- A. Section 23 0500 - "General Provisions – HVAC" shall apply to and become part of this Section.
- B. Repair existing insulation at points of connection and/or alterations to existing work.
- C. "Exposed" is defined as: Exposed to view when construction is complete. (Items which are not "exposed" are considered "concealed".)
- D. The use of any material containing asbestos is strictly prohibited.
- E. Include with insulation material submittal letters from the insulation material manufacturer certifying that the insulation material does not contain asbestos in any shape, form or quantity.

1.2 INSULATION:

- A. Comply with NFPA 90A.
- B. Pipe hanger shields are specified in Section 23 1000 - "Materials and Methods - HVAC."
- C. Use insulation and adhesives with Underwriter's Laboratories and ASTM E-84 flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding:
 - 1. 50 for pipe covering located in air ducts, plenum or casings.
 - 2. 150 for all other pipe, duct and equipment insulation.

PART 2 - MATERIALS

2.1 FIBERGLASS PIPE COVERING:

- A. Snap-on glass fiber insulation minimum density 5#/cu. ft. maximum thermal conductivity at 75°F mean temperature 0.25 BTU/(hr)(sq. ft.)(°F/in) with UL rated vinyl coated and embossed vapor barrier laminate of aluminum foil and kraft reinforced with glass fiber yarns (ASJ).
- B. For all lines seal jacket with self sealing lap. Butt adjoining sections of insulation tightly and seal with self-adhering butt joint strips.
- C. Cover fittings to thickness of adjacent covering with factory pre-molded fitting covers. Cover flanged valve bodies and flanged unions. Do not cover screwed unions on hot lines. Finish concealed fittings with a skim-coat of mastic and when mastic is dry, fitting shall be covered with glass fab and vinyl acrylic mastic unless otherwise noted below. Zeston type fitting covers may be substituted for glass fab and final coat of mastic on concealed fittings provided fire and smoke ratings are met. Finish fittings exposed in equipment rooms, boiler room, and in finished spaces with vinyl acrylic mastic over glass fab over mastic.
- D. At contractor's option, concealed tees may be insulated with field fabricated tee covers consisting of straight pipe covering on run of tee with notch at branch together with pipe covering on branch contoured to fit notch. Glass fab over skim coat of mastic shall be applied around main, lapping contoured joint at branch by 2" minimum for the full 360° of joint. Cover entire fitting covering with vinyl-acrylic mastic over glass fab, 1/8" thick (dry) coat. Submit sample of fabricated tee covering to Architect for approval before work is begun.

2.2 CELLULAR GLASS PIPE COVERING, RIGID:

- A. Cellular glass insulation having a maximum K factor at 50°F mean temperature not exceeding 0.28, and a compressive strength not less than 87#/sq. in., Pittsburgh Corning "Foamglas".
- B. Apply pipe covering in a single layer. Tightly butt and butter all joints and seams with vapor barrier mastic. Finish with a UL rated vapor barrier laminate of aluminum foil and Kraft reinforced with fiberglass yarn. Seal all laps and butt strips with suitable adhesive and cover with coat of vinylacrylic mastic.
- C. Insulate fittings with prefabricated or field fabricated fitting covers of the same material, buttered with mastic, securely held in place with stainless or copper wire with twisted ends turned in or fiberglass packing tape. Finish with glass fab over vinyl acrylic mastic with flooding coat of mastic applied over fabric.

- D. Fit pipe hangers over insulation (See PIPE HANGERS). Hanger Shields are specified under pipe hangers.
- E. Finish piping and fittings on outdoor piping with aluminum jacket (see below).

2.3 FOAMED PLASTIC PIPE COVERING: (DO NOT USE IN PLENUMS UNLESS COMPLIES WITH PARAGRAPH 1.2 ABOVE):

- A. Fire retardant foamed plastic pipe covering, maximum K factor at 75°F mean temperature not exceeding 0.27 BTU/(hr)(sq.ft.)(°F/in).
- B. Pipe covering may be seamless insulation slipped over piping before erection or may be slit longitudinally and installed over erected piping.
- C. Make fitting covers from segments of pipe covering.
- D. Cement all joints and seams in accordance with manufacturer's instruction.
- E. Fit pipe hangers over insulation (see PIPE HANGERS). Use hanger shields as specified under pipe hangers.
- F. Where exposed outside, cover insulation with aluminum jacket (see below).
- G. Armacell, Aeroflex or Normaco.

2.4 ALUMINUM JACKET (PIPING):

- A. 0.016" thick smooth aluminum jacket with laminated polyethylene and kraft paper adhered liner.
- B. Roll jacket slightly smaller than insulation diameter and secure in place with flat aluminum bands 12" o.c. Lap jacket minimum 2" and place overlap at $\pm 120^\circ$ arranged to shed water.
- C. Finish fittings on aluminum jacketed lines with 1/8" thick (dry) coat of vinyl acrylic mastic reinforced with glass cloth. In addition, provide preformed aluminum fitting jackets for outdoor fittings.
- D. Seal all joints on fitting covers with silicone sealant.

2.5 HOT EQUIPMENT INSULATION:

- A. 11 lbs. per cu. ft. density molded hydrous calcium silicate with a maximum K factor of 0.42 at 200 degrees °F mean temperature, similar to Kaylo.
- B. Secure with galvanized steel wire or band with 1/2" x 0.015 galvanized steel bands on 12" centers.
- C. Fill and point all joints and voids of insulation with mineral wool insulating cement. Next, cover all the insulation with a smoothing coat of finishing cement.
- D. Finish exposed equipment with glass cloth imbedded in vinyl acrylic mastic.
- E. Insulate sections of equipment requiring periodic servicing with sheet metal casings filled with the same thickness of material as the adjoining insulation.

2.6 COLD EQUIPMENT INSULATION (RIGID):

- A. Cellular glass insulating board having a thermal conductivity at 75°F mean temperature not exceeding 0.35 BTU/ (hr) (sq ft) (°F/in). Provide beveled lags for the particular diameter fastened in place with stainless steel bands. Butter all joints with vapor sealer mastic and tightly butt joints.
- B. Finish: Cover with white open weave glass cloth, 10-20 mesh embedded in and coated with a 1/8" dry coat Vinyl Acrylic Mastic.

2.7 DUCT INSULATION, EXTERNAL, FOR CONCEALED DUCTS:

- A. Flexible glass fiber insulation with foil-scrim-kraft (FSK) facing. Flame spread classification, 25 or less, smoke developed rating not exceeding 50. Minimum density, 1 lb./cu. ft., maximum thermal conductivity at 75°F mean temperature 0.26 BTU/(hr)(sq. ft.)(°F/in).
- B. Fire-retardant foamed plastic insulating board having a thermal conductivity at 75° mean temperature not exceeding 0.27 BTU/(hr)(sq.ft.)(°F/in.). Fasten in place and seal joints with adhesive in accordance with insulation manufacturer's instructions.
 - 1. Finish: Vimaso 749 vapor-block mastic – color grey.
 - 2. Armacell, Aeroflex or Normaco.

2.8 DUCT INSULATION, EXTERNAL, FOR EXPOSED INDOOR DUCTS:

- A. 6 lb/cu. ft. fiberglass board with FSK facing and thermal conductivity not exceeding 0.22 BTU/(hr)(sq.ft)(°F/in) at 75°F mean temperature.

2.9 DUCT INSULATION, EXTERNAL, FOR EXPOSED OUTDOOR DUCTS:

- A. 6 lb/cu. ft. fiberglass board with FSK facing and thermal conductivity not exceeding 0.22 BTU/(hr)(sq.ft)(°F/in) at 75°F mean temperature.
- B. Cover insulation with aluminum jacket sealed weather tight.

PART 3 - INSTALLATION

3.1 HVAC PIPING:

- A. Hot water supply and return piping; indoors above grade: "Fiberglass pipe covering", thickness per Table 1.

TABLE 1
INSULATION THICKNESS FOR HVAC HOT PIPING

Service	Runouts		Mains & Risers			
	Up to 1-1/2"	Up to 2"	Up to to 1-1/2"	2-1/2" to 4"	5" to 6"	8" and Up
Hot Water	1-1/2"	2"	1-1/2"	2"	2"	2"

* Runouts over 12 feet in length shall be classed as mains.

- B. Chilled water supply and return piping indoors above grade: "Cellular glass Pipe Covering, Rigid", 1" thick for lines 2-1/2" and smaller, 1-1/2" thick for lines 3" and larger. (Jacket exposed lines with aluminum jacket).
- C. Room fan coil AC unit chilled water runouts: "Foamed plastic Pipe Covering", 3/4" thick.
- D. Chilled and Condenser water supply and return lines outdoors above grade: Cellular glass pipe covering, 1-1/2" thick over electric pipeline heaters. Jacket with aluminum jacket.
- E. Chilled water supply and return piping outdoors below grade: "Cellular glass pipe covering", 1" thick for lines 2-1/2" and smaller, 1-1/2" thick for lines 3" and larger. Jacket with 2 layers 55# roofing felt or 4 layers 30# secured with 14 gauge stainless steel wire loops 12" on center.
- F. Refrigerant suction lines and hot gas bypass lines: "Cellular glass pipe covering, rigid," 1" thick for lines 2-5/8" OD and smaller, 1-1/2" thick for lines 3-1/8 OD and larger. Jacket lines located outdoors with aluminum jacket.
- G. Refrigerant suction lines and hot gas bypass lines: "Foamed plastic pipe covering", 3/4" thick for 1 inch OD and smaller.
- H. AC Unit drain lines: "Foamed Plastic Pipe Covering", 1/2" thick.
- I. Non-potable water lines outdoors above grade: As specified for chilled water and/or condenser water lines outdoors above grade over electric pipeline heaters.
- J. Non-potable water lines downstream of backflow preventer shall be insulated the same as hot water piping, indoors above grade.

3.2 HOT EQUIPMENT:

- A. Buffer Tank; "Hot Equipment Insulation", 1-1/2" thick.
- B. Air Separators: "Fiberglass Pipe Covering", 2" thick or Foamed Plastic, 1-1/2" thick.

3.3 COLD EQUIPMENT:

- A. Cold water chiller surfaces: Foamed plastic 1" thick.
- B. Chilled water compression tanks: Foamed plastic 1" thick.
- C. Chilled water one-shot chemical feeders: Foamed plastic 1" thick.
- D. Chilled water pumps: 1" thick foamed plastic insulation inside easily removable 20 gauge galvanized steel covers.
- E. Insulation for Strainers in chilled water lines:
 - 1. Equip with 20 gauge galvanized steel covers. Split along strainer centerline and secure with diecast latches. Insulate inside covers with 1" thick foamed plastic insulation. Provide gasketed openings for blow-down valves.
- F. Insulation for flexible connections in water lines:
 - 1. Build up insulation to thickness of adjacent pipe covering using foamed plastic sheet with joints sealed and staggered. Last layer shall lap adjacent pipe covering 3" and be sealed and banded to it.
- G. Insulation for casings, return bends and headers of duct mounted coils: 1/2" thick foamed plastic.

3.4 DUCT INSULATION, EXTERNAL, FOR CONCEALED DUCTS:

- A. For flexible glass fiber insulation:
 - 1. Lap jacket and vapor seal all joints and seams with suitable mastic.
 - 2. On rectangular ducts 30" wide and wider, support insulation with weld pins and speed clips 18" on centers. Seal weld pins with mastic and FSK tape.
 - 3. Thickness and Extent: All sheet metal supply return and outside air ducts not specified to be lined: Minimum 2" thick except as noted below. Note: Conical and straight spin-ins on both lined and unlined ducts shall be insulated as noted below. (See Foamed Plastic Insulation below.)
- B. All metal surfaces of ceiling diffuser (CD) located above the ceiling: 2" thick (seal air tight to diffusers).
- C. Foamed Plastic Insulation:
 - 1. Insulate portions of fire damper sleeves in insulated ducts, which are not concealed in walls, partitions and floors as specified with 3/4" thick foamed plastic insulation. Do not extend the insulation through the wall, floor or partition. Seal to wall and glass fiber insulation (or if lined duct seal foamed plastic insulation to duct with 3" lap over liner). On externally insulated duct, lap glass fiber insulation over foamed plastic and seal to foamed plastic.

2. Insulate all flexible connectors in sheet metal ducts with 1" thick foamed plastic sheet with joints sealed. Extend insulation minimum 3" upstream and downstream of flex connector joints and seal to sheet metal duct.
 3. Insulate portions of lined ducts at manual dampers with 3/4" thick foamed plastic insulation overlapping the liner a minimum 3" upstream and downstream of the damper. Seal foamed plastic insulation to duct.
 4. Insulate all casings, headers and return bends on duct-mounted coils, and coils at terminal units with 3/4" thick foamed plastic insulation. Headers and return bends shall be insulated with 3/4" foamed plastic cemented inside galvanized sheet metal covers gasketed to coil casing.
 5. Insulate all unlined ducts with dampers, all conical branch duct fittings and straight branch duct spin-ins with 3/4" thick foamed plastic insulation. Glass fiber insulation on the branch ducts shall overlap foamed plastic insulation on the conical fittings and spin-ins. Seal fiberglass to foamed plastic. For connections of flexible duct to spin-ins or conical branch duct fittings, connect flexible duct inner liner to sheet metal with specified clamps and lap outer liner and insulation over foamed plastic and clamp with Panduit strap. Seal flex duct outer cover to spin-in or conical fitting insulation. Insulation contractor shall submit sample of spin-in and conical fitting insulation and flexible duct connection for approval.
- D. Insulate portions of fire damper sleeves in insulated ducts which are not concealed in walls, partitions and floors as specified in A or B above. Do not extend the insulation through the wall, floor or partition.

3.5 DUCT INSULATION, EXTERNAL, FOR EXPOSED DUCTS:

- A. Insulate all exposed supply, return and outside air ducts and exposed return bends, headers and casings of all duct mounted coils not specified to be lined with 1" thick foamed plastic insulation cemented in place with adhesive in accordance with insulation manufacturer's instructions.
- B. Insulate all exposed supply, return and outside air ducts located in Mechanical Room with 2" thick 6#/cu. ft. fiberglass board with FSK jacket. Secure board with weld pins and speed clips 12" on centers. Seal clip indentations with mastic. Seal all joints and seams with mastic.
- C. Cover all angles, seams and joint reinforcing with insulation and seal vapor tight.

3.6 DUCT INSULATION, EXTERNAL, FOR EXPOSED OUTDOOR DUCTS:

- A. Insulate all exposed outdoor supply, return and outside air ducts with 2" thick 6#/cu. ft. fiberglass board with FSK jacket. Secure board with weld pins and speed clips 12" on centers. Seal clip indentations with mastic. Seal all joints and seams with mastic.
- B. Cover all angles, seams and joint reinforcement with insulation and seal vapor tight. Finish with aluminum jacket cover sealed weather tight.
- C. In addition, line duct with fire-retardant foamed plastic insulating board having a thermal conductivity at 75° mean temperature not exceeding 0.27 BTU/(hr)(sq.ft.)(°F/in.). Fasten in place and seal joints with adhesive in accordance with insulation manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 23 0500 – “General Provisions – HVAC” shall apply to and become part of this Section.

PART 2 - EQUIPMENT AND SPECIALTIES

2.1 DEHUMIDIFIERS

- A. U.L. labeled refrigerated dehumidifiers consisting in general of an evaporator coil, condenser coil, fan motor and fans, refrigeration compressor, drain pan, and controls all enclosed in a heavy gauge steel cabinet with baked enamel finish.
- B. Santa Fe or approved equal.

2.2 HOT WATER CONDENSING BOILERS – NATURAL GAS

A. SUMMARY

- 1. This Section includes packaged, factory-fabricated and assembled, gas-fired, firetube duplex alloy stainless steel ultra-high efficiency condensing boilers, trim and accessories for generating hot water.

B. REFERENCES

- 1. ASME Section IV
- 2. CSD-1, Controls and Safety Devices
- 3. XL GAPS
- 4. NEC, National Electric Code
- 5. UL-795 7th Edition
- 6. AHRI, BTS-2000
- 7. ASHRAE 90.1

C. SUBMITTALS

- 1. Product Data: Include performance data, operating characteristics, technical product data, rated capacities of selected model, weights (shipping, installed and operating), installation and start-up instructions, and furnished accessory information.

2. Shop Drawings: For boiler, standard boiler trim and accessories.
 - a. End Assembly Drawing: Detail overall dimensions, connection sizes, connection locations, and clearance requirements.
 - b. Wiring Diagrams: Detail electrical requirements for the boiler including ladder type wiring diagrams for power, interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
3. Certificate of Product Rating: Submit AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input, and Gross Output conform to the design basis.
4. Thermal efficiency curves: Submit thermal efficiency curves between and including minimum and maximum rated capacities, for return water temperatures ranging from 80°F to 180°F.
5. Water side pressure drop curve.
6. Flue gas temperature curves: Submit flue gas temperature curves for minimum and maximum boiler capacity, for return water temperatures ranging from 80°F to 160°F.
 - a. If submitted flue gas temperatures, minimum or maximum inputs are different from that of the basis of design manufacturer and model, the manufacturer shall be responsible for draft calculations and reselection of the flue gas exhaust system.
7. Source quality-control test reports.
8. Field quality-control test reports: Start-up by a factory authorized service company.
9. Operation and Maintenance Data: Data to be included in Installation and Operation Manual.
10. Warranty: Standard warranty specified in this Section.

D. QUALITY ASSURANCE

1. Manufacturer Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than twenty-five (25) years.
2. Aftermarket Support and Service: The manufacturer shall have a factory authorized service training program, where boiler technicians can attend a training class and obtain certification to perform start-up, maintenance and basic troubleshooting specific to the product line.
3. 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.
4. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers", for a maximum allowable working pressure of 160 PSIG.
5. CSD-1 Compliance: The boiler shall comply with ASME Controls and Safety Devices for Automatically Fired Boilers (CSD-1).
6. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
7. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by ETL.

8. AHRI Compliance: Boilers shall be tested and rated according to the BTS-2000 test standard and verified by AHRI.
9. NOx Emissions Compliance: Boiler shall be tested for compliance with SCAQMD and TCEQ.
10. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
11. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
12. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
13. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
14. In order to provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

E. COORDINATION

1. Mechanical contractor shall coordinate the size and location of concrete bases. Cast anchor-bolt inserts into bases.

F. WARRANTY

1. Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual.
 - a. Warranty Period for the Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to:
 - 1) Flue gas condensate corrosion, and/or defective material or workmanship for a period of ten (10) years, non-prorated, from the date of shipment from the factory.
 - 2) Thermal shock for the lifetime of the boiler.
 - b. Warranty Period for the Burner: The boiler manufacturer shall warranty the mesh burner head against defective material or workmanship for a period of five (5) years, non-prorated, from the date of shipment from the factory.
 - c. Warranty Period for all other components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material for a period of two (2) years, non-prorated, from the date of shipment from the factory.

G. MANUFACTURERS

1. This specification is based on Xvers L, Type H as manufactured by Raypack a Rheem Company.
2. Basis-of-Design Product: Subject to compliance with requirements specified.

H. CONSTRUCTION

1. Description: Factory-fabricated, -assembled, and -pressure tested, duplex stainless steel firetube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including flue gas vent; combustion air intake connections, water supply, water return, condensate drain, and controls. The boiler, burner and controls shall be completely factory assembled as a self-contained unit. Each boiler shall be neatly finished, thoroughly tested, and properly packaged for shipping. Closed-loop water heating service only.
2. Heat Exchanger: The heat exchanger is defined as the surfaces of the pressure vessel where flue gases transfer sensible and latent heat to the hydronic fluid. The heat exchanger shall be a three-pass firetube design constructed using only duplex alloys of stainless steel.
 - a. The boiler shall be a firetube design, such that all combustion chamber components are within water-backed areas. Watertube boilers will not be accepted.
 - b. Furnace: First pass of the combustion chamber shall be constructed of duplex alloy stainless steel with a minimum wall thickness of 0.25" and a minimum bottom head thickness of 0.625".
 - c. Firetubes: Second and third passes of the combustion chamber shall be constructed of duplex alloys of stainless steel having a minimum wall thickness of 0.109".
 - d. Furnace to tube connections shall be constructed with low weld intensity, a tube to tube minimum spacing of 2" center to center, minimum 5/8" tube to tube ligament, and shall not contain any overlapping welds.
 - e. Heat exchange capability shall be maximized within the heat exchanger via the use of corrugated firetube technology. The corrugation process shall not remove any material from the tubes. Aluminum heat transfer enhancements are dissimilar metals and are unacceptable.
3. Pressure Vessel: Design and construction shall be in accordance with Section IV of the ASME Code for heating boilers.
 - a. The shell shall be minimum: 0.3125" thick steel, SA-790 or SA-516 Grade 70.
 - b. The top head shall be a minimum 0.375" thick steel, SA-790 or SA-516 Grade 70.
 - c. The water side of the pressure vessel shall be a counter-flow design with internal water-baffling plates.
 - d. The boiler return and supply water connections shall be: 4" 150# ANSI flanged. The water connections shall not be designed to support an external structural load from the piping system.
4. Fuel/Air Mixture Combustion System: Air and gas pre-mix on the suction side of the fan.
 - a. A Flame-by-Wire™ or equivalent electronic combustion control system shall be provided to empower technicians to accurately dial-in positions electronically. The system shall feature O2 Compensation™ or equivalent to continuously tune the burner air-fuel ratio in real time, automatically adjusting for changes in seasonality to maximize combustion efficiency and condensate production for greater energy savings and reduced emissions. Pneumatic ("negative regulation", "zero governor") type systems offer far less precision and are not capable of independent air and gas control and are not accepted.

- b. The air and gas tolerance shall be no greater than $\pm 0.2^\circ$ to allow for much more precise control of air-fuel ratio compared to linkages that may slip, or pneumatic gas valves which drift over time and have difficulty handling environmental and installation fluctuations.
 - 1) Combustion air flow shall be controlled by fan speed and a servo-motor actuated butterfly valve. Fuel flow shall be controlled by a servo-motor actuated butterfly valve.
 - c. PURE Control™ algorithms with open-loop instrumentation shall be used for autonomous fuel/air ratio tuning without requiring manual input. O₂ feedback or monitoring-only systems cannot adjust for operation variability and are not accepted.
- 5. Burner: Standard natural gas, forced draft.
 - a. Burner Head: Shall be a woven fiber premix design.
 - b. Excess Air: The burner shall operate at no greater than 8.0% excess O₂ over the entire turndown range. Due to significant reductions in combustion efficiency at high levels of excess O₂, boilers exceeding 8.0% excess O₂ at any operating condition shall not be accepted.
 - c. Emissions: When operating on natural gas, the boiler shall maintain a NO_x level of <20 ppm, and CO emissions less than 50 ppm, over the complete combustion range at a 3% O₂ correction.
- 6. Blower: Variable speed, non sparking, hardened aluminum impeller centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.
 - a. Motor: Brushless DC variable speed motor with hall effect sensor feedback; internal electronic commutation controller with built in speed control and protection features; long life, sealed, ball bearing with high temperature grease.
 - b. Variable speed blower: Closed loop PWM signal input with tachometer output.
- 7. Main Fuel Train:
 - a. The boiler shall have a pre-mix combustion system, capable of operating at a minimum 4" W.C. incoming natural gas pressure while simultaneously achieving emissions performance, full modulation, and full rated input capacity. Maximum natural gas pressure allowed to the inlet of the fuel train shall be no less than 28" W.C.
 - b. A factory mounted main fuel train shall be supplied. The fuel train shall be fully assembled complete with high and low gas pressure switches, wired, and installed on the boiler and shall comply with CSD-1 code. The fuel train components shall be enclosed within the boiler cabinet.
 - c. Standard CSD-1 fuel train shall comply with AXA XL.
- 8. Ignition: Direct spark ignition with transformer.
- 9. Boiler Enclosure:
 - a. Sealed Cabinet: Jacketed steel enclosure with left hinged full height front access door, fully removable latching access panels, gasketed seams to maintain sealed combustion, mounted on a steel skid with steel plate decking.
 - b. Control Enclosure: NEMA 250, Type 1.
 - c. Finish: Internally and externally primed and painted or powder coated.

- d. Combustion Air: Drawn from the inside of the sealed cabinet, preheating the combustion air.
- 10. Rigging and Placement: The boiler shall come with lifting eyes and fork hole accessibility for rigging.
- 11. Exhaust Manifold: Shall be constructed of stainless steel, with an area for the collection and disposal of flue gas condensate.
- 12. Characteristics and Capacities:
 - a. Heating Medium: Closed loop hot water with up to 50% propylene or ethylene glycol by volume. Standard capacities shall be based on 100% water.
 - b. Design Water Pressure Rating: 160 psig.
 - c. Safety Relief Valve Setting: 125 psig.
 - d. Minimum Return Water Temperature: No minimum temperature required.
 - e. Maximum Allowable Water Temperature: 210°F.
 - f. Minimum Water Flow Rate: No minimum flow rate required to protect the heat exchanger.
 - g. Maximum Water Flow Rate: No maximum flow rate requirement.
 - h. Minimum Delta-T: No minimum delta-T required.
 - i. Maximum Delta-T: 100°F
 - j. Minimum Side Clearance: Shall not exceed 1" between any number of boilers.
 - k. Maximum Allowable Operating Setpoint: 200°F
 - l. Jacket Losses: External convection and radiation heat losses to the boiler room from the boiler shall comply with IAW ASHRAE 103-2007, and shall not exceed 0.2% of the rated boiler input at maximum capacity.
- 13. The boiler shall have its efficiency witnessed and certified by an independent third party, and the efficiency must be listed on the AHRI directory (www.ahridirectory.org) for natural gas operation. The test parameters for efficiency certification shall be the BTS-2000 standard. The certified thermal efficiency for natural gas firing shall not be less than: 98%.
- 14. A zero flow or low flow condition shall not cause any harm to the pressure vessel or heat exchanger of the boiler. Flow switches, dedicated circulator pumps, or primary-secondary arrangements shall not be required to protect the boiler from thermal shock. Boilers requiring the use of flow switches or primary-secondary piping arrangements are unacceptable.
- 15. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.

I. TRIM

- 1. Safety Relief Valve: ASME Rated.

2. Pressure and Temperature Gauge: Minimum 3-1/2" diameter, combination pressure and - temperature gauge. Gauges shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
 - a. Mounted in the field in the boiler supply water piping prior to the first isolation valve by the boiler installer.
3. Combustion Air Inlet Filter: 50 Micron.
4. Flue Gas Condensate Drain Trap: A flue gas condensate drain trap shall be provided to prevent positive pressure exhaust gases from entering the boiler room.
5. Flue Gas Condensate Neutralization: Provide and install manufacturer's pH neutralization kit downstream of condensate drain trap.

J. CONTROLS

1. The boiler electrical controls shall include the following devices and features:
 - a. 7" color touch screen control display factory mounted on the front cabinet panel door.
 - 1) The control display shall serve as a user interface for programming parameters, boiler control and monitoring; and shall feature a screen saver, alarm horn speaker, boiler status, configuration, history and diagnostics.
 - b. Integral controls power supply.
 - c. Flame safeguard control with 9 combustion fuel/air load profile points.
 - d. All standard controls shall be factory mounted and wired according to UL requirements.
2. Burner Operating Controls: To maintain safe operating conditions, factory mounted and wired burner safety controls limit burner operation:
 - a. High Limit: A manual reset mechanical Aquastat device shall stop the burner if operating conditions rise above maximum boiler design temperature.
 - b. Low-Water Cut Off: Electronic probe type mounted in the pressure vessel shall prevent burner operation on low water alarm.
 - c. Air Safety Switch: Prevent operation unless sufficient combustion air is proven.
 - d. Blocked Exhaust: Prevent operation in the event of a blocked flue gas exhaust stack.
3. O₂ Compensation: To maximize efficiency throughout seasonality:
 - a. System shall use algorithms to automatically adjust the fuel/air ratio during operation, optimizing combustion reliability, flame stability, combustion efficiency, and the dewpoint temperature for formation of flue gas condensate.
 - b. O₂ monitoring-only type systems that cannot automatically adjust combustion for seasonal variability shall not be accepted. Systems that trim but at less than a 100% duty cycle are unable to cope with rapid changes in operating conditions and shall not be accepted.
4. Boiler Operating Controls and Features:
 - a. Inlet Water Temperature Monitoring.
 - b. Combustion Air Temperature Monitoring.

- c. Flue Gas Exhaust Temperature Monitoring: Sensor probe shall be stainless steel.
- d. Proportional Integral Derivative (PID) temperature load control capability for hydronic and domestic hot water in standalone or lead/lag operation.
- e. Operating temperature sensor for automatic start and stop.
 - 1) The temperature sensor shall have tolerance according to IEC 60751
- f. Time of day display.
- g. Customizable boiler name display.
- h. Two customizable boiler interlock terminals displayed.
- i. Alarm history for a minimum 100 most recent alarms including status at time of lockout.
- j. Administrative password protection options.
- k. Indirect domestic hot water priority.
- l. Outdoor air temperature (OAT) reset controls with warm weather shutdown:
 - 1) OAT reset shall automatically adjust the setpoint according to changes in the outdoor temperature, and disable the boilers above a warm weather shutdown temperature.
 - 2) The boiler manufacturer shall provide an OAT sensor.
 - 3) The temperature sensor shall be field installed in an outdoor area not exposed to direct sunlight or the exhaust of other mechanical equipment, and wired the boiler controller.
 - 4) The control shall be field programmed with the outdoor reset schedule.
- m. Variable Speed System (Secondary) Pump Control:
 - 1) When installed in a variable primary flow configuration, the boiler controller shall provide the capability to control two variable speed hydronic heating pumps. One pump shall be duty, and one standby.
 - 2) The duty system pump shall be enabled upon the outdoor air temperature dropping below the warm weather shutdown temperature. Pumps shall be automatically rotated.
 - 3) Variable speed signal shall be provided to modulate pump speed according to hydronic heating loop Delta-T. A user selectable parameter allows for Delta-P in place of Delta-T.
- n. Motorized isolation valve control:
 - 1) Upon heat demand for the boiler, the control shall provide an enable/open signal.
 - 2) After the burner is disabled and upon the heat exchanger delta-T dropping to a user programmable delta-T, the signal will be disabled.
 - a) Boilers which utilize only a time delay close as the only means of valve actuation are unable to optimize for residual heat, and will not be accepted.

- 3) In variable primary arrangements, the control shall hold the lead boiler isolation valve open at all times.
- 5. Building Automation System Interface: Hardware and software to enable building automation system (BAS) to monitor, control, and display boiler status and alarms.
 - a. Hardwired Contacts:
 - 1) Monitoring: Boiler Status, Burner Demand, General Alarm.
 - 2) Control with Factory Installed Jumper: Safety Interlock for External Device, Remote Enable, Emergency Stop (E-Stop).
 - 3) Remote Setpoint Signal: 4-20 mA or 0-10 VDC.
 - b. Communication Protocol: A communication interface with BAS shall enable BAS operator to remotely enable and monitor the boiler plant from an operator workstation.
 - 1) The boilers will communicate with each other and the Building Automation System via a daisy chain addressed Modbus network. Field wiring between nodes shall be twisted pair low voltage with shielded ground.
 - 2) A BACnet MSTP and IP protocol communication gateway shall be provided. The BACnet gateway is field installed on a boiler. Additional boilers in the lead/lag system shall not require a dedicated BACnet gateway for the BAS to monitor status. A communication point mapping list shall be provided.
 - 3) A LonWorks protocol communication gateway shall be provided. The LonWorks gateway is field installed on a boiler. Additional boilers in the lead/lag system shall not require a dedicated LonWorks gateway for the BAS to monitor status. A communication point mapping list shall be provided.

K. ELECTRICAL POWER

- 1. Single-Point Field Power Connection: Factory-installed and factory-wired switches, transformers, control and safety devices and other devices shall provide a single-point field power connection to the boiler.
- 2. Electrical Characteristics:
 - a. Voltage: 120 V.
 - b. Phase: Single.
 - c. Frequency: 60 Hz.

L. VENTING

- 1. The boiler shall be capable of operating with a stack effect not exceeding -0.04" W.C. and a combined air intake and exhaust venting pressure drop not exceeding +1.50" W.C.
- 2. Combustion Air Intake: Direct vent the boiler using sealed combustion by drawing combustion air in from the outdoors.
 - a. Sealed Combustion: Schedule 40 PVC pipe or smooth-walled galvanized steel, vent termination with 1/2" x 1/2" mesh bird screen.

3. Flue Gas Exhaust: The flue gas exhaust stack shall be AL 29-4C or 316L stainless steel, listed and labeled to UL-1738 / C-UL S636 for use with Category II/IV appliances, guaranteed appropriate for the application by the manufacturer and supplier of the venting.
4. Common Exhaust Vents: The draft system shall be designed for Category II and to prevent the backflow of exhaust gases through idle boilers.
5. Condensate drain piping must be galvanized, stainless steel, or Schedule 40 CPVC. Copper, carbon steel, or PVC pipe materials are not accepted.

M. SOURCE QUALITY CONTROL

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
2. Each boiler shall be installed and operated in a functioning hydronic system, inclusive of venting, as part of the manufacturing process. A factory test fire report corresponding to the boiler configuration shall be included with each boiler.

MI. EXAMINATION

1. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
 - a. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
2. Examine mechanical spaces for suitable conditions where boilers will be installed.
3. Proceed with installation only after satisfactory conditions have been verified.

MII. BOILER INSTALLATION

1. Install boilers level on concrete pad, minimum 6 inches high.
2. Install gas-fired boilers according to NFPA 54. Equipment and materials shall be installed in an approved manner and in accordance with the boiler manufacturer's installation requirements.
3. Assemble and install boiler trim.
4. Install electrical devices furnished with the boiler but not specified to be factory mounted.
5. Install control wiring to field-mounted electrical devices.

MIII. CONNECTIONS

1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
3. Connect gas piping to boiler gas train inlet with isolation valve and union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
4. Connect hot water supply and return water connections with shutoff valve and union or flange at each connection.

5. Install piping from safety relief valves to the nearest floor drain.
6. Install piping from flue gas condensate drain connection to the condensate drain trap and to the nearest floor drain.
7. Boiler Venting:
 - a. Install flue venting and combustion air-intake.
 - b. Connect to boiler connections, flue size and type as recommended by the manufacturer.
8. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
9. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

Q. FIELD QUALITY CONTROL

1. Perform tests and inspections and prepare test reports.
 - a. After boiler installation is completed, the manufacturer shall provide the services of a field representative to inspect components, assemblies, and equipment installations, including connections and provide startup of the boiler and training to the operator.
 - b. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.
2. Tests and inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 1) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
 - 2) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
3. Remove and replace malfunctioning units and retest as specified above.
4. Occupancy Adjustments: When requested within 12 months of startup, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other than normal occupancy hours for this purpose.

2.3 AIR COOLED CONDENSING UNITS:

- A. Include one reciprocating compressor, condenser and condenser fan, all enclosed in a single casing. Provide separate refrigerant circuit for each compressor.
- B. Casings: aluminum or galvanized steel designed for outdoor installation. (Galvanized steel casings shall be finished with enamel over bonderizing.) Equip casings with access panels, condenser inlet guards and fan outlet guards. Provide padlock connections for power and control access panels.

- C. Compressors: welded hermetic compressors, spring isolated, with reversible oil pumps. Refrigerant: R454B.
- D. Condensers: aluminum fins securely bonded to seamless copper tubes. Condenser fans: direct driven propeller fans, resiliently mounted, with weather protected fan motors.
- E. Provide liquid receiver if condenser coil will not contain entire system charge where 80% full at 100F suction and discharge service valves and liquid stop valve.
- F. Controls: factory wired and located in a readily accessible location. Provide (2 step) line voltage contactor and both temperature and current sensitive overload devices and phase loss protection for compressor motor, cycle timer to limit compressor starts to 5 or 6 minute intervals, oil pressure switch, high and low pressure switches and crankcase heater. Provide field or factory mounted low-ambient-start devices and variable air volume or fan cycling head pressure controls for stable starting and operation in ambients down to 0°F.
- G. Mount condensing units on poured in place pad.
- H. Provide 5 year non-prorated compressor parts warranty.

2.4 AIR COOLED CONDENSER:

- A. Air cooled condenser power and control circuits shall be factory wired and terminated in weather-proof junction boxes for a single power connection.
- B. Condenser coils shall consist of seamless copper tubes and headers and aluminum fins mechanically bonded to the tubes.
- C. Fans shall be (multiple) resiliently mounted direct drives propeller fans with weather-protected motors.
- D. Casing shall be galvanized steel panel reinforced with galvanized steel rolled or formed shapes and shall be phosphatized and finished with air-dry paint.
- E. Fans shall be equipped with outlet guards and coils shall be equipped with inlet screens.
- F. Coils shall be circulated as required and sub-cooling coils shall be provided.
- G. Controls shall be factory wired to a terminal strip and shall consist of fan contactors, variable speed motor controls for at least 1/3 of the motors, refrigerant pressure switch and ambient thermostat.
- H. Condenser shall be mounted on a concrete pad as shown.

2.5 HEAT PUMP OUTDOOR UNIT

- A. Outdoor unit: a reciprocating compressors, heat transfer coil, fans, and inter-connecting piping and controls all enclosed in a single casing. For multiple compressor units provide separate refrigerant circuits.
- B. Casings: designed for outdoor installation, constructed of not lighter than (20) gauge galvanized steel with baked enamel finish over bonderizing. Provide access panels, condenser inlet guards and fan outlet guards.
- C. Compressors: Welded hermetic, spring isolated, with reversible oil pumps. Refrigerant: R454B.
- D. Coils: aluminum fins securely bonded to seamless copper tubes. Fans: direct driven propeller fans with weather protection for fan motors.

- E. Provide suction and discharge service valves, liquid stop valve, and solenoid change-over valves.
- F. Controls: factory wired and located in a readily accessible location. Compressor motor shall have line voltage (multi-step) contactor and both temperature and current sensitive overload devices. Include high and low pressure switches, short cycle timer, crank case heater, defrost thermostat, and defrost timer. Provide field or factory mounted low-ambient-start devices and variable air volume or fan cycling head pressure controls for stable starting and operation in ambients down to 0°F.
- G. Mount outdoor units on poured in place pad as shown.
- H. Provide 5 year non-pro-rated compressor parts warranty.

2.6 AIR COOLED WATER CHILLER UNITS:

- A. Include multiple microprocessor controlled scroll compressors, condenser and condenser fan and liquid cooler, all enclosed in a single casing. Provide a separate refrigerant circuit for each compressor. Chiller shall have power wiring arranged for a dual power feed to unit. Refrigerant: R-32. Chillers shall be certified in accordance with the latest Standard AHRI 550/590. Chillers shall have a minimum EER 9.88 BTU/(W-hr).
- B. Cabinet: heavy gauge aluminum or galvanized steel for outdoor installation. (Galvanized steel casings shall be finished with enamel over bonderizing.) Equip cabinets with access panels, condenser inlet guards and fan outlet guards. Provide padlock connections for power and control panels.
- C. Compressors: hermetic scroll-type compressors, including the following:
 - 1. Complaint design for axial and radial sealing.
 - 2. Refrigerant flow through the compressor with 100% suction cooled motor.
 - 3. Large suction side free volume and oil sump to provide liquid handling capability.
 - 4. Compressor crankcase heaters to provide extra liquid migration protection.
 - 5. Annular discharge check valve and reverse vent assembly to provide low-pressure drop, silent shutdown and reverse rotation protection.
 - 6. Initial oil charge.
 - 7. Oil level sightglass.
 - 8. Vibration isolator mounts for compressors.
 - 9. Brazed-type connections for fully hermetic refrigerant circuits.
 - 10. Compressor motor overloads capable of monitoring compressor motor current.
 - 11. Factory-mounted compressor acoustic sound blankets.
- D. Condenser coils: all-aluminum microchannel coils.
- E. Pump:
 - 1. Pump package includes: two pumps, expansion vessel, drainage valve, shut-off valve at entering and leaving connections.

2. The pump package is single point power integrated into the chiller unit power with a separate factory wired control panel and separate power for freeze protection.
 3. The control of the pump is integrated into the chiller controller. The unit control module displays evaporator pump starts and run-times. Freeze protection down to an ambient of -29°C (-20°F) is included as standard. The cold parts of the pump package will be insulated. Designed with one redundant pump, it is controlled to operate both pumps through a lead/lag and failure/recovery functionality.
 4. A variable speed drive is installed in an additional panel to control the pump. The inverter is adjusted upon start up to balance the system flow and head requirements. The purpose is to save on wasted pump energy caused by a traditional balancing valve.
- F. Condenser fans: dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise, full airfoil cross section, providing vertical air discharge and low sound. Each fan in its own compartment.
- G. Vibration Isolation: Provide seismic deflection rated vibration isolators sized for operational weight of chillers.
- H. Fan Motors: High efficiency, direct drive, rigid mounted, with double sealed, permanently lubricated, ball bearings.
- I. Water chiller: shell and tube or shell and coil direct expansion chiller (with a separate refrigerant circuit for each compressor), shell baffles to provide capacity shown, drain connection, 1-1/2" thick evaporator foamed plastic insulation. Paint all foamed plastic insulation with two (2) coats of manufacturer approved weather resistant paint.
- J. Interconnecting refrigerant piping: Type L hard copper, wrought copper sweat fittings silfossed, foamed plastic insulation.
- K. Provide (liquid receiver if condenser coil will not contain entire system charge where 80% full at 100°F) suction and discharge service valves and liquid stop valve.
- L. Controls: factory wired, located in a readily accessible rain and dust tight control cabinet with provision for padlocking.
1. Compressor motor controls: line voltage contactors and both temperature and current sensitive overload devices, cycle timer to limit compressor starts to 5 or 6 minute intervals, oil pressure switch, high and low pressure switches and crank case heater.
 2. Chiller controls: solenoid liquid valve for each circuit, operating thermostat to cycle solenoids valves, and low limit chilled water thermostat.
 3. Provide automatic reset upon power loss.
- M. Chillers shall have a minimum 14,000 amps interrupting capacity (AIC) rating.
- N. The chiller warranty shall include the entire chiller and shall be for 5 years from start-up date. During the warranty period the manufacturer shall furnish all **parts** and **labor** required for any warranty failure. The warranty shall include any expenses required for travel, lodging, meals, etc. for the technician performing the work or any freight costs for replacement parts.
- O. The installation, pressure testing, evacuation, dehydration, charging and initial startup, final assembly and alignment of all refrigeration equipment shall be done under the supervision of the manufacturer's factory trained representative. Include services of a factory trained technician for instructing Owner's operating personnel in machine operation: One (1), Eight (8) hour day. Training shall be scheduled and coordinated with the Owner a minimum of two (2) weeks prior to date of training. Review offactory

start-up reports along with operation and maintenance (O&M) manuals shall be included in Owner training.

- P. Provide a minimum of three (3) sets of hard copies and two (2) CD's with PDF files with manufacturer's operating and maintenance (O&M) manuals and parts lists for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency thereof. Include all warranty dates on equipment and guarantees. Refer to O&M requirements.
- Q. Mount chiller on 4 inch concrete pad.
- R. Provide differential pressure switch with chiller.
- S. Provide full integrated BAS connectivity via BACnet® MS/TP. Coordinate requirements with Honeywell Controls vendor prior to order being placed. See controls sequences on drawings for capabilities. BAS shall have capability of load limiting chiller.
- T. Provide 5 year non-prorated compressor parts and labor warranty as part of the chiller warranty.
- U. Chillers shall be Carrier 30RC or approved equal.

2.7 VARIABLE FREQUENCY SPEED CONTROLLERS:

- A. For each motor so scheduled provide a variable frequency, AC, solid state, induction motor speed controller. The speed controller shall be self-contained, with all components enclosed in a NEMA 1 cabinet and be capable of operation 1-40 degrees centigrade. The controller shall be capable in operating with $\pm 10\%$ of system voltage and 60 Hz $\pm 3\%$ frequency variation. It shall have 10-1 frequency range. The speed controller shall be wall mounted.
- B. The speed controller shall be automatically controlled by a pneumatic 3-15 psi signal, 10 volt dc, 4-20 milliamps, control signal. 20 milliamps shall correspond to maximum speed and 4 milliamps shall correspond minimum speed. The controller shall have capability to invert the input signal, if necessary due to process requirements. Coordinate control signal with controls contractor.
- C. The VFD's shall limit harmonic distortion reflected onto the utility system to a voltage and current level as defined by IEEE 519 for general systems applications, by utilizing the standard 3% nominal impedance integral ac three-phase line reactor. An isolation transformer or external line reactor may be substituted as an option. Provide line reactor on the output of the drive to limit standing wave and to prevent damage to the VFD and motor. **All VFD's for motors 100 HP or more shall be Active Front End (AFE) utilizing insulated gate bipolar transistors (IGBTs) instead of diodes in the rectifier circuit. Active Front End (AFE) drives shall limit total harmonic distortion to 3%.**
- D. Total harmonic distortion shall be calculated under worst case conditions in accordance with the procedure outlined in IEEE Standard 519-1992. Copies of these calculations shall be provided in the submittal. The contractor shall provide any needed information to the VFD supplier three (3) weeks prior to submittal date.
- E. If the system cannot meet the IEEE 519-1992 harmonic levels with VFD's provided with the standard input line reactor or optional input isolation transformer, the VFD manufacturer shall supply a twelve pulse, multiple bridge rectifier ac to dc conversion section with a phase shifting transformer.
- F. The speed controller shall be completely prewired at the factory and shall have one input power connection and one output power connection to the motor. If isolation transformer, line filters, or other equipment is required external to the speed controller cabinet, then all interconnecting wiring shall be provided at no extra cost to the Owner. See Electrical single line wiring diagram for input wire size and lug size required.
- G. Sound power developed by speed controllers shall not numerically exceed NC-75 sound pressure and by motors shall not exceed 4 dB(A) above specific motor across the line delivered sound pressure levels in 2nd through 8th octave bands.

- H. VFD programmable parameters shall be adjustable from the keypad. The display shall be alphanumeric, programmable with status indicators. The display shall be in plain English words for parameters, status and diagnostic messages. Alphanumeric codes and/or tables are unacceptable.
- I. Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's RS-232 port or RS-485 port and Windows™ based software. In addition, the software shall permit control and monitoring via the VFD's RS-232 port or RS-485 port. VFD manufacturer may offer a BAS serial link and field bus adapter for standard protocols.
- J. Provide two (2) programmable Form C contact outputs (one for motor running and one for fault trip) and one (1) programmable 24VDC open collector output (for drive ready).
- K. Provide six (6) digital inputs for start/stop, local/remote, external interlock, two preset speeds and run enable.
- L. The drive shall record and log faults. The VFD shall display all faults in plain English.
- M. The variable frequency drive(s) and all components shall be designed, manufactured and tested and approved in accordance with the latest applicable ANSI, IEC, UL, CUL, CSA and NEMA standards. Each drive shall be rated to withstand a minimum of 65,000 amps fault current. (Verify available fault current with electrical.)
- N. The supplier of the drive assembly shall be the manufacturer of the electromechanical power components used within the assembly, such as bypass contactors, circuit breaker, fused disconnect switch devices when specified.
- O. The supplier of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- P. The VFD's shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source VFD's are not acceptable. Insulated Gate Bipolar Transistors (IGBT's) shall be used in the inverter section. Bipolar Junction Transistors, GTO's or SCR's are not acceptable.
- Q. The VFD's shall be capable of operating any NEMA Design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD. VFD carrier frequency shall be limited to 3-8 kHz for optimum motor performance.
- R. The VFD's shall be able to start into a spinning motor. The VFD's shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the VFD's shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
- S. The speed controller shall incorporate the following minimum features:
 - 1. Door interlocked circuit breaker or disconnect switch with input fuses capable of being locking in off/open position.
 - 2. All control inputs isolated from ground and power.
 - 3. Hand-off-automatic selector (on face of panel).
 - 4. Ground fault protection, over current, over voltage, under voltage, over temperature, loss of speed reference, and UL 5086 motor overload protection.
 - 5. Pilot light indication for VFD and bypass modes (on face of panel).

6. Individual acceleration/deceleration adjustments.
 7. Maximum and minimum speed adjustments.
 8. 120V AC control power transformer for low voltage control that can easily interface with building safe interlock circuits.
 9. Solid State microprocessor based logic for starting and stopping motors.
 10. One analog output signal for output frequency.
 11. Insensitivity to incoming phase rotation.
 12. Auto reset with coast down timer with 0.05 second dropout (after power or thermal shutdown).
 13. Output current limiters.
 14. Motor stall protection.
 15. Manufacturer's warranty of 2 years from date of start-up.
 16. Output isolation contactor.
 17. Bypass contactor mechanically and electrically interlocked with the output isolation contactor.
 18. Overload relays for bypass contactor.
- T. Provide factory check-out and start-up service.
- U. Speed controllers shall be suitable for use with current shown on the Electrical drawings.
- V. Speed controllers shall be ABB ACH-580.

2.8 CLOSE COUPLED IN-LINE PUMPS:

- A. Enclosed impeller design arranged to permit removing impeller without dismantling piping. Motors: 1800 rpm drip proof, high efficiency (see Motors). Provide motors sized to prevent overload at zero head with impeller furnished.
- B. Shafts: turned from heat treated carbon steel, key seat for the impellers, threaded for shaft nuts, and finished turned over entire surface.
- C. Shaft Sleeves: Equip portions of the shafts coming in contact with the water with removable bronze or stainless steel sleeves.
- D. Impeller: bronze with machined finish on the outside and smooth surfaces inside, balanced to prevent vibration. Impeller diameters shall not exceed 85% of maximum diameter for volute.
- E. Casing wearing rings: bronze, easily replaceable, installed to prevent rotation.
- F. Equip pumps with mechanical seals suitable for use with design water temperatures. Provide 1 spare shaft seal of each size used on job.
- G. Pumps: Taco.

2.9 HORIZONTAL FAN COIL UNITS:

- A. Air handling units: factory fabricated units having capacity shown, consisting in general of a filter section, a cooling coil section, an access section, a reheat coil section, drip pan and drain sections, and supply fan section, all the product of a single manufacturer. Provide all sections of the same frame size with support rails for all sections. Provide lifting lugs for suspending from structure.
- B. Casing: not lighter than 18 gauge galvanized steel, all sections of casing insulated with 2" thick 3 lb./cu.ft. coated fiberglass insulation. All sections shall be of double wall construction with solid 26 gauge galvanized steel liner on air side of all sections except coil section, which shall be solid.
- C. Drain pans: double construction with insulation between pans and 16 gauge type 304 stainless steel inner pan.
- D. Coil sections shall be double wall solid construction with the coils scheduled. Coils shall comply with the requirements below for coils.
- E. Provide spacer sections for installing control bulbs between coils. At least 18" space must be provided between preheat and chilled water coils.
- F. Provide hinged and latched access doors in casings at fan sections, filter sections, plenum sections, upstream and downstream from cooling coils and elsewhere as shown and/or required for access to equipment and/or controls. Construct doors with 1-1/2" insulation between 2 sheets 24-gauge galvanized steel. Set doors in frames arranged so that doors will be flush with exterior of casing. Equip each door with at least 2 hinges and 2 sets of double acting latches. Latches shall be made from nonferrous metal, with a lever handle on the outside and a lever handle on the inside of the casing. Lever handle on the outside of the casing shall cam over a door pull with a stop. Doors shall be reinforced to prevent wracking and warping. Provide 3" butt hinges and weld to doors and to door frames. Provide galvanized steel nosings on casing insulation at doors. All pressurized access doors shall open into the fan section. Install gaskets at all section connections.
- G. Automatic dampers shall comply with the requirements for automatic dampers below.
- H. Air filters: Provide side access filter sections, 2 inch thick, MERV 8 filters.
- I. Provide vapor proof marine lights in all sections. Lights shall be factory wired with switches located next to access door. Wiring to be in compliance with NEC and Division 26.
- J. Fans: Forward curved centrifugal fans. Bearings shall be minimum **L₁₀ 200,000** hour self-aligning grease lubricated ball bearings. Grease fittings shall be extended to accessible locations after units are installed. Fan and fan motor shall be mounted on spring isolated base inside unit, and snubbing isolators shall be provided for discharge flexible connections. Fan motor shall be mounted on an adjustable base and shall be equipped with V-belt drive sized for 150% motor nameplate rating, adjustable pitch motor pulley for motors 25 H.P. and smaller.

2.10 PACKAGED AIR HANDLING: DOAS-SS

- A. Air Handling Units: supply fans, coils, filters, and drip pans, horizontal or vertical as shown.
- B. Casings: galvanized steel not lighter than (22) gauge, reinforced with angles or formed shapes with baked enamel finish over bonderizing. Casing panels: removable for access to fans, motors, coils, and bearings. Provide knockouts for piping and electrical connections. Casing shall be insulated with 1" thick foil-faced duct liner meeting the requirements of NFPA 90A.

- C. Provide statically and dynamically balanced belt driven centrifugal fans with self aligning ball bearings, adjustable pitch motor (pulley), and adjustable motor base. (Size belt drives for 50% overload.) Fan motor and drive shall be located inside unit cabinet. Provide fan starting relay for each unit.
- D. Coils: include direct expansion coils and hot gas reheat coils. (Refrigerant shall consist of nonferrous fins securely bonded to seamless copper tubes, and shall bear AHRI approved ratings.)
- E. Drain pans: Double construction with insulation between pans and 16 ga. Type 304 stainless steel inner pan.
- F. Filters: 2" thick MERV 13 filters. Turn equipment over to Owner with clean filters.
- G. Install unit on vibration isolators on 4 inch concrete pad.
- H. Units shall be: Trane BCVE.

2.11 SPLIT SYSTEM AIR CONDITIONERS - SMALL:

- A. Split system air conditioners shall consist of a wall mounted indoor section, outdoor condensing unit, connecting refrigerant piping, and electronic controls. System shall be UL rated.
- B. Indoor unit shall consist of centrifugal evaporator fan(s), evaporator coil, drain pan with condensate pump and safety switch, all enclosed in a plastic casing equipped with adjustable supply grille and return air grille. Provide 3 pole disconnect switch.
- C. Outdoor unit shall consist of compressor, condenser coil, condenser fan, and controls, all enclosed in a metal grilled cabinet suitable for roof or pad mounting. Provide refrigerant piping kit, pre-insulated, properly sized for capacity shown. (See drawings to determine length.) Provide low ambient operation to 20°Fdb outdoors.
- D. Controls shall consist of a wall mounted remote controller utilizing a microprocessor. Functions shall include:
 - 1. Computerized dehumidification.
 - 2. Operation mode setting.
 - 3. Self-diagnostic display.
 - 4. Room temperature display.
 - 5. Twenty-four hour on-off timer.
 - 6. Fan speed indicator.
 - 7. Memory.
 - 8. Low ambient operation.
- E. Split system air conditioners shall be Fujitsu or approved equal.

2.12 VARIABLE REFRIGERANT FLOW SIMULTANEOUS HEATING AND COOLING SYSTEM

- A. General: The variable refrigerant flow heating and cooling system is designed and specified for heat recovery simultaneously heating and cooling. Variable refrigerant flow systems manufactured by Fujitsu.

- B. Submittal Required: In addition to detailed equipment submittal noted above, successful bidder shall submit a detailed, dimensioned refrigerant piping plan showing line lengths and sizes. Refrigerant piping shall be as approved by the equipment manufacturer.
- C. System Description
1. The variable capacity heat pump and air conditioning system shall be a variable refrigerant flow series heat/cool split system using simultaneous heat/cool operation. The system shall consist of multiple indoor units and one or more outdoor units manifolded for combined capacity requirements. The outdoor unit shall be direct expansion type air cooled heat pump with variable speed driven rotary compressor utilizing advanced inverter control.
 2. By varying the rotational speed of the compressor, the inverter control is matching the amount of refrigerant being delivered to the needs of each zone during full and partial-load conditions. Indoor units shall be supplied as per schedule. Each indoor unit is capable of operating separately with individual temperature control. The indoor units shall be connected to the system utilizing solenoid valve kits matching the size of the indoor unit.
 3. The system shall be piped with refrigerant lines using factory supplied connectors on all branching lines. All refrigerant piping shall be insulated as specified. The system shall be charged with R410A refrigerant according to manufacturer's guidelines.
- D. Quality Assurance:
1. The units shall be listed by Underwriters Laboratory or the Canadian Standard Association (CSA / CSA-US) and bear the UL or CSA label.
 2. All factory wiring shall be in accordance with national or state electric codes.
 3. The system shall be manufactured in a facility bearing ISO 9001 and/or ISO 14001 certification which is a set of standards applying to environmental protection set by the International Standard Organization (ISO). The system shall be factory tested.
- E. Handling and Storage: The units shall be handled and stored according to manufacturer's recommendations. Each unit shall be supplied with initial charge of R454B.
- F. Warranty: The unit shall have a manufacturer's warranty (parts and labor) for a period of one (1) year from the date of installation. There shall be a six (6) year compressor (parts) warranty from the date of installation.
- G. Installation and Start Up: The system including refrigerant piping and charge must be installed and commissioned by a factory trained technician.
- Operating Range (Outdoor Ambient)
Cooling: 14°F_{DB} to 109 °F_{DB}
Heating: -4°F_{WB} to 59 °F_{WB}
- H. Outdoor Unit:
1. General: The outdoor unit shall be designed specifically for use with VRF inverter technology components.
 2. The unit shall be factory assembled and wired with all refrigerant and electronic controls.
 3. The refrigerant circuit shall consist of a DC Inverter type rotary compressor, motors, fans, condenser coil, electronic expansion valve, oil separators, service ports, liquid receivers and accumulators, capillary tube, 4-way valves, solenoid valves, and strainer.

4. All refrigerant piping (suction, liquid and discharge) must be individually insulated between the outdoor and indoor units.
5. Connectability: Up to 16 indoor units on a single outdoor unit and up to 40 indoor units on combination units. Diversity ratio 50 - 130%
6. The sound power level shall not exceed 65 dB(A) at 3.3 feet in front at height of 4.9 feet during standard heat or cool mode. At the "Quiet" mode this value shall drop to 62 dB(A).
7. The system will automatically restart operation after a power failure lost setting. (No reprogramming).
8. The following safety devices shall be included: high pressure switch, low pressure switch, control circuit fuses, crankcase heater, overcurrent (CT method), inverter protection, anti-cycletimer.
9. Reverse-cycle Defrost for outdoor unit cycle defrost.
10. The outdoor unit shall be completely weatherproof and corrosion resistant. Unit panels shall be painted with baked enamel finish.
11. Condenser Fan:
 - a. Condensing unit shall consist of one propeller type fan direct drive 0.7 kW motor with variable speed DC inverter with high pressure switch and overcurrent (CT method) connection).
 - b. The fan shall be vertical type discharge air configuration.
 - c. The fan shall be protected with fan guard to prevent contact with moving parts.
12. Outdoor Coil:
 - a. The condenser coil shall be made of copper tubes and aluminum fins mechanically bonded.
 - b. The condenser finned area shall accommodate for system subcooling capacity in cooling mode.
 - c. The condenser finned area shall accommodate for system superheat capacity in heating mode.
13. Compressors:
 - a. Inverter Compressor: The compressor shall be a DC Inverter type scroll hermetic compressor with variable refrigerant flow capability.
 - b. Oil Separator shall be part of the discharge (hot gas) line.
 - c. Provide Suction Line Accumulators
 - d. Compressor motor shall be type IPMSM (Interior Permanent Magnet Synchronous Motor).
14. Electrical:
 - a. The power supply to the outdoor unit shall be 208/230 Volts, 3 phase, 60 Hertz
 - b. The control voltage between the outdoor units and indoor and indoor units shall be 12 VDC in 18 AWG stranded, shielded cable. The shielding must be grounded on one side.

I. Indoor Units:

1. 4-Way Ceiling Mounted Semi-Recessed Indoor Fan Coil Units and Horizontal Fan Coil Units Ducted:

a. General : Unit Sizing and Cabinet:

- 1) Semi-recessed ceiling units shall be constructed for installation in a 24" by 24" ceiling grid system without modification to the ceiling system. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air or nitrogen before shipment from the factory.
- 2) Four-way grille shall be fixed to the bottom of the cabinet allowing two, three or four-way airflow.

b. Fan:

- 1) The indoor unit fan shall be a turbo fan assembly driven by a single motor.
- 2) The indoor unit fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
- 3) The indoor unit fan shall consist of three speeds, Low, Mid, and High.
- 4) The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow
- 5) The auto air swing vanes.

c. Cassette Filter: Return air shall be filtered by means of an easily removable, washable filter.

d. Fan Coil: Return air plenum filter box 1" thick pleated filter, MERV 8.

e. Coil:

- 1) The indoor unit shall be of non-ferrous construction with smooth plate fins on copper tubing.
- 2) The tubing shall have inner grooves for high efficiency heat exchange.
- 3) All tube joints shall be brazed with silver alloy.
- 4) The coils shall be pressure tested at the factory.
- 5) A condensate pan and drain shall be provided under the coil.
- 6) Refrigerant lines to the indoor units shall be individually insulated with 3/4" closed cell foam insulation.
- 7) This model has a factory installed condensate lift pump.
- 8) Capacity: See the schedule on the drawings for the capacity requirement in each zone.

- 9) Power Requirements: Power requirement shall be 208 to 230 Volts single phase power

J. Wall Mount Indoor Fan Coil Unit:

1. Split system air conditioners shall consist of a wall mounted indoor section, connecting refrigerant piping, and electronic controls. System shall be UL rated.
2. Indoor unit shall consist of centrifugal evaporator fan(s), evaporator coil, drain pan with condensate pump and safety switch, all enclosed in a plastic casing equipped with adjustable supply grille and return air grille. Provide 3 pole disconnect switch.
3. Controls shall consist of a wall mounted remote controller utilizing a microprocessor. Functions shall include:
 - a. Computerized dehumidification.
 - b. Operation mode setting.
 - c. Self-diagnostic display.
 - d. Room temperature display.
 - e. Twenty-four hour on-off timer.
 - f. Fan speed indicator.
 - g. Memory.
 - h. Low ambient operation.

K. Heat Pump Vertical Indoor Units:

1. Indoor units: supply fans, coils, filters, and drip pans, vertical as shown.
2. Casings: galvanized steel not lighter than (22) gauge, reinforced with angles or formed shapes with baked enamel finish over bonderizing. Casing panels: removable for access to fans, motors, coils, and bearings. Provide knockouts for piping and electrical connections. Casing shall be insulated with 1" thick foil-faced duct liner meeting the requirements of NFPA 90A.
3. Provide statically and dynamically balanced direct driven centrifugal fans with self aligning ball bearings, adjustable speed motor (3 speed). Fan motor and drive shall be located inside unit cabinet. Provide fan starting relay for each unit.
4. Coils: include refrigerant coils and electric heating coils. Refrigerant coils shall consist of nonferrous fins securely bonded to seamless copper tubes, and shall bear AHRI approved ratings.
5. Drain pans: provide corrosion resistant coating and insulating corrosion-resistant fill.
6. Filters: 1" thick throwaway filters, MERV 8. Turn equipment over to Owner with clean filters. Provide one set of spare filters.
7. Electric Heaters:
 - a. All heaters shall be listed in the Underwriters Laboratories, Inc. Electrical Appliance & Utilization Equipment list.

- b. Heaters shall have ceramic supported nichrome wire elements, flanged mounting plate, NEMA 1 control box containing contactors for heaters, factory wired to terminal strips and 1/2" insulation between mounting plate and control box. All sheet metal parts in air stream aluminized or galvanized steel. Provide spaces at terminal end of heater so that internal duct insulation will not cause hot spots.
 - c. Equip heaters with factory wired automatic high limit control and a supplementary independent thermal device to disconnect all power circuits in case automatic high limit fails. Equip heaters shall be supplied with control circuits suitable for 24 volt control, factory wired to terminal blocks in control box.
 - d. Provide staging as required by code, but not fewer stages than those shown.
- 8. Indoor Units: of same manufacturer as outdoor units.
- 9. Provide insulated plenum bases as shown.
- L. Controls:
 - 1. Zone Control:
 - a. Control of the zone (indoor) units shall be accomplished with a wired zone controller.
 - b. Zone controller models available shall be as follows:
 - 1) Standard wired zone controller with diagnostic capability
 - 2. Intelligent controller:
 - a. This controller shall connect to the system communication trunk and provide the capability of programmed control on all of the zone units connected to the trunk.
 - b. This controller shall provide web access to the system.
 - c. This controller shall have a user interface with a touch screen.
 - d. This controller shall have BACnet serial interface with BAS.

2.13 FOUR PIPE CEILING CASSETTE FAN COIL SYSTEM:

- A. Chilled and Hot Water Cassette Fan Coil.
 - 1. System Description:
 - a. Chilled Water Hot Water Fan Coils are manufactured with galvanized steel and high impact molded polymers.
 - b. Chilled Water Hot Water Cased Fan Coil are manufactured with galvanized steel and high impact molded polymers.
 - c. Units shall be Carrier Air Stream or approved equal.
 - 2. Quality Assurance:
 - a. ETL Certified in accordance with U.L. Standard 95, latest version (U.S.A.).
 - b. Manufactured in a facility registered to ISO 9002, Manufacturing Quality Standard.
 - c. Fully load tested at the factory.

- d. Damage resistant packaging.
- 3. Equipment: Cassette Fan Coil .
 - a. General:
 - 1) Unit shall be a factory assembled and tested water fan coil.
 - 2) Unit shall be assembled with high quality.
 - 3) Contained within the unit shall be all factory wiring, piping, and associated controls.
 - 4) Include 3-way automatic control valve piping package.
 - b. Unit Cabinet and Cover:
 - 1) Cabinet is constructed of galvanized sheet metal.
 - 2) Cover composed of high impact polymers.
 - 3) Internally and externally insulated to ensure quiet operation.
 - c. Fan Motor and Blower Wheels:
 - 1) Available in 208/230-1-50/60 VAC.
 - 1) Fan motor shall be three speed, direct drive, and PSC type.
 - 2) Fan motor shall be totally enclosed.
 - 3) Fan motor shall be internal overload protected.
 - 4) Radial blower wheel is dynamically balanced.
 - d. Air Distribution:
 - 1) Unit contains four manually adjustable discharge air louvers.
 - e. Water Coil:
 - 1) Manufactured with water coils containing copper tubing mechanically bonded to aluminum fins.
 - 2) Maximum operating pressure is 150 psig.
 - 3) Coils are designed to accept an entering water temperature not to exceed 160°F
 - 4) Pressure independent flow control required on both coils to not exceed max flow for each coil.
Consult primary coil and secondary coil data for proper sizing.
 - f. Drain Pan:
 - 1) Constructed of injected molded polystyrene.
 - g. Filters:
 - 1) Unit shall contain a woven panel washable filter.
 - h. Fresh Air:
 - 1) Unit shall be able to receive up to 50% filtered fresh air.
 - 2) Fresh air introduced shall be externally fan forced and externally controlled.
- 4. Controls:
 - a. Fan coils are factory wired and tested.
 - b. Unit includes a terminal block that is capable of incorporating a 24 vac, field supplied, hard wired thermostat.
 - c. Provide 3-way automatic control valve piping package for each unit.
- 5. Safeties:
 - a. Fan coil contains a renewable fuse on the low voltage side of the transformer.
 - b. Coils shall be designed to accept an entering water temperature not to exceed 160°F.
- 6. Electrical Requirements:
 - a. Electrical line voltage connections shall be made at the factory supplied terminal block.
 - b. Factory wiring shall be rated according to UL listing at the time of manufacturing.

7. Installation in high ambient/high humidity environments:
 - a. Cabinets are internally insulated from the factory. However, when these units are installed in high ambient/high humidity environments, additional external cabinet insulation may be required.

8. Definitions – Abbreviations:

CFM = Cubic Feet per Minute

DB = Dry Bulb Temperature

EWT = Entering Water Temperature

GPM = US Gallons Per Minute

MBH = BTU X 1000

SC = Sensible Cooling

TC = Total Cooling = Sensible + Latent

WB = Wet Bulb Temperature

WPD = Water Pressure Drop in feet of head

dB = Decibel Level

m = Meter

In = Inches

FP I= Fins per Inch

OD = Outside Diameter

ID = Inside Diameter

MCA = Minimum Circuit Amps

MOP = Maximum Over current Protection

LBS = Pounds U.S

9. Measurements:
 - a. All measurements with regard to length, width, and height shall be in inches.

B. 4-Pipe Chilled and Hot Water Fan Coil High Static:

1. System Description: Chilled Water Fan Coils are manufactured with heavy gauge galvanized steel to resist corrosion.
2. Quality Assurance:
 - a. Certified in accordance with U.L. Standard 95, latest version (U.S.A.)
 - b. Manufactured in a facility registered to ISO 9902, Manufacturing Quality Standard.
 - c. Fully load tested at the factory.
 - d. Damage resistant packaging.

3. Equipment – Cased Horizontal Fan Coil.
 - a. General:
 - 1) Unit shall be a factory assembled and tested chilled and hot water fan coil.
 - 2) Shall be assembled with heavy gauge galvanized steel.
 - 3) Contained with the unit shall be all factory wiring, piping, associated controls and special accessories required prior to start up. Filters are not included with the fan coil.
 - 4) A filter rack is built into the return of each fan coil.
 - b. Unit Cabinet:
 - 1) Composed of heavy gauge galvanized steel casing with a baked polyester powder.
 - 2) Shall be internally insulated to ensure quiet option.
 - c. Fan Motors:
 - 1) Shall be available in 208/230-1-50/60 VAC.
 - 2) Fan motors shall be three speed, direct drive, and PSC type.
 - 3) Totally enclosed.
 - 4) Internal overload protected.
 - d. Blower Wheels:
 - 1) Blower wheels are forward curved and dynamically balanced.
 - e. External Static Pressure.
 - 1) Unit shall be rated for a minimum external static pressure of 0.3" WG and maximum of 0.5" WG.
 - f. Water Coil:
 - 1) Manufactured with water coils containing 3/8 copper tubing mechanically bonded to aluminum fins.
 - 2) Contain both a manual water/air bleed port per coil.
 - 3) Coils have a max operating pressure of 150 PSIG.
 - 4) Maximum liquid solution temperature is 180 degrees F.
 - 5) Heating coil to be in the reheat position between cooling coil and fan.
 - g. Drain Pan:
 - 1) All drain pans shall be coated on both the interior and exterior with baked polyester powder to resist corrosion.
 - 2) The exterior of all drain pans shall be insulated with closed cell insulation to prevent condensation.
 - 3) Pans shall contain sloped drain connection as well as a sloped secondary drain connection.
 - 4) Field supplied and installed P-Traps are required.
4. Controls:
 - a. Fan coils shall be completely factory wired and tested.
 - b. All components shall be wired to an internal terminal block to allow for a field installed 24 vac thermostat fan speed control and automatic 3-way control valves.
 - c. Controls shall include the following components.
 - 1) 24vac transformer.
 - 2) Three fan relays.
 - 3) Optional thermostats.
5. Safeties:
 - a. Fan coil shall contain a non-reusable fuse on the secondary voltage side of the transformer.
6. Operation Characteristics – Electrical Requirements:
 - a. Primary electrical power supply shall enter the unit at a single location.
 - b. Electrical power supply shall be rated to withstand 120°F operating ambient temperatures.

- c. Control and high voltage points shall be accessed through terminal block.

2.14 SINGLE ZONE ROOF TOP 100% FRESH AIR UNIT DOAS (GAS FIRED HEATING CYCLE):

- A. Each unit shall be a horizontal single package heating and cooling unit. All operating components shall be assembled together in a weather-proof casing designed for outdoor installation.
- B. Casing shall be constructed of galvanized steel not lighter than 20 gauge with epoxy primer and baked enamel finish. Portions of casing in contact with supply air shall be double wall construction with minimum R13 insulation.
- C. Unit shall be mounted on a galvanized steel curb mounting frame contoured to fit unit, and all supply ducts shall pierce the roof within the curb. Curb shall be equipped with a flashing pressure treated wood nailer and gaskets for the unit to curb joint.
- D. Refrigeration components shall include room side centrifugal fan with adjustable speed drive, dual variable speed scroll compressors with crankcase heaters, safety cut-outs for high and low pressure and motor temperature, direct expansion cooling coil, air cooled condenser with direct driven propeller condenser fan with weather protected fan motor, and insulated refrigeration piping and specialties. Provide hot gas reheat for humidity control. Condenser fan shall be equipped with a discharge guard. Equipment condenser coil with hail guards
- E. Refrigerant: R454B.
- F. Heating Components: Heater Section AGA approved for outdoor installation with alloy heat exchanger stainless steel ribbon burners, manual gas valves, automatic, pilot safety, electrically ignited pilot, high unit thermostat and bonnet thermostat. Combustion air and flue gas openings shall be rain tight, arranged to allow operation under all normal wind conditions.
- G. A filter section with 2" throwaway filters and hinged and latched access doors shall be provided (MERV 13 filters).
- H. Unit components shall include automatic modulating outside air dampers with modulating damper operator with adjustable position.
- I. Provide 5 year non-pro-rated compressor parts warranty and 10-year prorated gas fired heat exchanger parts warranty.
- J. Units shall be Greenheck.

2.15 COMPUTER ROOM AC (CRAC) UNIT (AIR COOLED – LIEBERT PDX):

- A. Summary: These specifications describe requirements for a Mission Critical Cooling system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.
- B. Design Requirements: Self-contained, factory-assembled unit with upflow air delivery. The system shall have a net total cooling capacity of 98 MBH with a net sensible cooling capacity of 86.4 MBH based on an entering air temperature of 75 °F dry bulb and 61.1 °F wet bulb. The unit is to be supplied with 208 volt, 3 ph, 60 Hz electrical service. Net capacities shall include losses due to fan motor heat.
- C. Submittals: Submittals shall be provided after the agreement of the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical and Capacity Data; Piping and Electrical Connection Drawings.

- D. Frame: The frame shall be MIG welded, formed sheet metal. It shall be protected against corrosion using the autophoretic coating process. The frame shall be capable of being separated into three parts in the field to accommodate rigging through small spaces.
- E. Upflow Top Air Supply, Front Throw: The supply air shall exit from the top of the cabinet with the air throw towards the front.
- F. Upflow Air Return, Front: The return air shall enter the unit from the front of the cabinet through factory installed grilles. Grilles shall be painted black.
- G. Exterior Panels: The exterior panels shall be insulated with a minimum 1 in. (25mm), 1.5 lb. (0.68 kg) density fiber insulation. The main front panel shall have captive 1/4 turn fasteners.
- H. Filters, 4": Filters shall be deep pleated 4" filters with an ASHRAE 52.2 MERV8 rating (45% ASHRAE 52.1) or ASHRAE 52.2 MERV11 rating (60-65% ASHRAE 52.1).
- I. Extra Filter Set: One extra set of filters shall be provided per system.
- J. Blower Section: The blower section shall be designed for 4145 CFM at an external static pressure of 0.5 in. wg. The fans shall be the centrifugal type, double width double inlet and shall be dynamically balanced as a completed assembly. The shaft shall be heavy duty steel with self-aligning, permanently sealed, pillow block bearings with a minimum L3 life of 200,000 hours. The fans shall draw air through the A-frame coil to ensure even air distribution and maximum coil performance. A static regain duct shall be factory-installed to the bottom of the blower.
- K. Motor: The fan motor shall be mounted to an automatic, spring-tensioning base. The motor shall be removable from the front of the cabinet.
- L. Premium Efficiency Motor: The fan motor shall be Open Drip-Proof, Premium efficiency and shall meet NEMA Premium standard.
- M. Drive Package: The motor sheave and fan pulley shall be double-width fixed pitch. Two belts, sized for 200% of the fan motor horsepower shall be provided with the drive package. An auto-tension system shall provide constant tension on the belts. Belts, shaft, blower bearings, sheave and pulley shall be warranted for five years (parts only).
- N. Humidifier: A humidifier shall be factory-installed inside the unit. Bypass air slots shall be included to enable moisture to be absorbed into the air stream. The humidifier capacity shall be 7.7lb./hr. The humidifier shall be removable from the front of the cabinet.
- O. Infrared Humidifier: The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be removable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped, ready for field connection to water supply. The humidifier shall be equipped with an automatic water supply system and shall have an adjustable water-overfeed to prevent mineral precipitation. A high-water detector shall shut down the humidifier to prevent overflowing. A factory-provided air-gap shall prevent backflow of the humidifier supply water.
- P. Reheat: The environmental control unit shall include a factory-installed reheat to control temperature during dehumidification.
- Q. 2-Stage Electric Reheat: The electric reheat coils shall be low watt density, 304/304 stainless steel fin tubular construction, protected by thermal safety switches, shall be 12 kW controlled in three stages. The reheat elements shall be removable from the front of the cabinet.

- R. Digital Scroll Compressors: The compressor shall be scroll-type with a variable capacity operation capability. Compressor solenoid valve shall unload the compressor and allow for variable capacity operation. The compressor shall be suction gas cooled motor, vibration isolators, thermal overloads, automatic reset high pressure switch with lockout after three failures, rotalock service valves, pump down low pressure transducer, suction line strainer, and a maximum operating speed of 3500 RPM.
- S. Crankcase Heaters: The compressors shall include crankcase heaters, powered from the indoor unit electric panel.
- T. R-410A Refrigerant: The system shall be designed for use with R-410A refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants.
- U. iCOM™ Microprocessor Control With Large Graphic Display: The iCOM unit control shall be factory-set for Intelligent Control which uses “fuzzy logic” and “expert systems” methods. Proportional and Tunable PID shall also be user selectable options. Internal unit component control shall include the following:
 - 1. Compressor Short Cycle Control - Prevents compressor short-cycling and needless compressor wear.
 - 2. System Auto Restart - The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
 - 3. Sequential Load Activation - On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
 - 4. Predictive Humidity Control - calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.
- V. The User Menus Shall be Defined as Follows:
 - 1. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
 - 2. Event Log: Unit memory shall hold the 400 most recent events with id number, time and date stamp for each event.
 - 3. Graphic Data View: Eight graphic records shall be available: return air temperature, return air humidity, supply air temperature, outdoor temperature and four custom graphs.
 - 4. Unit View - Status Overview: Simple or Graphical “Unit View” summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
 - 5. Total Run Hours: Menu shall display accumulative component operating hours for major components including compressors, Econ-O-Coil (FC), fan motor, humidifier and reheat.
 - 6. Various Sensors: Menu shall allow setup and display of optional custom sensors. The control shall include four customer accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20 mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC if desired. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.

7. Display Setup: Customer shall pre-select the desired grouping of display languages at the time of the order from the following choices:
Group 1: English, French, Italian, Spanish, German
Group 2: English, Russian, Greek
Group 3: English, Japanese, Chinese, Arabic
8. Service Contacts: Menu shall allow display of local service contact name and phone number.
9. Setpoints: Menu shall allow setpoints within the following ranges:
 - Temperature Setpoint 65-85°F (18-29°C)*
 - Temperature Sensitivity +1-10°F (0.6-5.6°C)
 - Humidity Setpoint 20-80% RH*
 - Humidity Sensitivity 1-30% RH
 - High Temperature Alarm 35-90°F (2-32°C)
 - Low Temperature Alarm 35-90°F (2-32°C)
 - High Humidity Alarm 15-85% RH
 - Low Humidity Alarm 15-85% RH
10. Standby Settings/Lead-Lag: Menu shall allow planned rotation or emergency rotation of operating and standby units.
11. Timers/Sleep Mode: Menu shall allow various customer settings for turning on/off unit.
12. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available:
 - High Temperature
 - Low Temperature
 - High Humidity
 - Low Humidity
 - Compressor Overload (Optional)
 - Main Fan Overload (Optional)
 - Humidifier Problem
 - High Head Pressure
 - Change Filter
 - Fan Failure
 - Low Suction Pressure
 - Unit Off
13. Audible Alarm: The audible alarm shall annunciate any alarm that is enabled by the operator.
14. Common Alarm: A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.
15. Remote Monitoring: All alarms shall be communicated to the Liebert monitoring system with the following information: Date and time of occurrence, unit number and present temperature and humidity.
16. Sensor Calibration: Menu shall allow unit sensors to be calibrated with external sensors.
17. Maintenance/Wellness Settings: Menu shall allow reporting of potential component problems before they occur.

18. Options Setup: Menu shall provide operation settings for the installed components.
 19. System/Network Setup: Menu shall allow Unit-to-Unit (U2U) communication and setup for teamwork modes of operation (up to 32 units).
 20. Teamwork Modes of Operation: Saves energy by preventing operation of units in opposite modes multiple units.
 21. Auxiliary Boards: Menu shall allow setup of optional expansion boards.
 22. Diagnostics/Service Mode: The iCOM control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.
 23. Factory Settings: Configuration settings shall be factory-set based on the pre-defined component operation.
 24. Change Passwords: Menu shall allow new passwords to be set or changed.
 25. System View - Status Overview: "System View" shall display a summary of operation for the total number of operating units within a Unit-to-Unit (U2U) configuration.
 26. Spare Parts List: Menu shall include a list of critical spare parts, their quantity and part numbers.
 27. Unit Diary: Menu shall include a free field area within the unit memory where unit history may be stored for reference.
- W. Unit shall be provided with the following options:
1. Locking Disconnect Switch: The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed and prevent access to the high voltage electrical components until switched to the "OFF" position.
 2. High Temperature Sensor: The firestat shall be factory-installed in the unit and shall be factory-set to 125°F (52°C). It shall immediately shut down the environmental control system when activated. The sensor shall be mounted with the sensing element in the return air.
 3. Smoke Sensor: The smoke sensor shall immediately shut down the environmental control system and activate the alarm system when activated. The smoke sensor shall be mounted in the electrical panel with the sensing element in the return air compartment. The smoke sensor is not intended to function as or replace any room smoke detection system that may be required by local or national codes. The smoke sensor shall include a supervision contact closure.
 4. Low Voltage Terminal Package: Factory-installed and wired terminals shall be provided for customer connection to lock out the reheat and humidifier upon contact closure. Two (2) extra N/O common alarm contacts shall be provided. Two (2) extra remote shutdown terminals shall be provided.
 5. Compressor Overload (Optional): A pair of N/O contacts shall be factory-installed and wired to each compressor to indicate Compressor Overload.

- X. Air-Cooled Systems: The indoor evaporator unit shall include refrigerant piping, with a factory holding charge of nitrogen. The hot-gas and liquid lines shall be spun shut and shall include a factory-installed Schrader valve. Field relief of the Schrader valve shall indicate a leak-free system.
1. Air-Cooled Condenser: The Liebert manufactured outdoor air-cooled condenser shall be the low profile, multiple direct drive, propeller fan type. The condenser shall balance the heat rejection of the compressor at 95 °F ambient. The condenser shall be constructed of aluminum and contain a copper tube, aluminum fin coil arranged for horizontal air discharge.
 2. Fan Speed Control: The winter control system for the air-cooled condenser shall be Liebert Fan Speed Control. The variable speed motor shall operate from 0 to 230 volts single phase, 10 to 1050 RPM. It shall be designed with ball bearings, permanent lubrication, internal overload protection, 40°C rise at full speed, 65°C rise at 10 RPM. The control system shall be complete with transducers, thermostats and electrical control circuit, factory prepackaged in the integral condenser control box. The transducer shall automatically sense the highest head pressure of either operating compressor and control the variable speed fan on the air-cooled condenser to properly maintain the head pressure. The fan speed control system shall provide positive startup and operation in ambient temperature as low as -20°F. The air-cooled condenser shall have a 208 volt, 3 ph, 60 Hz power supply.
 3. Condenser Disconnect Switch: A disconnect switch shall be factory-mounted and wired to the condenser control panel, accessible from the exterior.
- Y. Floor Stand: The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be 12 inches high.
- Z. Unit shall be Liebert PDX Model PX029UA1A809XJ.

2.16 CENTRIFUGAL ROOF EXHAUSTERS:

- A. Centrifugal power roof ventilators with AMCA certified air and sound ratings, belt or direct driven as shown. Provide permanently oiled bearings, statically and dynamically balanced backward curved blade wheels and spun aluminum housing with curb cap, disconnect switches, back-draft damper and outlet bird screen. For belt driven fans provide V-belt drive sized for 50% overload, adjustable pitch motor pulley and adjustable motor base. For each fan furnish an 18 gauge galvanized steel insulated prefabricated curb with integral cant. Furnish baffled sound absorbing curbs where required to obtain noise levels specified. Static pressures scheduled are external to sound curbs.
- B. For kitchen range hood furnish UL762 labeled up-blast discharge fan without sound curb.
- C. Fans shall be Greenheck.

2.17 IN-LINE CENTRIFUGAL FANS:

- A. AMCA approved air and sound rated direct (or) belt driven fans (as scheduled), complete with V-belt drives sized for 50% overload, self aligning grease lubricated ball bearings, adjustable pitch motor pulleys, adjustable motor bases and statically and dynamically balanced backward curved blade wheels, all enclosed in a galvanized steel housing with inlet bell and outlet duct collars. (Fan wheel and motor assembly shall be hinged for access.)
- B. Fans shall be Greenheck type SQ.

2.18 CEILING EXHAUST FANS:

- A. AMCA rated direct driven centrifugal fans designed for ceiling mounting, complete with removable white aluminum, ceiling grille insulated housing, fan speed controllers, rubber-in-shear isolators, disconnect switch, and integral back draft damper. Max. noise level: 3 sones.
- B. Fans: Greenheck SP.

2.19 PROPELLER FANS:

- A. AMCA rated fans, belt or direct driven as scheduled. Equip belt driven fans with V-belt drives sized for 50% overload, adjustable pitch motor pulleys and adjustable motor bases.
- B. Equip each fan with belt and wheel guards and a mounting panel not lighter than 16 gauge.
- C. Provide gravity operated shutters where indicated in equipment schedule. Equip motor operated shutters with spring return motors with oil-immersed gear trains.
- D. Where indicated on plans provide fans equipped with panels reversed for supply operation.
- E. Where shown provide penthouses constructed of not lighter than 18 gauge galvanized steel and 18 gauge galvanized steel prefabricated curbs. Equip penthouses with access doors and internal insulation not lighter than 1" x 3 lb/cu. ft.
- F. Fans: Greenheck.

2.20 ELECTRIC WALL HEATERS:

- A. UL listed recessed convection heaters with finned sheathed heating elements, resiliently mounted direct driven propeller fan with motor heat shield, concealed thermostat, concealed on-off switch, high limit controls, and junction box for connecting power wiring.
- B. Cabinets: 16 gauge steel, with pencil proof welded steel bargrilles (bars 1/16" x 3/8" minimum). Equip cabinet with adjustable recessing frame. Finish: Baked enamel, over bonderizing. Architect will choose color from manufacturer's standard selections.
- C. Electric wall heaters: 2 KW and larger, Markel 3400 series, less than 2 KW, Markel Series 3120, Erincraft AWH or equal.

2.21 ELECTRIC DUCT HEATERS:

- A. Slide-in heaters with all sheet metal parts inside duct aluminized or galvanized steel, listed in the Underwriters Laboratories, Inc. Electrical Appliance & Utilization Equipment List.
- B. Heaters shall have ceramic supported nichrome wire elements, flanged mounting plate, control box and 1/2" insulation between mounting plate and control box. Provide spacers at terminal end of heater so that internal duct insulation will not cause hot spots. Provide general purpose control boxes for indoor heaters and weather-tight control boxes for heaters located outdoors. (Connections between control box and duct shall be airtight under 1" WG static pressure.)

- C. Control box shall contain non-fused disconnect switch, fuse blocks and fuses for each phase, 3 pole contactors for 3 phase heaters and 2 pole contactors for single phase heaters other than 277 and 120 volt heaters. (Contactors shall be designed for quiet operation.) Contactors shall be factory wired to terminal strips.
- D. Controls: SCR modulating control with factory wired automatic high limit control, air flow switch, and a supplementary independent thermal device to disconnect all power circuits in case automatic high limit fails, factory supplied control circuit transformers suitable for 24 volt control, factory wired to terminal blocks in control box.
- E. Provide staging as shown.
- F. Provide camlocked duct access doors at electric heaters.

2.22 ELECTRIC UNIT HEATERS:

- A. UL listed electric unit heaters having capacity shown with resiliently mounted direct driven propeller fan with guard, finned-sheathed heating elements, and enameled steel enclosure not lighter than 20 gauge. Heater shall be equipped with automatic reset high limit controls, power contactors and control transformer for 24 volt control, factory wired to terminal strips.
- B. For horizontal heaters provide adjustable horizontal louvers. For vertical heaters provide louver.
- C. For each unit heater provide room thermostat to cycle contactor and fan. Mechanical Contractor shall provide and install all control wiring in conduit and all control accessories as required for connecting wall mounted thermostat.
- D. Electric Unit Heater: Markel 5100 Series or equivalent by Chromalox, Erincraft or Berko.

2.23 UNIT HEATERS HAZARDOUS LOCATION, (ELECTRIC):

- A. UL listed electric unit heaters approved for use in Class I Division 1 Environment having capacity shown with resiliently mounted direct driven propeller fan with guard, finned-tube heating elements. Motor approved for use in hazardous location.
- B. 14 gauge steel cabinet, powder coated epoxy paint finish with adjustable louvers for air directional control.
- C. Permanently sealed, liquid to air, finned tube heat exchanger core for use in hazardous environment.
- D. Controls shall be factory installed and wired in an enclosure approved for use in a hazardous location. Contactor and back-up contactors to be heavy duty type rated for 100,000 cycles at full load. Standard 24 volt control circuit supplied by internal Class II transformer. Disconnect switch factory mounted and wired. Provide remote thermostat.
- E. Heater: Markel HCA Series or approved equal.

2.24 EXPANSION JOINTS, ANCHORS AND GUIDES:

- A. Expansion joints: 150 psig WP controlled flexing bellows type packless joints with stainless steel bellows, compression traverses not less than those shown and extension traverses not less than 1/4". Joints 2" and smaller: screwed with union ends. Joints 2-1/2" and larger: flanged.

- B. Alignment guides: prefabricated guides consisting of a steel spider clamped to pipe riding inside a steel cylinder with integral mounting feet. Install guides 4 and 18 pipe diameters upstream and downstream from each expansion joint.

2.25 WATER SPECIALTIES:

- A. Install ASME rated pressure relief valves as noted, providing full size drain lines to within 1 ft. of floor. Relief valves: Watts, McDonnell & Miller, or equal.
- B. Install 1/2" IPS x 150 psig WP float type automatic air vents in water lines as shown and/or required to prevent air binding. Run 3/8" OD line to outdoors or nearest floor drain or AC system drain line from each vent. Install a 1/2" ball valve ahead of each air vent. Vents shall be Armstrong, or equal.
- C. Strainers: 125 psig WP, pot or angle type as shown. Strainers 2" and smaller: bronze or iron bodies with screwed connections; strainers 2-1/2" and larger: iron bodies and flanged connections. Screens: bronze, monel metal or stainless steel with perforations as follows:

Strainer Size	Perforation Size
3/4" to 2" inclusive	1/32"
2-1/2" to 6" inclusive	1/16"
8" to 12" inclusive	1/8"
Over 12"	1/4"

The free area of each screen shall be not less than three times the area of the strainer inlet pipe. Equip each strainer with 1/2" valved drain, and unless the strainer design is devoid of air pockets, a 1/4" air vent cock.

- D. Compression and expansion tanks: black steel (bladder) tanks ASME stamped for 125 psig WP. Provide tappings and specialties as shown. (Initial air charge: as required to provide 10 psig fill pressure at top of system.)
- E. Line mounted air separators: tangential separators with tappings shown, without strainers. Separators shall be Bell & Gossett.
- F. Install float type water feeders on expansion tanks as shown. Feeders: McDonnell & Miller #25.
- G. Install backflow preventers equal to Watts 900 in all (potable) city water connections to HVAC water systems.
- H. Install air control fittings equal to Bell & Gossett "Airtrol", in all compression tanks and boilers as shown.
- I. Install drain valve with hose connection and air venting provision on each compression tank.
- J. Pressure reducing valves for make up water connections 125 psig WP, iron, bronze trim, set point range as required to provide 10 psig fill pressure at top of system, B&G or equal.
- K. Balancing valves, 2" and smaller: Bronze body, ball type, 125 psig working pressure, 250°F maximum operating temperature, and having threaded ends. Valves shall have fixed orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set positions.

- L. Calibrated balancing valves ("Circuit Setter"): 125 psig WP, 2" and smaller bronze, screwed; 2-1/2" and larger IBBM, flanged plug valves. All with indicator for angular position of valve, meter connections with positive shut-off valves and internal seals to prevent leakage around stem. For each valve provide a flow vs. differential pressure vs. angular position calibration chart and pre-formed foam insulation suitable for temperatures from 35 to 250F. Armstrong, B&G, Illinois, Taco or equal.
- M. Flow meters: 150 psig WP venturi flow meters, bronze, screwed in sizes 2" and smaller; steel, butt welded in sizes 2-1/2" and larger, 2% accuracy, maximum line pressure drop 1.0 ft. water. Provide quick connect gauge valves for each venturi meter. For entire job provide one portable cased differential pressure meter with shut-off and vent valves and 40 feet of 150 psig WP hose, together with a calibration curve for each meter. Armstrong, Presco.

2.26 REFRIGERANT SPECIALTIES:

- A. Install moulded desiccant core filter dryer in each liquid line. Provide throwaway dryers for lines 1/2" and smaller. Provide replaceable core dryers for lines 5/8" and larger. Dryers shall be Sporlan "Catchall". For heat pump units filter dryer to be bi-directional flow.
- B. Install moisture indicating sight glass in each liquid line. Install a refrigerant charging valve in each liquid line near each sight glass.
- C. Service valves: wing cap valves, Henry with locking cover.
- D. Expansion valves: thermostatic valves with external equalizers, Sporlan.
- E. Hot gas bypass valves: self contained valves sized to pass gas flow at last step of compressor unloading and shall discharge between expansion valve outlet and distributor. Sporlan.
- F. Evaporator pressure regulating valve: sized to pass full suction gas flow rate with a pressure drop not exceeding 2 psi. Equip valve with external pneumatic connection for operation by pneumatic controls (see CONTROLS).
- G. Install solenoid valve in each liquid and hot gas bypass line. Hot gas solenoid valve shall be equipped with a high temperature coil. Solenoid valves for heat pump units shall be bi-directional flow.

2.27 UNDERGROUND INSULATED PIPING SYSTEM (CHILLED WATER, AND HOT WATER LINES)

- A. Furnish and install underground, insulated piping as shown. Provide single pipe installed within a prefabricated PVC or FRP conduit casing. Jacketing material: High impact, seamless polyvinylchloride (PVC) Class 12454-B compound conforming to ASTM D1784, Type 1, Grade 1 or filament wound polyester resin/fiberglass reinforced composite (FRP). Minimum jacket thickness 120 mils (PVC) or 85 mils (FRP). Carrier pipe shall be schedule 40 steel, ASTM A-53, Grade B with beveled ends for welding. Piping system shall be rated for minimum 250 °F.
- B. The unloading, handling and installation of the underground-insulated piping system shall be in strict accordance with the manufacturer's recommendations. Before installation, a factory-trained representative of the pipe manufacturer shall examine the pipe for damage. All damaged piping shall be repaired in accordance with manufacturer's recommendations or discarded. A qualified, factory-trained representative of the piping manufacturer shall be present during all critical periods of the installation and testing of the piping system, and shall furnish a certificate upon completion of the installation indicating that the system was installed in accordance with the manufacturer's recommendations. The factory representative shall provide training to the contractor for installation of joints, fittings, etc. and shall supervise the installation of all pipe and jacket joints.

- C. Hydrostatically test all piping in the field under a pressure of 250 psig or twice the working pressure, whichever is greater, and hammer test all piping joints. All pressure testing shall be conducted prior to any joint insulation in the presence of the owner's representative. If any joints are covered prior to observation of testing by the owner's representative, and his submission of a written authorization to proceed, the joints shall be uncovered and the system shall be retested. Give 24 hours prior notice to architect prior to testing.
- D. Piping shall be insulated with two component Polyurethane Foam, none shrinking, 3.0 lbs/cubic foot density, 0.140 BTU-inch/hour-°F-ft², closed cell content of 90-95% in conformance with MIL-1-24172 and ASTM C-591 completely filling the annular space between carrier pipe and jacketing. Minimum insulation thickness shall be 1.5 inches. Carrier pipe shall be concentric to casing pipe within ¼" at the casing center point and within 1/16" at the end seals. After welding and testing, all joints shall be insulated and sealed in accordance with manufacturer's recommendations.
- E. All fittings including elbows, expansion loops, anchor plates, and oversized jacketing for expansion shall be factory fabricated, insulated and jacketed. All expansion capability required for the system shall be provided in expansion loops or expansion elbows. Only straight pipe joints shall be field fabricated and insulated. Submit piping layout with routing, expansion loops, expansion elbows, anchors, thrust blocks, etc. as recommended by the piping manufacturer. Submit details of all factory fabricated fittings, expansion elbows, and expansion loops. All fittings shall be of the same material as the straight pipe. Provide concrete thrust blocks at piping anchors as recommended by the manufacturer.
- F. Provide rubber end seals tight fitting to carrier pipe for each section of pipe and fittings. Rubber end seals shall be high temperature heat resistant Ethylene Propylene Diene Monomer (EPDM). Provide jacket end caps where piping system terminates underground and PVC insulation caps where piping terminates in mechanical rooms. Painted mastic end seals are not acceptable.
- G. Furnish and install a concrete anchor block poured around each steel anchor plate in accordance with details and manufacturer's recommendations. The anchor plates shall be 1/2" thick steel plates welded to the carrier pipe and sealed to the pipe jacketing in accordance with manufacturer's recommendations. Submit anchor plate details.
- H. Base of trench shall be of clean earth, sand, or limestone screening to provide a 4" thick bed properly hand tamped. Backfill shall be clean earth, sand, or limestone screening completely enveloping piping on both sides and top to a minimum thickness of 18". All backfill shall be carefully hand tamped in 6" layers until 18" has been deposited over top of bed and placement of piping prior to beginning backfilling and first 6" thick hand tamped backfill layer. If the owner's representative does not observe the pipe bed or backfill and submit a written authorization to proceed, then all backfill shall be removed and reinstalled in accordance with the above methods. Give 24 hours prior notice to Architect prior to required observation by owner's representative.
- I. The underground piping system shall be Thermacor Ferro-Therm SC, or Thermal Piping System. For consideration of other manufacturers, submit complete manufacturer's product data and experience of local representative.

2.28 AIR PURIFICATION SYSTEM:

- A. Description of Work:
 - 1. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.
- B. Quality and IP Assurance:
 - 1. Basis of design is Global Plasma Solutions. All other manufacturers requesting prior approval must submit product drawings, specifications and test results specified in section 2.2 at least four weeks prior to bid date.

2. The Air Purification System shall be a product of an established manufacturer within the USA. Direct Current (DC) Ion modules manufactured outside the USA and assembled in the USA on mounting plates or formed channels shall not be acceptable.
3. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
4. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable. Any system containing titanium dioxide (TiO₂), which has been listed by the CDC as a known carcinogen, shall not be acceptable.
5. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2019 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations. The data shall be based on the manufacturer's use of the same make and model number as the equipment submitted on this project.
6. The Air Purification Technology shall have been tested by UL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers requesting prior approval shall submit their independent UL 867 test data with ozone results to the engineer for preliminary review and during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.
7. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.001 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.001 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.
8. All manufacturers shall have their product tested to UL 2998 Environmental Standard for confirmation of no ozone with certificate available. The final report shall indicate the ozone levels and high voltage output the device's electrode(s) were operating during the test. Reports that do not include high voltage output during the UL 2998 testing shall not be acceptable.

C. Submittals:

1. Product Data: Submit manufacturer's technical product data for ion generators including:
 - a. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
 - b. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
 - c. Performance data for each type of plasma device furnished.
 - d. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2019 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
 - e. Product drawings detailing all physical, electrical and control requirements.

- f. Copy of UL 867 independent ozone test.
 - g. Copy of UL 2998 conformance certificate.
 - Statement on the manufacturer's letterhead stating that the technology contains no titanium dioxide (TiO₂).
 - 2. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.
- D. Product Delivery, Storage and Handling:
- 1. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.
 - 2. Store in original cartons and protect from weather and construction work traffic.
 - 3. Store indoors and in accordance with the manufacturers' recommendation for storage.
- E. Warranty:
- 1. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.
- F. Products:
- 1. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.
 - 2. Basis of Design: Global Plasma Solutions
 - 3. All other Suppliers of comparable products requesting prior approval shall:
 - a. Submit for prior approval four weeks in advance in accordance with the requirements of Section 23 0500.
 - b. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2019 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application using the same make and model equipment shall also be included.
 - c. Submit independent test data from UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.
 - d. Submit UL 2998 Environmental Claim Certificate proving no ozone output.
 - e. Submit pathogen testing per section 2.2.
 - f. Submit at least two other end user references in the same application with contact phone number, email, equipment used and application for the equipment at that facility. Manufacturers not having the above references in similar applications using the same equipment models as proposed on the current project shall not be acceptable.

- g. Ionization bars manufactured using DC output ionization modules shall not be permitted due to corrosion, ion short-circuiting, and intermittent coil coverage and shock hazard.
 - h. Ionization bars manufactured using ion modules not having epoxy coating all circuit boards and internal components shall not be acceptable.
 - i. Manufacturers submitting as an alternate shall include their DO-160 test results.
 - j. It is the responsibility of any alternate manufacturer and mechanical contractor proposing an alternate to the basis of design to confirm any proposed substituted product does not infringe on the patented intellectual property of the basis of design. The engineer and owner recognize the basis of design holds multiple patents and multiple patents are pending.
 - G. Bi-Polar Ionization Design & Performance Criteria:
 - 1. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.
 - 2. The Bi-polar Ionization system shall be capable of:
 - a. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
 - b. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 - c. Capable of reducing static space charges.
 - d. Effectively reducing space particle counts.
 - e. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
 - f. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
 - 1) MRSA - >96% in 30 minutes or less
 - 2) E.coli - > 99% in 15 minutes or less
 - 3) TB - > 69% in 60 minutes or less
 - 4) C. diff - >86% in 30 minutes or less
 - 5) Noro Virus -> 93.5% in 30 minutes or less
 - 6) Legionella -> 99.7% in 30 minutes or less
- Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELAC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.
- g. Capable of modular field assembly in six inch (150mm) sections.

3. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive and negative output (DC type) shall not be acceptable. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.
 - a. Air exchange rates may vary through the full operating range of a constant Volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
 - b. Velocity Profile: The air purification device shall not have maximum velocity profile.
4. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.
5. Equipment Requirements:
 - a. Electrode Specifications (Bi-polar Ionization):
 - 1) Each alternating current (AC) Ionization Bar with Bi-polar Ionization output shall include a minimum of eighteen carbon fiber cluster ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 0.50" (12.5mm) apart shall not be acceptable. The plasma electrode shall require no more than 1.0" (25mm) in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air purification manufacturer except self-tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion.
 - 2) Electrodes shall be provided in 6.0" (150mm) increments, epoxy filled for an IP55 rating and utilizing brass connection hardware that is recessed into the connection joint once fully engaged and assembled.
 - 3) Electrodes shall be energized when the main unit disconnect is turned on.
 - 4) The ionization output shall be a minimum of 60 million ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles.
 - 5) Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.
 - 6) Ionization bars shall be constructed of UL 94VO and UL746C composite material.
6. Air Handler Mounted Units:
 - a. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the remote mount power supply using the cables provided by the air purification manufacturer. A 24VAC, 115VAC or 208-230VAC circuit shall be provided to the plasma generator power supply panel. No more than 15 watts shall be required per power supply. Each power supply shall be capable of powering up to 6 ionization bars or a total of 100 linear feet of bar. Each plasma generator shall be designed with powder coated metal casing, liquid tight flexible conduit and a high voltage quick connector.

7. Plasma Requirements:

- a. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.
 - 1) The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 24VAC, 115VAC or 208-230VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
 - 2) Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced (AC Ionizers only are acceptable). Imbalanced levels shall not be acceptable.
 - 3) Ionization output from each bar shall be a minimum of 60 million ions/cc per inch of bar when tested at 1" from the ionization bar. Bars with needles spaced further apart than 0.5" shall not be acceptable.
 - 4) Each plasma electrode shall be made from an all composite, UL 94V0 and UL 746C rated material for prevention of corrosion and electrical insulation.
- b. Ozone Generation:
 - 1) The operation of the electrodes or Bi-polar ionization units shall conform to UL 2998 as tested by UL proving no ozone output.

8. Electrical Requirements:

- a. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC, 115 VAC or 208-230VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

9. Control Requirements:

- a. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset. Systems requiring fuses shall not be acceptable.
- b. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS as well as a local "Plasma On" indication light.
- c. If scheduled, the ionization system shall be provided with a stand-alone, independent ion sensor designed for duct mounting to the ionization bar to monitor the ion output and report to the BAS system that the ion device is working properly. Ion systems provided without an independent ion sensor, shall not be permitted. The control voltage to power the ion sensor shall be 24VAC to 260VAC and draw no more than 150mA of current. The sensor shall provide at minimum, dry contact status to the BAS and optionally a BacNet or Lonworks interface as specified on the control drawings. If scheduled, manufacturers not providing a stand-alone ion sensor shall not be acceptable.
- d. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown on the plans. The contractor shall follow all manufacturer IOM instructions during installation.
- e. An optional fiberglass NEMA 4X panel with Plasma On/Off Indicator Light (interfaced with stand-alone ionization detector), Ionization Output On/Off Indicator Light and an On/Off Illuminated Switch shall be provided to house the power supply, if noted on the schedule.

H. Execution:

1. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

I. Assembly & Erection: Plasma Generator:

1. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.
2. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.
3. All equipment shall be protected from dust and damage on a daily basis throughout construction.

J. Testing:

1. Provide the manufacturers recommended electrical tests.

K. Commissioning & Training:

1. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 23 0500 – “General Provisions – HVAC” shall apply to and become part of this Section.

1.2 SHOP DRAWINGS:

- A. See Section 23 0500 – “General Provisions – HVAC”.
- B. Ductwork Shop Drawings shall include details of duct construction: seams, joints, gauges, reinforcing, elevations, and hanger details for each pressure class and size range together with details of turning vanes, branch connections, dampers and access doors. Include access door locations and sizes. Identify on the shop drawings duct sections as they will be identified for fabrication and installation. Provide section drawings of locations where ducts cross or demonstrate with elevations that ducts will fit.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Air terminal submittal data shall include, for each terminal, both radiated and discharge sound power in DB re 10 to the minus 12 watts in octave bands 2 through 7. All air terminal controls shall be installed in a unit mounted control panel and shall be UL listed as an assembly.

2.2 GRILLES, REGISTERS AND DIFFUSERS:

- A. General: Air devices may be Price, Titus, Krueger, Nailor, or approved equal. Titus part numbers are given for reference. Coordinate border and frame types for air devices with ceiling types as shown on Architectural Reflected Ceiling Plan.
- B. Rectangular Louver Face Diffusers One-, Two-, Three-, Four-Way or Corner Throw (LD or CD): Fixed pattern louver face diffusers, all aluminum with white enamel finish, removable cores latched in place, opposed blade dampers, adjustable multi-blade scoops, #TDC,-AA.
- C. Linear Diffuser/Boot: Fixed pattern extruded aluminum 2-way throw diffuser designed for variable volume use, mounted on outlet of galvanized steel boot with 1/2" internal insulation, and round side inlet collar with damper. Diffuser/Boot shall be designed to lay into ceiling grid and be supported by grid. Provide all necessary mounting clips and accessories. Boot insulation shall comply with the requirements for duct insulation, internal. Diffuser finish: off white enamel, #MLF.
- D. Supply Registers (SR): Adjustable vertical face bars, adjustable horizontal rear bars, opposed blade dampers, plaster frames, adjustable multi-blade scoops, all aluminum with prime coat finish: #272.
- E. Drum Louvers (DL): Adjustable vertical blades and rotating drum with optional opposed blade damper with screwdriver operator accessible through discharge of DL. All aluminum finish with prime coat.

- F. Wall Return Registers (WRR): All aluminum, aluminum lacquer finish, horizontal bars fixed at about 35° angle, plaster frames, opposed blade damper #350. (Wall Return Grilles {WRG} Delete opposed blade damper).
- G. Wall Exhaust Registers (WER): Same as wall return registers.
- H. Ceiling Return Registers (R): All aluminum, 1/2" x 1/2" x 1/2" cube core, plaster frame, opposed blade dampers, white enamel finish #50F. Omit dampers for registers not attached to return ductwork.
- I. Ceiling Exhaust Registers (E) and Ceiling Transfer Registers (T): Same as Ceiling Return Registers.

2.3 SHEET METAL SPECIALTIES:

- A. Make rectangular take-offs in low pressure supply, return, and exhaust ducts using 45° entry tap (SMACNA Duct Construction Standards "Branch Connections" figure #2-6) with manual damper with end bearings and locking quadrant in branch. Saw-mark ends of damper rods parallel to blades. End bearings and quadrants shall have air tight duct connections and shaft seals: Duro-Dyne or equal.
- B. Manual balancing dampers: comply with SMACNA HVAC Duct Construction Standards, figure 2-12 and 2-13. Equip all dampers with locking quadrants and end bearings. Saw-mark ends of damper rods parallel to blades. End bearings and quadrants shall have air tight duct connections and shaft seals, Duro-Dyne or equal.
- C. When Damper quadrants are located other than above lay-in ceilings.
 - 1. Substitute Young number 315 or 270-896C adjustable cover concealed regulators or Ventlock #677 regulators and an additional end bearing for the quadrant (regulator covers shall be white). Provide all cable, gears, joints, rods, etc. as required to place the regulator in the ceiling within 6 feet horizontal of the damper, as directed by the Architect.
 - 2. Provide an access door for access to the quadrant (See "Access Doors", hereinafter).
- D. Provide "Stand-offs" (hat sections) for damper quadrants, controls, etc., on externally insulated ducts. "Stand-offs" are required at quadrants on spin-in dampers.
- E. Branch duct connections for connecting round low pressure branches to rectangular low pressure trunks: galvanized steel spin-in or side takeoff fittings with integral dampers, collars, similar and equal to Flexmaster, Series FLD or STOD for sheet metal trunks with stand-offs. Provide integral dampers with 2" insulation build-out, shaft, U-bolt, nylon bushings, locking quadrant and handle. Gauges: as required for pressure class. (26 gauge minimum.)
- F. Branch duct connections for connecting round medium pressure duct to rectangular medium pressure duct: galvanized steel bellmouth fitting with neoprene gasket and pre-drilled mounting holes equal to Buckley Air-Tite. Gauges as required for pressure class (24 gauge minimum). Flexmaster STO or approved equal may be substituted at contractor's option (24 gauge minimum). Branch duct connections for connecting round medium pressure duct to round or flat oval medium pressure duct: galvanized steel conical saddle or flanged fitting equal to United. Gauges as required for pressure class (22 gauge minimum).

2.4 FLEXIBLE DUCT CONNECTIONS:

- A. Install Neoprene coated glass cloth flexible connections at all duct connections to all fans, all AC Units and all powered induction units.
- B. Install flexible connections in all ducts at building expansion joints.

2.5 ELECTRICAL GROUNDING:

- A. Ground supply fans.
- B. Install braided copper jumpers around all flexible connections, taking care that jumpers do not bind flexes.

2.6 DUCTWORK - GENERAL:

- A. Unless otherwise shown or specified construct ducts of galvanized steel sheet metal using gauges and recommended details as contained in the current edition of the SMACNA HVAC Duct Construction Standards. Ductwork shall include supply air, exhaust air, return air, and outdoor air ducts, together with all necessary fittings, splitters, dampers, quadrants, flexible connections, sleeves, hangers, support, braces, etc. Hang and install ducts in a neat and workmanship manner with adequate bracing and cross breaking to prevent breathing, rattling, and vibration. **DO NOT USE SNAP-LOCK SEAMS.**
- B. Install Duro-Dyne locking quadrants and Duro-Dyne end bearings on all splitters and manual volume dampers located above accessible ceiling and Young #315 regulator, and Duro-Dyne end bearings elsewhere. Provide stand-offs for quadrants on externally insulated ducts. (Refer also to "Sheet Metal Specialties.")
- C. Duct dimensions are **net dimensions inside insulation**. Determine gauges by actual duct size.
- D. All duct turns (except as noted below for 90 degree turns) shall be radiused with a centerline radius of 1.5 times the duct width in the plane of the turn. At the contractor's option, 90 degree turns may be square throat elbows vaned to provide a dynamic loss coefficient ("C") not greater than 0.2 or shall be radiused. Do not use "push on" vane runners. Duct turns less than 20 degrees may be mitered. Do not use off-sets that reduce the cross-sectional area of the duct.
- E. Duct Sealing: Seal duct seams and joints after assembly as noted below. Seal entire circumference of all branch duct connections, tapping collars and spin-ins. Seal ducts using mastic sealant equal to solvent based United Duct Sealer.
 - 1. Class A Seal: Seal all joints and seams and leak test at pressure specified. Leakage cfm per 100 sq. ft. duct surface area shall not exceed 8 times the square root of the test pressure in inches of water and no leaks shall be audible.
 - 2. Class B Seal: Seal entire circumference of all transverse joints, seal all longitudinal joints.
 - 3. Class C Seal: Seal entire circumference of all transverse joints.
 - 4. Class D Seal: Seal corners of transverse joints.
- F. Access Doors: Provide access door at all control components in ductwork, control dampers, smoke detectors, airflow stations, static pressure sensors, humidifier manifolds, and elsewhere as required to access equipment.

2.7 DUCTWORK - LOW PRESSURE:

- A. Ductwork, Low Pressure, shall include: All supply, return, outside air and exhaust ductwork other than medium pressure duct.
- B. Construct ducts in accordance with SMACNA Duct Construction Standards for pressure and seal classes noted below. Do not use snap-lock seam.
- C. Pressure and Seal Classes: 1" Pressure Class, Seal Class "C".
- D. Hang ducts using 1"x12-gauge galvanized straps at transverse joints but not greater than 8 ft. apart.
- E. All exposed ductwork shall be provided with "paint grip" finish to accept epoxy paint finish. No adhesive labels shall be placed on the exposed surface of exposed ductwork.
- F. Provide galvanized sheet steel metal ducts of sizes shown on plans, construct, hang, support and reinforce in accordance with 2" Pressure Class as contained in the current edition of the SMACNA Duct Construction Standards. Use reinforcement noted for the longest side on all sides of the duct and bolt together at corners with minimum 5/16" diameter bolts. Do not penetrate duct at reinforcement with screws. **DO NOT USE SNAP-LOCK SEAMS.**

2.8 DUCTWORK LOW PRESSURE ROUND:

- A. Low pressure round ductwork includes all round supply, return, outside air, and exhaust ductwork except as specified medium pressure round ductwork.
- B. Ductwork: Factory fabricated single-wall galvanized steel round spiral lock seam ducts of 28 gauge for ducts up to 14" in diameter, 26 gauge for ducts from 15" to 26" in diameter, 24 gauge for ducts 27" to 36" in diameter, and 22 gauge for ducts over 36" in diameter.
- C. Fabricate fittings by continuous brazing or electric welding. Thickness of metal for round fittings: 26 gauge for fittings up to 14" in diameter, 24 gauge for fittings 15" to 26" in diameter, 22 gauge for all fittings over 26" in diameter. Elbows shall have a center-line radius of 1.5 diameters, 5 piece construction. Take-offs shall be 45 degree laterals. Splitters (tees) shall be reducing Y-Branch with dampers.
- D. Make transverse joints using beaded slip couplings, sealing compound equal to solvent based United Duct Seal and sheet metal screws.
- E. Provide hanger straps per SMACNA table no more than 8 ft. apart. Straps shall encircle duct. Do not penetrate ductwork at hangers.
- F. No adhesive labels shall be placed on the exposed surface of exposed ductwork.
- G. Ductwork and fittings shall be United McGill Airflow, Semco, Spiral Systems, Spiral Pipe of Texas or Eastern Sheet Metal round duct and fittings, 2" WG standard.

2.9 FLEXIBLE DUCTS:

- A. Flexible duct connectors: 2 element spiral construction composed of galvanized steel supporting spiral and coated woven textile fabric with metal or mineral base, UL listed as Class I Air Duct and Connector (UL 181).
- B. Flexible connectors shall not exceed 5 feet in length and turns shall not exceed 20 degrees with maximum of two turns.
- C. Make connections between flexible ducts and other equipment using galvanized steel draw bands with plated screws and buckles and United Duct seal for high and medium pressure ducts and nylon draw bands for low pressure ducts.
- D. Factory insulate cold flexible ducts using insulation equivalent to that specified for cold ducts minimum R5 rating and provide continuous vapor barrier at connections to other ducts and equipment.
- E. Hang ducts in accordance with manufacturer's instructions.
- F. Flexible ducts: Thermaflex M-KC, EverClean, or Flexmaster Type 4M.

2.10 WEATHER LOUVERS:

- A. Louvers shall be AMCA certified 6" thick extruded aluminum drainable stationary louvers with minimum 0.08" thick blades and frame and minimum 50% free area nominal. Equip with 1/2" mesh aluminum birdscreen on inside of louver. Color to be selected by Architect. Finish to be manufacturer's Kynar 500 Fluoropolymer coating conforming to AAMA 605.2. Provide samples of color and finish to Architect for approval. Air pressure drop shall not exceed 0.15" WG at maximum air velocity of 850 FPM through free area. Water penetration shall not exceed 0.01 ounces per SF of free area.
- B. Louvers shall be Ruskin ELF6375DX or equivalent by Greenheck, or approved equal.

2.11 STORM SHELTER LOUVERS:

- A. Storm shelter louvers shall be AMCA certified 5.5" thick heavy gauge extruded aluminum stationary louvers with minimum 0.25" thick blades nominal wall thickness. Equip with 1/2" mesh aluminum insect screen and extended sill. Louver shall have mounting angles and welded construction. Louvers shall be UL classified wind-storm rated assembly in accordance with FEMA Guidelines P-320 and P-361, and ICC500(2020). Color to be selected by Architect. Finish to be manufacturer's Kynar 500 Fluoropolymer coating conforming to AAMA 605.2. Provide samples of color and finish to Architect for approval.
- B. Storm shelter louvers shall be Greenheck AFL-501 or equivalent by Ruskin.

2.12 AUTOMATIC DAMPERS:

- A. Provide and install automatic dampers as shown on plans, scheduled, or as required. Coordinate size, quantity and locations of automatic dampers with automatic control work as required. Dampers shall be factory fabricated with extruded aluminum blades and frames.

- B. Damper frames shall be 5" x 1" x .125" (minimum thickness) extruded aluminum hat channel with hat shaped mounting flanges on both sides of the frame. Each corner shall be reinforced with two die formed internal braces and machine staked for maximum rigidity or integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking.
- C. Damper blades shall be airfoil type extruded aluminum with metal blade to metal blade overlap. Each blade shall be maximum 6" depth with integral structural reinforcing tube running full length. Minimum thickness of blade shall be 0.070". Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal. Blade operation is parallel or opposed. Blades shall be contained within the damper frame.
- D. Blade edge seals shall be flexible and suitable for -72°F to +275°F mechanically locked in extruded blade slots yet easily replaceable in field. Jamb seals shall be flexible stainless steel, compression type to prevent leakage between the end of the blade and the damper frame. Use of blade end to overlap the frame for jamb seal is not acceptable. Adhesive or clip-on type blade or jamb seals are not acceptable.
- E. Bearings shall be non-corrosive molded synthetic. Axles shall be 1/2" plated steel hexagonal shaped and to provide positive locking connection to blade. Linkage shall be concealed out of airstream, within frame to reduce pressure drop, noise and maintenance.
- F. Provide and install Electric, 24 or 120V AC, spring return, 2-position or modulating damper actuator(s) as specified in controls specification sections or as indicated on drawings. Actuator(s) shall be sized as required to sufficiently open/close dampers under operating conditions. Multiple actuators shall be provided as required.
- G. Install dampers in accordance with manufacturer's installation instructions and requirements. Install dampers square and free from racking.
- H. Dampers must be accessible to allow inspection, adjustment, and replacement of components. Provide and install access doors as specified and required.
- I. Provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.
- J. Submittal shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Damper shall be tested and licensed in accordance with AMCA 511 for Air Performance and Air Leakage. Damper shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as Class 1A.
- K. Saw-mark ends of damper rods parallel to blades.
- L. Rectangular dampers shall be Ruskin Model CD50, Greenheck VCD-43, or preapproved equivalent.
- M. Round dampers shall be Ruskin Model CDRS25, Greenheck VCDR-53, or preapproved equivalent.

2.13 FIRE DAMPERS:

- A. Provide and install UL labeled 1-1/2 hour fire dampers, wherever sheet metal ducts pass through chase walls, floors outside fire chases, and elsewhere as shown or required by local code. See Architectural plans for fire ratings of walls. All fire dampers required may not be shown on mechanical plans.
 - 1. Fire dampers shall be "venetian blind" dampers. Unless otherwise shown folded blades and frames shall not obstruct air stream. Provide type C fire damper in all medium pressure supply ducts. Dampers in floors shall be spring loaded.
- B. Install access door in low pressure ducts at each fire damper. Install wall or ceiling access door for access to fire dampers not accessible through lift-out ceilings. See ACCESS DOORS, below.

2.14 AIR FLOW MEASUREMENT STATIONS:

- A. Coordinate size, quantity and location of air flow measuring stations with requirements of Automatic Control work.
- B. Fixed pitot-static rakes together with air straightening devices, all factory mounted in galvanized steel housings not lighter than 20 gauge.
- C. For each monitoring station provide a DDC airflow transmitter, microprocessor based, capable of receiving flow signals from an airflow station and producing dual outputs, linear and scaled for air volume and differential pressure. Transmitter features shall include:
 - 1. Accuracy: +/- 0.25% of Natural Full Span, including non-linearity, hysteresis, and non-repeatability.
 - 2. Temperature Effect:
 - a. Zero: None, corrected by Auto-Zero.
 - b. Span: 0.015% of full span/F.
 - c. Automatic zeroing: Accuracy with 0.1% of calibrated span; frequency every 1 to 24 hours on 1 hour intervals.
 - d. Stability: +/- 0.5% of Natural Span for 6 months.
 - 3. Transmitters shall provide signal proportional to air flow and shall input signal to designated DDC panel.
 - 4. Coordinate transmitter span with actual maximum and minimum duct velocities. Coordinate transmitter output for compatibility with DDC system. Calibrate transmitter at factory. Recalibrate in field after test and balance of system has been performed.
 - 5. Transmitters shall include and integral multi-line digital display for use during configuration and calibration and to display transmitter output during normal operation mode.
- D. Maximum static pressure drop through air measurement station 0.04" WG at 1000 FPM face velocity.
- E. Air flow measurement stations shall be Air Monitor, Ebtron or approved equal.
- F. Install an access door in duct immediately upstream from each air flow measuring station.

2.15 STATIC PRESSURE MEASUREMENT STATIONS:

- A. Coordinate size, quantity and location of static pressure measuring stations with requirements of automatic control work.
- B. Fixed static pressure rakes together with air straightening devices all factory mounted in galvanized steel housings not lighter than 20 gauge.
- C. For each static pressure measurement station provide static pressure calibrated magnehelic gauge.
- D. Maximum static pressure drop at 1000 fpm face velocity 0.04" WG.
- E. Install an access door in duct immediately upstream from static pressure measuring stations.
- F. Static pressure measurement stations shall be Air Monitor, Ebtron or equal.

2.16 ACCESS DOORS:

- A. Access doors in low pressure ducts: galvanized steel frame flange mounted permanently secured to duct with a hinged gasketed access port held in place with thumb operated latches. Doors in insulated ducts: double thickness with insulation. Doors in non-insulated ducts: a single thickness. Size doors to permit removal of equipment or maintenance. Minimum 18" x 18" in ducts 20" or greater. Minimum 12" x 12" in ducts 14" to 18" and minimum 8" x 12" in ducts 10" to 12". If duct is less than 10", enlarge duct at access door (and fire damper, if applicable) to allow minimum 8" x 12" access door. Kees "FH" series standard pressure flanged mount. Install for flush interior on double wall doors.
- B. Mark access points in lift-out ceilings with colored vinyl stick-on discs. Locate discs on grid adjacent to point of access and coordinate location of access doors in non-accessible ceiling with General Contractor.

END OF SECTION

PART 1 - GENERAL

- A. Provisions of Section 230500 - "General Provisions - HVAC" shall apply to and become a part of this section.
- B. The HVAC testing and balancing work specified in this section shall be done by an Associated Air Balance Council (AABC) member or by a National Environmental Balancing Bureau (NEBB) member (and an AABC "National Project Performance Guarantee" shall be provided for the project). The Testing and Balancing Agency's (TABA) project manager shall be an AABC certified or NEBB certified testing and balancing engineer and be responsible for supervision of and certification of the work herein specified.
- C. The Testing and Balancing agency will be employed by the mechanical subcontractor.
- D. The balancing agency shall submit records of experience in the field of air and hydronic system balancing or any other data as requested by the Architect. The supervisory personnel for the firm shall have at least five (5) years' experience, and all the employees used in this project shall be qualified technicians in this specific field.
- E. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the Architect to determine the balancing agency's performance capability.

1.2 SCOPE:

- A. All air and water balance work shall be done in accordance with the AABC National Standards for Testing and Balancing Heating & Air Conditioning Systems (AABC National Standards), or NEBB National Standards edition in force at time of bidding. If these specifications set forth more stringent requirements than the AABC National Standards, these specifications shall prevail.
- B. The systems to be balanced and/or tested shall include:
 - 1. Server CRAC Units.
 - 2. Chilled Water System.
 - 3. Hot Water System.
 - 4. DOAS Units.
 - 5. VRF System.
 - 6. 4-Pipe Fan Coil Units.

1.3 DOCUMENTS:

- A. The architect will provide the balancing agency one copy of each of the following documents:
 - 1. Project drawings and specifications.

2. Approved construction revisions pertaining to the HVAC systems.
3. Approved submittal data on HVAC equipment and systems to be installed under Division 23.
4. Approved HVAC shop drawings.
5. Approved HVAC wiring diagrams, control diagrams and equipment brochures, as appropriate.

1.4 COORDINATION:

- A. The TABA shall perform its services in close coordination with the work specified in Division 23.
- B. The plans and specifications indicate meters, valves, dampers, etc. for the purpose of adjusting the HVAC systems to obtain optimum operating conditions. In the event that any of meters, valves, dampers, etc. have been installed in a manner which will not permit their being used for their intended purpose, TABA shall so notify the Mechanical Contractor so that the above items may be correctly installed as specified in the other sections of Division 23.
- C. Work included in this section shall not be started until the systems involved meet the following conditions:
 1. Air Distribution Systems
 - a. Systems have been completed (including sealing and/or leak testing where specified) with all components properly installed and ready for operation, fans are rotating correctly, motor starters have correct overload elements, variable speed drives have been put into operation and clean filters (of the type required for finished system) have been installed.
 - b. All dampers, including automatic dampers, are operating smoothly and without binding and that the automatic dampers close tightly and open wide without binding.
 2. Water Circulating Systems:
 - a. Systems have been completed, including leak testing and cleaning and until systems have been refilled, pumps are rotating correctly, correct overload elements have been installed in pump motor starters (variable speed drives have been put into operation) and strainers have been cleaned and baskets used for the ultimate installation have been installed.
 - b. Compression tanks have been installed and correct system pressure is being maintained, all air vents have been installed and system has been vented and is free from air.
 3. Automatic Control System:
 - a. Systems have been completed and are operating as designed.
 - 1) Installation is complete, all instruments (including room thermostats) have been field calibrated and operate correctly, and are set for design operating conditions.
 - 2) TABA personnel have been instructed in the proper use of and in changing set points of the various controllers including via computer or keypad if required.

1.5 NOTIFICATION FOR TESTING & BALANCING WORK TO BEGIN:

- A. When the above conditions have been met, the Mechanical Contractor shall notify the TABA in writing that the system(s) are ready for Testing and Balancing.

- B. When the TABA has been notified that the systems are ready for testing and balancing, the TABA shall inspect the various systems involved and notify Mechanical Contractor of any condition which may impede the TAB work (missing dampers, valves, incomplete control or electrical work, etc.).
- C. When the deficiencies noted above have been corrected, Mechanical Contractor shall again notify TABA that the system(s) are ready for testing and balancing.

1.6 INSPECTIONS:

- A. During construction the TABA shall inspect the installation of the piping systems, sheet metal work, control system and mechanical equipment.
- B. The inspections should be made when 60% of the ductwork has been installed and when 90% of the equipment has been installed.
- C. The TABA shall submit a brief written report of each inspection to the Mechanical Contractor.

1.7 TESTING AND BALANCING PROCEDURES:

- A. All testing and balancing work shall be done in accordance with the AABC National Standards.
- B. Air Systems:
 - 1. Fan Speed: Test and adjust fan RPM to achieve design CFM requirements.
 - 2. Current and Voltage: Measure and record motor current and voltage of each fan.
 - 3. Pitot-tube Traverse: Perform a Pitot-tube traverse of main supply and return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation why a traverse was not made must appear on the appropriate datasheet.
 - 4. Outside Air: Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and discharge air temperatures with heating and cooling coil valves shut. Make allowances for heat of compression and motor heat where applicable.
 - 5. Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
 - 6. Air Temperature: Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.
 - 7. Zone Ducts: Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
 - 8. Main Ducts: Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
 - 9. Branch Ducts: Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
 - 10. Tolerances: Test and balance each diffuser, grille and register to within -5% and +10% of design requirements.

11. Identification: Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.
12. Description: Record the size, type and manufacturer of each diffuser, grille and register on air outlet data sheets.
13. Minimizing Drafts: Set grille bars for throws, diffusers for patterns and adjust all diffusers, grilles, and registers to minimize drafts in all areas.

C. Water Circulating System Procedures:

1. The various water circulating systems shall be filled, purged of air and put into operation by the contractor before hydronic balancing is begun.
2. The flow of water through all coils shall be adjusted by manipulating balancing valves until the rated pressure drop through the coil or metering device is obtained.
3. Water Treatment: Examine the water in the system and determine if the water has been treated and cleaned. If it has not, request the contractor to clean and treat the water.
4. Strainers: Request that the contractor clean all strainers.
5. Air Vents: Check all air vents at the high points of the water system and determine if they are installed and operating.
6. Valves: Set all balancing valves and automatic temperature control bypass valves to the full-open position for balancing. For three-way valves, the rated pressure drop shall first be adjusted with the three-way valve set so that all water flows through the coil. The bypass balancing valve shall then be adjusted on each coil until equal pressure drop between supply and return connections is obtained, with the three-way valve set to bypass the coil.
7. Pumps: Adjust circulating pumps to meet design GPM requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Measure and record operating current and voltage.
8. Tolerances: Proceed to balance all chilled-water and hot-water coils within 10 percent of design requirements.
9. Marking: Mark all settings and record all data after completing the flow readings and coil adjustments.

D. Verification of Temperature Control:

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
2. Verify that all controlling instruments are calibrated and set for design operating conditions.
3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

1.8 TEST AND BALANCE REPORT:

- A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified test and balance engineer. Any drawings submitted must be to a scale of 1/8" per foot or larger.

- B. Six (6) copies or PDF electronic file of the test and balance report are required and shall be submitted to the Architect and Engineer.
- C. The report shall contain the following general data in a format selected by the balancing agency:
 - 1. Project Number
 - 2. Contract number
 - 3. Project title
 - 4. Project location
 - 5. Project architect
 - 6. Project mechanical engineer
 - 7. Test and balance agency
 - 8. Test and balance engineer
 - 9. General contractor
 - 10. Mechanical subcontractor
 - 11. Dates tests were performed
 - 12. Certification
- D. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC or NEBB National Standards. At a minimum, the report shall include:
 - 1. Preface: A general discussion of the system, any abnormalities and problems encountered.
 - 2. Instrumentation List: The list of instruments including type, model, manufacturer, serial number and calibration dates.
 - 3. System Identification: In each report, the VAV boxes, zones, supply, return, and exhaust openings, and traverse points shall be numbered and/or lettered to correspond to the numbers and letters used on the report data sheets.
 - 4. Air handling equipment test report forms: Record the following on each air-handling equipment test form:
 - a. Manufacturer, model number and serial number
 - b. All design and manufacturer-rated data
 - c. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of these procedures. For specific systems, such as ones with diversity, see the AABC *National Standards*.
 - d. Suction and discharge static pressure of each fan, as applicable.
 - e. Outside air, return air and total CFM.
 - f. Actual operating current, voltage and brake horsepower of each fan motor.

- g. Final RPM of each fan.
- h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
- i. Belt size and quantity.
- j. Static pressure controls' final operating set points.
- 5. Pump Test Forms: Submit pump curve showing design-, operating-, and no-flow points of operation. Also, record the following items on each pump test form:
 - a. Manufacturer, size and serial number.
 - b. All design and manufacturer's rated data.
 - c. Pump operating suction and discharge pressure and final total dynamic head.
 - d. No flow (pump discharge valve closed) suction and discharge pressure and corresponding total dynamic head. This procedure is to determine actual impeller size.
 - e. Rated and actual operating current, voltage, and brake horsepower of each pump motor.
- 6. Chiller Test Forms: Record the following items for each chiller:
 - a. Manufacturer, model number and serial number.
 - b. All design and manufacturers' rated data.
 - c. Rated and actual pressure drop across evaporators and condensers and related GPM.
 - d. Entering and leaving water temperatures.
 - e. Rated and actual operating current and voltage.
- 7. Heating and cooling-coil test forms: Record the following items on each test form:
 - a. Manufacturer.
 - b. All design and manufacturers' rated data.
 - c. Rated and actual water pressure drop through each coil and related GPM.
 - d. Rated and actual static pressure drop across each coil.
 - e. Entering and leaving water temperatures.
 - f. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil; dry-bulb temperatures entering and leaving each heating coil.
- 8. Electric Heating Coil/Duct Heater test forms: Test and record the following on each electric-heating-coil test form:
 - a. Manufacturer and model number.
 - b. All design and manufacturer rated data.
 - c. Actual operating current and voltage.
 - d. Coil location and identification number.

9. Boiler test forms: Record the following items on each boiler test form:
 - a. Manufacturer and model number.
 - b. All design and manufacturers' rated data.
 - c. Service and location.
 - d. Actual pressure drop and related GPM.
 - e. Entering and leaving temperatures.
 - f. Temperature control setting.
10. Test and balance drawings: Include the following:
 - a. Multi-Aqua Cassettes: Indicate mark, design maximum airflow, actual maximum airflow, minimum design airflow and minimum actual airflow.
 - b. All air devices: Indicate terminal unit as air handler served from design airflow, actual airflow, neck size and air device type.
 - c. Air Handlers: Indicate mark, design supply airflow, actual supply airflow, design return airflow, actual return airflow, outside air design airflow and outside air actual airflow.
 - d. Fans: Indicate mark, design airflow and actual airflow.

1.9 FINAL ACCEPTANCE:

- A. Before Certificate of Final Payment is issued the TABA shall recheck, in the presence of the Owner's representative, Architect & Engineer, specific and random selections of data recorded in the certified test and balance report.
- B. Points and areas for recheck shall be selected by the Owner's representative.
- C. Measurements and test procedures shall be the same as the original test and balance.
- D. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.
- E. If random tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, all at no additional cost to the Owner.

1.10 OPPOSITE SEASON TEST:

- A. The TABA shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE:

- A. Section 23 0500 – “General Provisions – HVAC” shall apply to and become part of this Section.
- B. Refer to Section Fire Alarm System (FAS).

1.2 CONTROL SYSTEMS:

- A. Furnish and install complete and ready for operation.
- B. Products of a manufacturer maintaining complete service and parts facilities in Alabama continuously for the last three years.
- C. Control equipment, except for items comprising an integral part of the water or refrigeration piping, shall be installed by trained mechanics employed by the control manufacturer.
- D. Before installation, submit for approval 5 copies of complete power and control wiring and piping diagrams and list of control panel locations by room name and number. Hang a photostatic copy of the "as built" diagram, framed behind glass, in each equipment room. Provide one set of reproducible sepias of "as built" control diagrams at completion of project for the Owner's use.
- E. Provide permanent nameplates for control switches and motor starters. Nameplates: engraved laminated plastic with letters legible under normal operating conditions. (Black on white).
- F. Permanently identify control devices and room thermostats, so they may be identified on control diagrams. Provide engraved plastic nameplates for items mounted outside of or on faces of panels. Mark other instruments with indelible ink.

1.3 CONTROL WIRING:

- A. Include all control and interlock wiring and power wiring for control panel in this Section. Install all control and interlock wiring in EMT. EMT and EMT fittings shall comply with the provisions of Electrical Work. **Plenum-rated communication wiring shall be allowed in lieu of conduit only when installed concealed above accessible ceilings (such as above lay-in ceilings) and shall be supported by cable tray or j-hooks on intervals not to exceed 5'-0" on center in accordance with Division 26 Specifications.**
- B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls and partitions.
- C. Wire all devices individually to terminal strips in control panels.
- D. Furnish necessary relays and auxiliary contactors and other accessories required. Provide interlock relays per N.E.C. Coordinate start-stop stations, auxiliary contacts, etc., with supplier of Starters and Motor Control Centers specified in Electrical Work.

1.4 CONTROL PANELS:

- A. Local Control Panels: construct of galvanized steel with baked enamel finish or aluminum-plywood-aluminum fronts and backs and extruded tops, bottoms, and ends. All panels shall have piano hinges and key locking latches (key panels alike). Permanently label instruments located in panels consistent with labeling on control diagram. Cement photostat of approved diagram inside each panel cover. (Include Local-Remote switching for control point adjusters on face of each panel.)
- B. Bottom of control panels shall be located not less than 2-1/2 feet above floor and top not more than 6 feet above the floor.

1.5 INTERFACES WITH FIRE ALARM SYSTEM (FAS):

- A. Relays actuated by FAS will be mounted in FAS Panels located in Fan Rooms, Equipment Rooms, etc.
- B. Wiring from local panels to FAS panels is included in this Section.
- C. Control point adjusters actuated by FAS System will be located in FAS Panels. Pneumatic tubing between Local Control Panels and FAS Panels is included in this Section.
- D. Fire Control Panel: Furnished and installed under Electrical Work. Connections between Fire control Panel and fan starters, damper air solenoids, etc. shall be included under Controls (See also Section "FAS").

END OF SECTION

PART 1 - GENERAL:

1.1 PROVISIONS OF DIVISION 23:

- A. Section 23 0500 - "General Provisions - HVAC" shall apply to and become part of this Section.

1.2 PROVISIONS OF DIVISION 26:

- A. "General Provisions, Electrical" shall apply to this Section.

1.3 SYSTEM DESCRIPTION:

- A. Provide a building automation system (BAS) consisting of a network of distributed direct digital control processors (DCP) bus connected to a central computer. DCP's shall be microprocessor based and strategically located at data concentration points or in close proximity to the end devices to be monitored and/or controlled. The DCP's shall include stand alone capability of direct digital control with integrated energy management programs including duty cycling, demand, optimum start and analog load reset.
- B. The central computer (CC) shall include an operator's console with display, keyboard and printer. Central software shall include historical data storage, logging and retrieval, upline and downline loading of stored DCP programs, CC and DCP programming software, data logging of analog and digital values and color dynamic graphic software (mouse driven). Alarms and logical groups shall have alphanumeric points and group descriptors.
- C. Provide all sensors, actuators, transducers, DCP's and central equipment to meet functional description.
- D. Products of a manufacturer maintaining complete service and parts facilities in Alabama continuously for the last three years shall be **Honeywell – Southeastern Temperature Controls. Contact: Mike Enea (205) 296-2866, E-mail: menea@STCBAS.com**
- E. Control equipment, except for items comprising an integral part of the water or refrigeration piping, shall be installed by trained mechanics employed by the BAS manufacturer.
- F. Use standard components, regularly manufactured and not custom designed for project. Use systems and components proven in use.
- G. System shall be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.

1.4 WORK REQUIRED:

- A. All engineering design, labor, materials, equipment and services necessary for and reasonably incidental to proper completion of BAS work as shown or herein specified (excepting only work or materials specified or noted as being done or furnished by others), consisting in general of the following, complete and ready for operation.
1. Central Control (CC)
 2. Distributed Control Panels (DCP)
 3. Software packages
 4. Remote control, alarm and sensing devices
 5. Fire alarm system interconnects
 6. Interface with Power Company meter.
 7. Complete wiring network interconnecting all parts of the system
 8. Instruction of Owner's operating personnel
 9. Service contract

1.5 SUBMITTALS:

- A. Within 30 days of notice to proceed and prior to installation of any equipment, the BAS contractor shall provide 6 copies of submittals for approval. Submittals shall include:
1. A complete system block diagram showing all computers, peripherals, power connections and source, plan of equipment in main control room, trunk wiring links, DCP's and location, and a listing of all points and systems connected to each DCP.
 2. Complete operating sequences for all programs provided for HVAC equipment.
 3. Specification data sheets for each piece of central and remote hardware, for software application package and for central programs and system services software.
 4. Proposed site-unique menu tree showing the full English descriptor proposed for each logical system and the full English description of each logical data point within each system.
 5. Menu map of all definition process menu paths showing all elements of menu prompts specified for system definition and user applications.
 6. Samples of all specified reports, logs, and printouts showing compliance with all requirements for English code-free outputs.
 7. Locations of all control panels by room name and number.
 8. Thirty days after approval of all above submittal data, submit typed copies of all system control sequences.

- B. Before installing any controls for variable air volume terminals or powered induction units, pipe up, mount reheat coil control valve and test one air terminal of each type used on the project to verify that controls work properly. Certify that the controls operate in accordance with the specified sequence.

1.6 ACCEPTANCE PROCEDURES:

- A. Upon completion, the contractor shall conduct a complete functional test of the system for the owner, architect, and engineer. Contractor shall simulate power failure recovery, and stand alone operation capability on communication loss with Central Control.
- B. Provide 3 full sets of as-built drawings, complete operating manuals and hardware and software documentation.

1.7 WARRANTY SERVICE:

- A. All components, software, parts and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for one year from acceptance date.
- B. Labor to trouble shoot, repair or replace system components shall be furnished at no charge to the owner during the warranty period.

1.8 MAINTENANCE:

- A. The BAS manufacturer shall have a local branch office within 100 miles of the installation staffed with trained, full-time employees capable of performing testing, inspection, repair and maintenance services for the life of the system.
- B. The meantime to repair once the BAS manufacturer's service representative is at the job site with the required parts shall not exceed two hours.

1.9 SYSTEM COMMISSIONING:

- A. The Contractor shall completely checkout, calibrate and test all hardware and software to insure that the system performs in accordance with the approved sequences of operation submitted.
- B. Include the services of a full time control technician for calibrating and adjusting controls for the first 10 working days after Owner has occupied building.
- C. Provide assistance to the Test and Balance Contractor during his review and testing of the Control Systems.

1.10 OPERATOR TRAINING:

- A. Contractor shall provide a minimum of two full day's instruction for the owner's operating personnel on system operation and routine maintenance procedures. The BAS manufacturer shall also provide four additional days of on-site instruction and assistance to the owner during the warranty period on a call basis. The owner shall schedule these days at least one week in advance and for intervals of no less than eight hours at a time. The four days are exclusive of necessary travel time. These sessions shall encompass all areas of the system as requested by the owner including troubleshooting, diagnostics and all levels of operation and software definition.

PART 2 - EQUIPMENT:

2.1 GENERAL:

- A. System components requiring line voltage inputs shall be designed and tested to operate satisfactorily and without damage at 10% above and 15% below nominal rated input voltage.
- B. All transmission bus connected devices shall be such that loss of any single device shall not disrupt or interfere with communication to other devices on the bus. Loss of communication with the central control and command station shall not cause any DCP to halt operation or to cease to perform its intended function (i.e., each DCP shall continue to operate on a stand alone basis).
- C. After power failure and upon a power restoration, the system shall provide automatic sequential restart of equipment based on current program time and program requirements without operator intervention.

2.2 CENTRAL CONTROL:

- A. Central control shall include a computer, monitor, wireless keyboard and mouse, printer and software.
- B. Computer shall be PC compatible with not less than 512 gigabyte solid state hard drive, 48X 16XDVD+/-RW/48X CDROM, 12 GB RAM, 3.0 GHZ microprocessor, 1 GB HD Video Card, minimum two HDMI outputs.
- C. Monitor shall be 24" LED color monitor with minimum 1920 x 1080 resolution and HDMI input.
- D. Printer: 8-1/2" x 11" color laserjet.
- E. Central control equipment shall be equipped with a power supply with filtered AC input, surge protection, battery backup and shall be installed on-site at a location directed by Owner.

2.3 DISTRIBUTED DIRECT DIGITAL CONTROL PROCESSORS (DCP'S):

- A. To prevent a single-failure catastrophe, multiple direct digital controllers shall be provided. Failure of any single controller shall have no effect on other controllers.
- B. Direct digital controllers shall be microprocessor-based with all hardware, software, and communications interfaces. DCP's shall be capable of stand-alone operation, and incorporation into larger systems. The controllers shall be either 16 bit, or multiple 8 bit microprocessors configured so that input-output processing and operator command processing may be offloaded from the control processing. If the DCP's use digital communication to remote "slave" gathering panels, all such communication circuits extending outside the DCP shall utilize dual (redundant) bus cabling, be supervised, and provided with an auto-failover feature.
- C. The controller shall be factory mounted and wired in a steel enclosure complete with all relays, digital to analog converters, and terminal strips. Controllers shall be expandable to 15% points of each type (analog and digital input and output) in excess of those actually required for this project.
- D. The controller shall operate within the following limits:
 - 1. Temperature 33 to 122°F.

2. Humidity 0 to 95% RH (non-condensing)
 3. Voltage 24 VAC + 10% to -15% 50 or 60 HZ.
- E. The controllers shall withstand storage conditions as follows:
1. Temperature -4 to 176°F.
 2. Humidity 0 to 95% RH (non-condensing)
- F. Local Diagnostics and Programming:
1. Each DCP shall be equipped to provide local diagnostics and adjustments either through a built-in digital display and keyboard to show such information as time and date, analog variables, binary conditions, system operation modes, critical alarms and operator definable functions to allow the operator to analyze and adjust the system being controlled or through a portable hand held operator's terminal. Provide one operator's terminal for each building.
 2. Adjustments shall include but not be limited to proportional gain, integral rate, velocity and acceleration constants associated with incremental control and on/off values of two-position control.
 3. The DCP shall be fully field programmable with the following built-in functions:
 - a. All closed loop control functions (P, PI, PID, incremental, floating, two-position, etc.)
 - b. All energy management functions
- G. The system shall utilize PROM and RAM memory. All DDC algorithms and parameters shall be RAM based for ready access for modification and adjustment. RAM memory shall be provided with 100 hours battery backup minimum.
- H. The controller software shall include a complete operating system, standard energy management application packages, standard control algorithm application packages, and an owner/user custom control and calculation application package complete with interpreter. Complete user documentation modules shall be provided.
- I. DCP's shall be capable of being programmed to utilize stored default values for assured fail safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the CC or another DCP, by loss of bus communication. Individual application software packages shall also be structured to assume a fail safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a "sensor failed" message at the central control and command station.
- J. The operating system software shall be PROM resident and operate independently of any central computer. The operating system shall control communications between the central terminal and the controllers and I/O modules, provide alarm monitoring and reporting, provide control application packages, and contain built-in diagnostic routines.
- K. The controller shall have memory error checking. Upon detection of a memory error, the CPU shall correct the error or halt to prevent erroneous operation. All "halts" shall report as an alarm at the central control terminal.

- L. After a power failure and upon a power restoration, the system shall provide automatic sequential restart of equipment based on current program time and program requirements without operator invention.
- M. Controllers shall accept industrial platinum and resistance sensors. Each output point shall be provided with an L.E.D. which shall indicate status of digital outputs and value (via variable intensity) of analog outputs. Processor software shall allow for scaling and for calibration of sensor lead length variations to insure display accuracies.

2.4 SOFTWARE:

- A. Software shall include the following:
 - 1. System access limitation with 3 levels of access (operation only; operation plus programming; operation, operation plus programming; assigning individual passwords and authorization levels).
 - 2. Psychrometric routines.
 - 3. Alarm lockout.
 - 4. Floating alarm limits.
 - 5. Time delay start sequence.
 - 6. Time of day.
 - 7. Optimum start-stop.
 - 8. Smoke control.
 - 9. Air economizer initiation.
 - 10. Chiller plant optimization.
 - 11. Air tracking.
 - 12. DDC programs as required.
 - 13. Event initiated programs.
 - 14. DCP programming (from CC and DCP).
 - 15. Data logging.
 - 16. Status logging (all points).

2.5 TRANSMISSION NETWORK:

- A. Communications between controllers shall have a system line capability of at least 3300 feet, or systems shall be equipped with modems.
- B. Transmission line shall be electrically isolated from the DCP's and operator's terminal by optical couplers at each interface to prevent any voltages in the transmission lines from damaging any of the electronic circuits.

2.6 CONTROL WIRING:

- A. Include all control and interlock wiring and power wiring for DCP's and control panel in this Section. Install in conduit in accordance with provisions of Electrical Work.
- B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls and partitions.
- C. Wire all devices individually to terminal strips in control panels.
- D. Furnish necessary relays and auxiliary contacts and other accessories required. Provide interlock relays per N.E.C. Coordinate start-stop stations, auxiliary contacts, etc., with supplier of Starters and Motor Control Centers specified in Electrical Work.

2.7 CONTROL DEVICES:

- A. Room temperature sensors: Accuracy $\pm 0.3^{\circ}\text{F}$, case to match case of pneumatic room thermostats.
- B. Single point temperature sensor (pipe or duct) accuracy $\pm 0.3^{\circ}\text{F}$ (accuracy for sensors serving BTU meters $\pm 0.1^{\circ}\text{F}$), stainless steel wells for pipe mounted sensor, bulb supports for duct mounted sensor.
- C. Remote bulb thermostats and temperature transmitters:
 - 1. Unless otherwise shown use averaging elements not less than 8 feet long for duct or casing cross sections up to 24 square feet face area and elements not less than 17 feet long for sections over 24 square feet face area, accuracy: $\pm 0.3^{\circ}\text{F}$.
 - 2. At contractor's option, average temperature measurements for mixed air or coil discharge air may be made by an array of paralleled Type J or Type T thermocouples. Individual thermocouples shall be located not more than 12" apart with the bottom row 3" above the bottom of the coil. In no case shall less than 6 thermocouples be used. Thermocouples: solid 24 gauge wire, teflon insulated. Thermocouple extension wire 16 gauge, solid, twisted, shielded PVC or teflon insulated. Thermocouples shall be mounted using an EMT grid.
- D. Humidity Sensors: Accuracy $\pm 1\%$ over 30 to 80% RH range. Case to match case of pneumatic room thermostat.
- E. Outdoor and Duct Humidity Sensors: Accuracy $\pm 1\%$ over 30 to 80% RH range.
- F. Thermometers: Pipe line thermometers are specified in another section. Install dial thermometers in ducts where shown on control diagrams, providing averaging bulbs where shown.
- G. Control Valves:
 - 1. 125 psig WP with plug and disc inner valve to insure modulation of flow where required. Valves 2" and smaller: all brass screwed or flared. Valves 2-1/2" and larger: flanged iron bodies and brass trim. Equip all valves with operators of sufficient power to insure tightness against pressure. Control valves operating with inlet steam pressure greater than 15 psig shall have stainless steel trim and renewable seats.
 - 2. Control valves shall be sized by the manufacturer of the control valve, based on actual capacity of equipment to be installed, and according to American National Standards Institute/Instrument Society of American Standard S75.01, "Control Valve Sizing Equations". Sizing data shall be submitted to Architect for review and acceptance.
 - 3. Control valves shall shut tight against 60 psig differential or inlet pressure.

- H. Freezestats: Manual reset, pneumatic not permitted. Locate freezestat bulbs between preheat and chilled water coils in units with chilled water coils and downstream from DX coils in units with DX coils.
- I. Firestats: Single pole double throw, electric, manual reset, pneumatic not permitted. Firestats shown to be connected to the fire alarm system: compatible with fire alarm system, furnished and installed under Controls, wired under Electrical Work.
- J. Flow Switches: Vaporproof enclosures, McDonnell & Miller. Pneumatic not permitted.
- K. Valve & Damper Operators: Of sufficient power to close/open valves and dampers under operating conditions. Electric valve and damper motors shall have oil immersed gear trains and spring return to normal position.
- L. Static pressure measurement stations shall be bi-directional pressure transducers providing 0 to 5 VDC or 4-20 mA proportional output. Bi-directional range shall be 0 to ± 0.1 to 0 to ± 50 in. W.C. Minimum $\pm 0.5\%$ full scale accuracy. Setra DPT264 or equal.
- M. Current Transformers: Comply with ISA 50.00.01, current-sensing fixed or split-core transformers with self-powered transmitter, adjustable trip and suitable for 175 percent of rated motor current.
- N. Air Flow Monitor (AFM):
 - 1. Provide airflow measurement devices where indicated on the plans. Fan inlet sensors shall not be substituted for duct or plenum sensor probes indicated on the plans.
 - 2. Each measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Each transmitter shall have an LCD display capable of displaying airflow. Airflow shall be field configurable to be displayed as a velocity or volumetric rate. Each transmitter shall operate on 24 VAC.
 - 3. Each sensing point shall independently determine the airflow rate which shall be equally weighted and averaged by the transmitter prior to output. Devices, which average multiple non-linear sensing point signals, are not acceptable. Pitot tube arrays are not acceptable.
 - 4. Each independent airflow sensor shall have a laboratory accuracy of $\pm 2\%$ of reading over the entire operating airflow range and be wind tunnel calibrated or verified against standards that are traceable to NIST.
 - 5. The transmitter shall be capable of communicating with the host controls using the following interface options:
 - a. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
 - b. RS-485: Field selectable ModBus-RTU and Johnson Controls N2 Bus.
 - c. 10 Base-T Ethernet: Field selectable ModBus TCP and TCP/IP
 - d. LonWorks Free Topology
 - 6. Airflow/Temperature measuring devices shall be UL listed as an entire assembly.
 - 7. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.
 - 8. AFM shall be Ebtron Gold Series or approved equal.

- O. Velocity Pressure Transducers 0 to 5 volts DC, accuracy $\pm 2\%$ full scale, return air range, (0 to 0.25" WG), supply air range (0 to 0.5") (0 to 1.0"), Setra or equal.
- P. Wells: install pipe line mounted control and indicating devices in stainless steel or brass thermometer wells.
- Q. Capillary Supports: securely support all duct-mounted and casing-mounted thermostat capillaries using factory fabricated copper bulb supports.
- R. Provide stand-offs for control devices mounted on externally insulated ducts and equipment.
- S. Anchor all items mounted on gypsum board (dry-wall) using toggle bolts or moly bolts, not expansion shields.
- T. Pressure Gauges:
 - 1. Install 4-1/2" pressure gauges with the provisions of Section "Materials & Methods - HVAC" on all water and all steam pressure sensing lines at pressure and differential pressure controllers.
 - 2. Provide 1-1/2" dial branch pressure gauges as close as possible to each valve and damper operator (use 1" gauges on air terminal dampers). Provide 1" minimum dial gauges on each port of each instrument, including receiver-controllers, transmitters, P.E. switches, etc. Provide 1" minimum dial gauge on each air terminal damper operator.
- U. Provide permanent nameplates for control switches and motor starters. Nameplates: engraved laminated plastic with letters legible under normal operating conditions. (White on black).
- V. Permanently identify control devices other than room thermostats, so they may be identified on control diagrams. Provide engraved plastic nameplates for items mounted outside of or on faces of panels. Mark other instruments with indelible ink. Mark room thermostats and room temperature sensors on inside of covers.
- W. Automatic Dampers:
 - 1. Provide and install automatic dampers as shown on plans, scheduled, or as required. Coordinate size, quantity and locations of automatic dampers with automatic control work as required. Dampers shall be factory fabricated with extruded aluminum blades and frames.
 - 2. Damper frames shall be 5" x 1" x .125" (minimum thickness) extruded aluminum hat channel with hat shaped mounting flanges on both sides of the frame. Each corner shall be reinforced with two die formed internal braces and machine staked for maximum rigidity or integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking.
 - 3. Damper blades shall be airfoil type extruded aluminum with metal blade to metal blade overlap. Each blade shall be maximum 6" depth with integral structural reinforcing tube running full length. Minimum thickness of blade shall be 0.070". Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal. Blade operation is parallel or opposed. Blades shall be contained within the damper frame.
 - 4. Blade edge seals shall be flexible and suitable for -72°F to +275°F mechanically locked in extruded blade slots yet easily replaceable in field. Jamb seals shall be flexible stainless steel, compression type to prevent leakage between the end of the blade and the damper frame. Use of blade end to overlap the frame for jamb seal is not acceptable. Adhesive or clip-on type blade or jamb seals are not acceptable.

5. Bearings shall be non-corrosive molded synthetic. Axles shall be 1/2" plated steel hexagonal shaped and to provide positive locking connection to blade. Linkage shall be concealed out of airstream, within frame to reduce pressure drop, noise and maintenance.
 6. Provide and install Electric, 24 or 120V AC, spring return, 2-position or modulating damper actuator(s) as specified in controls specification sections or as indicated on drawings. Actuator(s) shall be sized as required to sufficiently open/close dampers under operating conditions. Multiple actuators shall be provided as required.
 7. Install dampers in accordance with manufacturer's installation instructions and requirements. Install dampers square and free from racking.
 8. Dampers must be accessible to allow inspection, adjustment, and replacement of components. Provide and install access doors as specified and required.
 9. Provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.
 10. Submittal shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Damper shall be tested and licensed in accordance with AMCA 511 for Air Performance and Air Leakage. Damper shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as Class 1A.
 11. Saw-mark ends of damper rods parallel to blades.
 12. Rectangular dampers shall be Ruskin Model CD50, Greenheck VCD-43, or preapproved equivalent.
 13. Round dampers shall be Ruskin Model CDRS25, Greenheck VCDR-53, or preapproved equivalent.
- X. Combination Smoke & Fire Dampers:
1. Combination smoke and fire dampers shall be UL labeled 1-1/2 hour dampers complying with UL 555 and UL 555S and shall be labeled as such.
 2. Operators shall be spring return damper motors with oil immersed gear trains. Arrange linkages to provide normally closed dampers. (See automatic controls hereinafter.) Provide fusible link to connect operator to damper linkage and provide spring loaded linkages to close damper and latch to hold damper shut.
 3. Damper operators shall be located out of the air stream and shaft seals shall be provided where damper rods exit duct and sleeve.
 4. Provide factory fabricated steel wall (floor) sleeve at least 3" larger than wall thickness for each combination fire and smoke damper and install sleeve using bolts and angles as detailed in Plate #1 of SMACNA "Fire Damper Guide".
 5. Smoke detectors shall be ionization detectors which detect products of combustion. Furnish, wire, and install smoke detectors under this Section. Provide smoke detectors compatible with fire alarm system specified under Electrical Work and equip them with contacts for connection to fire alarm system. (See automatic controls, hereinafter.)
 6. Smoke detectors will be furnished and wired under ELECTRICAL WORK but shall be installed in ducts under this Section.

7. Locate smoke detectors so that indicating lights are visible and so that they will not be affected by moisture from coils or humidifiers.
8. Install access door in duct at each smoke damper.

2.8 CONTROL DEVICE APPLICATIONS:

- A. Pump Status: Flow switches.
- B. Fan Status: Differential static pressure switches.

PART 3 - CONTROL SEQUENCES:

3.1 GENERAL:

- A. Control diagrams on drawings are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown on control diagrams.
- B. As shown on drawings.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

A. General Conditions:

1. The accompanying General Conditions (front-end specifications) shall apply to and form a part of this section.

B. General Requirements:

1. Carefully examine General Conditions, other specification sections, and other drawings (in addition to Electrical) in order to be fully acquainted with their effect on electrical work.
2. Do all work in compliance with all applicable codes, laws, and ordinances, the National Electrical Safety Code, the National Electrical Code (hereinafter referred to as "Code"), applicable energy codes, and the regulations of the local utility companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like.
3. Cooperate with other trades and contractors at job. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.

C. Electrical Contractor Experience Requirements:

1. Electrical contracting firm shall be licensed as an electrical contractor in the state where work will be performed.

1.2 GENERAL SCOPE OF ELECTRICAL WORK (REFER TO DRAWINGS FOR OTHER SPECIFIC SCOPE ITEMS)

- A. Furnish all labor and materials to complete electrical work as shown on drawings and/or herein specified.
- B. Remove all existing electrical equipment and wiring made obsolete by this project and remove or relocate all electrical services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the completed project or any code pertaining thereto. Dispose of salvageable materials as directed by the Architect. Contractor shall schedule meeting to review scope of electrical demolition and to confirm scope and phasing of proposed demolition with the owner in the presence of the prime consultant prior to start of any electrical demolition.
- C. Furnish and install complete power, telephone and other electrical services as shown on drawings and/or specified herein.
- D. Pay all electrical utility company service charges (if any) in connection therewith, including permanent meter deposit. Meter deposits will be refunded to Contractor at time of Owner's acceptance.
- E. Furnish and install complete power distribution system as shown on drawings and/or specified herein.
- F. Furnish and install a complete Power Generation and Automatic Transfer Switch System as shown on drawings and/or specified herein.
- G. Furnish and install disconnect switches for motors as shown on drawings and/or specified herein.

- H. Furnish and install complete electrical grounding systems as shown on drawings and/or specified herein.
- I. Install and connect electrical equipment mentioned in Division 26/27/28 Specifications or noted in drawings, whether furnished by electrical contractor or by others.
 - 1. Where shown or specified, equipment furnished by others shall be installed and connected under this Contract.
 - 2. Where shown or specified, Contractor shall receive, unpack, check and assume custody of equipment furnished by Others. Contractor shall assume responsibility for care and safekeeping of this equipment, when delivered into his custody. He shall protect it from moisture, dust and damage during construction and until Owner acceptance of project.
- J. Furnish and install complete electrical lighting systems as shown on drawings and/or specified herein.
- K. Furnish and install all electrical items shown on drawings and/or herein specified, unless shown or specified otherwise.
- L. Furnish and install complete controls & auxiliary systems as shown on drawings and/or specified herein.
- M. Furnish and install complete telephone/data raceway (including all outlet boxes, face plates, conduit raceways, telephone backboards, terminal cabinets, etc.), wiring and devices system as shown on drawings and/or specified herein.
- N. Furnish and install a complete Fire Alarm System as shown on drawings and/or specified herein.
- O. Furnish and install a complete Surge Protection System as shown on drawings and/or specified herein.
- P. Furnish and install a complete Building Lightning Protection System as shown on drawings and/or specified herein.
- Q. Procure and pay for permits and certificates as required by local and state ordinances and fire underwriter's certificate of inspection.
- R. Balance loads as equally as practicable on services, distribution feeders, circuits and buses. Provide typewritten directory for each panel.
- S. Unless specifically indicated or required otherwise, terminate all circuitry/cabling provided within this contract at associated equipment/devices/etc. in accordance with all applicable codes, standards and supplier requirements, whether associated equipment/device/etc. is furnished within this contract or by others.
- T. Complete field testing, adjustment & startup of all systems listed above as shown on drawings and/or specified herein.

PART 2 PRODUCTS

2.1 APPROVED MATERIALS AND DEVICES

- A. Where not otherwise specified, provide only new, standard, first-grade materials/systems throughout, conforming to standards established by Underwriter's Laboratories, Inc., and so marked or labeled, together with manufacturer's brand or trademark. All equipment/systems subject to approval of

**SHELBY COUNTY EMA & IT BUILDING PROJECT
BASIC ELECTRICAL MATERIALS AND METHODS**

SECTION 26 0500 – PAGE 3 OF 9

Architect before installation. All like items and associated equipment/systems shall be of one manufacturer.

- B. To ensure proper coordination, it is intended that all electrical equipment and materials specified in Division 26/27/28 of these specifications and shown on the electrical drawings be furnished and installed by the electrical sub-contractor. It will not be permissible for any of these items to be furnished directly by the general contractor without the electrical contractor's coordination.
- C. To ensure commonality of spare parts, it is required that the electrical contractor provide the same brand for all circuit breakers, starters, power equipment, etc. provided under the following divisions of these specifications:
 - 1. SECTION 260573: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
 - 2. SECTION 262416: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
 - 3. SECTION 262417: LIGHTING PANELBOARDS
 - 4. SECTION 262816: SAFETY SWITCHES AND FUSES

2.2 SUBMITTALS

- A. All submittals to the design team shall be accompanied by a letter summarizing all proposed deviations from specified products or pre-approved substitutions. The absence of such a letter shall be understood to indicate that the contractor intends to meet all contract requirements, regardless of cut-sheets/data-sheets provided within the submittal.
- B. Submit to Architect ten (10) days prior to bid date three (3) copies of any items and/or manufacturers which are proposed as substitutes for those specified.
- C. Submit to Architect promptly after award of Contract and prior to purchasing, the number of copies required by the contract. All drawings of a specific item or system shall be made in one submittal, and within thirty (30) days after award of Contract. Shop drawings of all power equipment shall contain exact details of device placement, phasing and numbering, in form of elevations, for each major piece of equipment. Shop drawings shall be submitted on the following:
 - 1. SECTION 260536: CABLE TRAYS
 - 2. SECTION 260573: POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES
 - 3. SECTION 260943: LIGHTING CONTROL SYSTEM
 - 4. SECTION 260944: DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM
 - 5. SECTION 262416: POWER PANELBOARDS - CIRCUIT BREAKER TYPE
 - 6. SECTION 262417: LIGHTING PANELBOARDS
 - 7. SECTION 262816: SAFETY SWITCHES AND FUSES
 - 8. SECTION 263213: GENERATOR SETS
 - 9. SECTION 263353: UNINTERRUPTIBLE POWER SUPPLY - UPS
 - 10. SECTION 263623: AUTOMATIC TRANSFER SWITCHES
 - 11. SECTION 263633: GENERATOR LOAD BANK DOCKING STATION
 - 12. SECTION 264100: LIGHTNING PROTECTION SYSTEM
 - 13. SECTION 264300: SURGE PROTECTIVE DEVICES
 - 14. SECTION 265000: LIGHTING MATERIALS AND METHODS
 - 15. SECTION 271000: STRUCTURED CABLING SYSTEM
 - 16. SECTION 274100: TELEVISION DISTRIBUTION SYSTEM
 - 17. SECTION 281300: ACCESS CONTROL SYSTEM
 - 18. SECTION 283100: FIRE ALARM SYSTEM
 - 19. ALL POWER DISTRIBUTION EQUIPMENT (i.e. SWITCHBOARDS, PANELBOARDS, DRY TYPE TRANSFORMER, ETC.)
 - 20. ALL ELECTRICAL AND TELECOMMUNICATION EQUIPMENT LAYOUTS - Submittals shall include 1/4" = 1'-0" CAD drawings (hand drawn sketches will not be accepted) of each electrical

room, IT room, electrical equipment stand, generator area, or any other similar area with electrical equipment. Drawings shall indicate all panelboards, transformers, switchboards, generators, equipment racks, control panels, HVAC equipment, etc. that are located in each electrical/IT area. Layouts shall show that each piece of electrical equipment has the clearances, working space and dedicated equipment space required by applicable codes. No conduits to equipment within these areas shall be installed until submittals have been provided and returned without exception by the design team.

- D. The contractor shall fully review, comment upon and correct all shop drawings as required to assure compliance with contract documents prior to submittal to Architect. The failure of the contractor to properly review and correct shop drawings prior to submittal will result in rejection of shop drawings by the engineer. Review by the Architect will be for general conformance with contract documents. The contractor shall be fully responsible for correctness of all submitted dimensions, details, quantities and locations.
- E. None of the above items shall be installed until shop drawings or catalog data have been reviewed by Architect without rejection or required resubmittal. Any listed item not submitted, even if specified, shall be considered not acceptable and shall be removed if directed.
- F. Any required resubmittal will be reviewed by the Architect for conformance with previously issued comments only. The contractor shall be responsible for verifying that all items not specifically requiring resubmittal have not been altered from the previously reviewed submittal.
- G. Material proposed for substitution shall be of the same quality, perform the same functions, conform to such physical dimensions and appearance as are required by the Architect. All material proposed for substitution is subject to the approval of the Architect and his authority for approval is final. No material proposed for substitution will be considered unless all submittal data complies with the drawings and specifications of Section 16 as to time of submission, number of copies of submittal, and detail requirements.
- H. Samples of material shall be furnished where required by drawings or Division 26/27/28 Specification, or as requested by the Architect on items proposed as substitutes.
- I. Submit to Architect a certificate of final inspection from local inspection department.

PART 3 EXECUTION

3.1 SITE VISIT

- A. The Contractor shall visit the site to determine existing dimensions and conditions affecting electrical work. Failure to do so in no way relieves Contractor of his responsibility under Contract.

3.2 CLEARANCE WITH UTILITIES

- A. It shall be the responsibility of this Contractor, prior to bid, to reaffirm with the utility companies involved, that the locations, arrangement (and with power company voltage, phase, and metering required) and connections to utility service are in accordance with their regulations and requirements. If their requirements are at variance with these drawings and specifications, the Contract price shall include any additional cost necessary to meet those requirements without extra cost to Owner after a contract is entered into.
- B. On many projects the utility company may levy charges due to locations, size or type service involved. The Contractor shall be responsible for these charges (including permanent meter deposit), unless such charges are not available prior to bid and Contractor so documents as described below. The meter deposit will be refunded to the contractor at time of Owner's acceptance.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
BASIC ELECTRICAL MATERIALS AND METHODS**

SECTION 26 0500 – PAGE 5 OF 9

- C. Should above cost not be available, prior to bid, Contractor must submit a letter signed by a responsible utility company person so stating with his bid and in turn must be submitted by Prime Contractor with his bid to Owner. The cost will then be deleted from the Contract and become responsibility of the Owner.
- D. Arrange with utility companies for such services as shown or herein specified and installation of meter where shown. Furnish with shop drawings a signed document from utility companies describing the location and type of services to be furnished and any requirements they may have. This document shall be signed for each utility company by a person responsible for granting such service.

3.3 WORKMANSHIP

- A. All work shall be in accordance with the latest editions of NFPA 70 (National Electrical Code), NFPA 101 (Life Safety Code), National Electric Safety Code, International Building Code, applicable NECA standards and the rules and regulations of State and Local Authorities Having Jurisdiction.
- B. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance upon completion.
- C. All equipment, devices, etc. shall be installed in accordance with manufacturer's recommendations.
- D. All items shall be installed straight and plumb in a workmanlike manner and care shall be exercised so that like items are mounted the same position, heights and general location.
- E. Keep site clean of accumulation of cartons, trash and debris.

3.4 SAFETY

- A. The contractor is solely responsible for all job safety. Architect assumes no responsibility for job safety. Maximum consideration shall be given to job safety and only such methods as will reasonably ensure the safety of all persons shall be employed. The codes and regulations of OSHA shall be given strict compliance as well as such other codes, laws, and regulations as may be applicable.

3.5 CONTRACT DOCUMENTS

- A. Contract documents indicate diagrammatically, extent, general character and approximate location of work. Where work is indicated but minor details omitted, furnish and install it complete so as to perform its intended functions. For details and mechanical equipment, follow drawings provided by other disciplines (Architectural, Mechanical, Structural, Civil, etc.) and fit electrical work thereto.
- B. Contract documents consist only of the hardcopy documents issued by the Prime Architect. Electronic documents issued directly by the electrical engineer to the contractor and/or its sub-contractors/vendors are issued for convenience only (electronic documents are not formal contract documents).
- C. If the contractor and/or one of its suppliers require a one-time transfer of electronic files of the current electrical construction documents to prepare shop drawings (or for another similar purpose), it shall:
 - 1. Sign a waiver prepared by the electrical engineer prior to the transmittal of these files.
 - 2. Agree to pay the electrical engineer a fee of \$50.00 per drawing, up to a maximum of \$400 per transfer, payable upon receipt of the files.
 - 3. To the fullest extent permitted by law, indemnify, hold harmless, and defend JRA from all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the use of the CAD files.

- D. Take finish dimensions at job in preference to scaled dimensions.
- E. Except as above noted, make no changes in or deviations from work as shown or specified except on written order of Architect.

3.6 UNDERGROUND UTILITY/EQUIPMENT COORDINATION

- A. Prior to commencement of work, verify exact locations of all existing or proposed underground utilities and/or underground equipment and verify that proposed electrical installation does not conflict with these items. Notify Architect immediately if any conflict is found.

3.7 EQUIPMENT STORAGE

- A. Store all electrical equipment in dry, covered locations as directed by equipment manufacturers. Contractor shall be responsible for replacing or repairing improperly-stored equipment as directed by Architect.

3.8 EXCAVATION, CUTTING AND PATCHING

- A. Perform all cutting and excavating as necessary for installation of electrical systems, unless specifically covered under another section. After Architect's observation, complete all excavation, filling and backfilling as directed under specifications for preparation of site and earthwork. Foundations for equipment shall be as specified under concrete section. Concrete pads shall be minimum of 6" thick; unless greater thickness required by equipment manufacturer. Obtain specific approval of Architect before cutting into any structural members.
- B. For all such work employ competent workmen, and finish up in neat and workmanlike manner, equal to quality and appearance to adjacent work.

3.9 PENETRATIONS

- A. All penetrations in water tight barriers shall be made so that barrier rating is not compromised. Furnish roof flashing for all equipment installed under Division 26/27/28 that penetrates through the roof. Appropriate flashing is specified under roofing and sheet metal section. Supply these flashings for installation under roofing and sheet metal section.
- B. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly to maintain the fire/smoke rating of the associated membrane.
- C. Where penetrations are required through structural elements, verify penetration locations and sizes with structural engineer. In no case shall the structural integrity be compromised without written approval from structural engineer.

3.10 INSTALLATION OF EQUIPMENT - GENERAL

- A. Care shall be exercised in exact routing and location of all items so as not to obstruct access to equipment, personnel walkways, or expose it to potential mechanical damage.
- B. Items shall be securely anchored and/or fastened. Provide proper support for all equipment, devices, conduits, boxes, panels, etc. as required by code and for a workmanlike installation. Provide guy wiring for wood poles where required to prevent leaning. All construction shall meet the seismic design requirements of the building code. Items (especially transformers, light fixtures, equipment racks, freestanding gear, etc.) installed in seismic zones C, D, E or F shall be supported and braced per applicable codes and standards.

- C. All wall, pole or frame-mounted electrical equipment shall be mounted to metal unistrut (or similar) frames of same material as electrical equipment. For example, pole-mounted painted or galvanized steel disconnect switches shall be mounted to galvanized steel unistrut frames.
- D. All electrical equipment, furnished by Contractor or by others shall be covered and protected during construction.
- E. All control cabinets, panels, motor control centers and other electrical cabinets and enclosures shall have all trash removed and be vacuumed clean. All foreign paint, etc., shall be removed from exterior and all scratches in finish touched up with same color and material as original. Any rusted areas shall be sanded, primed and repainted.
- F. All relays, starters, push-button and other control devices shall be cleaned and if necessary, lubricated with CRC 2-26 to assure free operation.

3.11 MOTORS, STARTERS AND CONTROLS

- A. Unless otherwise specified or shown, all motors will be furnished and installed under other sections of this specification.
- B. Electrical Contractor shall install all starters and all electrical power wiring and connections to motors and starters.
- C. Unless otherwise specified or shown, all control items for motors shall be furnished, installed and wired in conduit under other divisions of this specification.

3.12 CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit numbers. No more outlets than are indicated shall be connected to a circuit.
- B. Branch circuit homeruns shall be installed as shown on drawings. Multiple homerun conduits shall not be combined by contractor into larger, single homerun conduits unless specific permission is granted by the Engineer.

3.13 LUG/TERMINAL RATINGS

- A. All lug/terminal ratings, sizes, locations, types, etc. shall be coordinated with the associated conductor sizes, types, routings, etc. by the contractor.
- B. All lugs/terminals/etc. shall be rated for 75 degree C terminations (minimum, unless specified otherwise).

3.14 EQUIPMENT FAULT CURRENT RATINGS

- A. All equipment and breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated distribution equipment. All interrupting ratings shall be full ratings. Where new devices or breakers are added to existing distribution equipment, the new devices/breakers shall have interrupting ratings matching or exceeding that of the existing distribution equipment.

3.15 OUTLET LOCATION

- A. Symbols shown on drawings and mounting heights indicated on drawings and in specifications are approximate only. The exact locations and mounting height must be determined on the job and it shall be the Contractor's responsibility to coordinate with other trades to ensure correct installation.

3.16 IDENTIFICATION

- A. Each panel shall have each circuit identified. Panels without branch circuit nameplates shall have typewritten directories.
- B. Each individually mounted switch, circuit breaker, starter and/or any other control or protective device shall identify equipment fed and fuse size, if any, by engraved plastic nameplate, white with black letters, screw attached.
- C. See Specification Section 260553 for additional requirements.

3.17 GROUNDING

- A. All equipment shall be grounded and bonded in accordance with all state/local regulations, The National Electrical Code and as specified herein.

3.18 TELEPHONE WORK

- A. Provide telephone raceways, outlets and backboards, as shown. Provide additional work as described in Specification Section 271000 and/or shown on drawings. Bond all raceways together at backboards and provide No. 6 ground wire extending from raceway bonds to cold water pipe, in 1/2 inch raceway. Carefully ream ends of all raceways.

3.19 PAINTING

- A. Refer to Painting/Finishing specifications for requirements regarding field painting of exposed conduit. Any scratches, dents or rust spots in conduit electrical enclosures, panels, motor control or any other electrical items shall have the dents removed, and they, along with any rust spots or scratches, sanded and touched up with the same exact color paint as original finish.

3.20 ACCEPTANCE TESTING

- A. Upon completion of work, the entire electrical system installed within this project shall be tested and shall be shown to be in perfect working condition, in accordance with the intent of the specifications and drawings. It shall be the responsibility of the Electrical Contractor to have all systems ready for operation and to have an electrician available to operate same in accordance with and under the supervision of the observation representative(s) of the Architect. The Electrician shall be available to assist in removal of panel fronts, etc., to permit inspection as required.
- B. The electrical sub-contractor shall include in bid price start-up assistance and training from a certified representative of the manufacturer for the following systems:
 - 1. SECTION 260943: LIGHTING CONTROL SYSTEM
 - 2. SECTION 260944: DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM
 - 3. SECTION 263213: GENERATOR SETS
 - 4. SECTION 263353: UNINTERRUPTIBLE POWER SUPPLY - UPS
 - 5. SECTION 263623: AUTOMATIC TRANSFER SWITCHES
 - 6. SECTION 263633: GENERATOR LOAD BANK DOCKING STATION
 - 7. SECTION 271000: STRUCTURED CABLING SYSTEM
 - 8. SECTION 274100: TELEVISION DISTRIBUTION SYSTEM

- 9. SECTION 281300: ACCESS CONTROL SYSTEM
- 10. SECTION 283100: FIRE ALARM SYSTEM

3.21 OPERATION AND MAINTENANCE DATA

- A. One set of marked "AS BUILT" drawings, three (3) sets of all equipment catalog and maintenance data and three (3) sets of all final shop drawings, on all equipment requiring same shall be turned over to owner. These items shall be bound in hard back book. Contractor shall explain and demonstrate all systems to Owner's representative.

3.22 GUARANTY-WARRANTY

- A. Furnish a written Guarantee-Warranty, countersigned and guaranteed by General Contractor, stating:
 - 1. That all work executed under this section will be free from defects of workmanship and materials for a period of one (1) year from date of final acceptance of this work.
 - 2. Above parties further agree that they will, at their own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the Guaranty-Warranty.

END OF SECTION 260500

PART 1 GENERAL

1.1 DESCRIPTION

- A. Power Wires and Cables
- B. Low Voltage Wires and Cables

PART 2 PRODUCTS

2.1 POWER WIRES AND CABLES - 600 VOLT

- A. General: Conductors shall have current carrying capacities as per N.E.C. and with 600 volt insulation, #12 minimum except for controls and fixture wire. Conductors shall be copper.
- B. General Application (see below for exceptions):
 - 1. At or Below Grade (including within slab-on-grade):
 - a. #8 or larger conductors:
 - 1) XHHW or RHH/RHW/USE stranded (in conduit).
 - b. #10 or smaller conductors for circuits terminating at motors:
 - 1) THHN/THWN or XHHW stranded (in conduit).
 - c. #10 or smaller conductors (excluding circuits terminating at motors):
 - 1) THHN/THWN or XHHW solid (in conduit).
 - 2. Above Grade:
 - a. #8 or larger conductors:
 - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
 - b. #10 or smaller conductors for circuits terminating at motors:
 - 1) THHN/THWN, XHHW or RHH/RHW/USE stranded (in conduit).
 - c. #10 or smaller conductors (excluding circuits terminating at motors):
 - 1) THHN/THWN, XHHW or RHH/RHW/USE solid (in conduit).
 - 3. Power Wire and cable shall be as manufactured by Southwire, Rome, Encore Wire, American Insulated Wire, Okonite, Phelps-Dodge, Americable, Aetna or approved equal.
- C. Emergency Feeder Wiring
 - 1. Where specifically required by NEC articles 700, 701, or other similar sections, feeder-circuit wiring for emergency systems and legally-required standby systems shall be a listed electrical circuit protective system consisting of 2-hour fire-rated, mineral insulated, copper-sheathed wiring cable (Pyrotenax System 1850 or equal).
- D. Class 1 Control Cabling (120VAC Control Circuits, Etc.)
 - 1. Unless specified otherwise, Class 1 control cabling shall:
 - a. Be rated for exposed cable tray installation.
 - b. Be plenum rated.

- c. Be UL-rated for the proposed application.
 - d. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
 - e. Utilize copper conductors.
 - f. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
 - g. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
 - h. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.
 - i. Be rated for 600V.
 - j. Be industrial grade.
 - k. Have stranded conductors.
 - l. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
 - 2. Control cabling shall be as manufactured by Belden, AlphaWire or General Cable.
- E. Fixture Wiring
- 1. Conductor Types:
 - a. Type TFFN or XFF.
 - 2. Minimum Sizes:
 - a. For fixtures up to 300 watts: #16.
 - b. For fixtures over 300 watts up to 1500 watts: #14.
 - c. For fixtures over 1500 watts: as required.
 - d. Conductors to concrete pour fixtures: #12.
 - 3. Fixture wire shall extend only from fixture to first junction, and not over 6 feet, except for concrete pour units.

2.2 WIRE CONNECTIONS:

- A. All connector types:
 - 1. Shall be properly rated for the proposed application by UL and per the manufacturer.
- B. At Motor Connections (within motor terminal boxes):
 - 1. On Unshielded Wire:
 - a. Single conductor per phase: shall be made with insulated set screw connectors or 3M 5300 Series 1kV Motor Lead Connections kits with mechanical lugs as required.
 - b. Multiple conductors per phase: shall be made with insulated mechanical lugs, rated for the associated motor cable types, by Polaris or Ilasco.
 - 2. On Shielded Power Wire:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER CONDUCTORS AND CABLES**

SECTION 26 0519 – PAGE 3 OF 6

- a. The braided shields and internal grounding conductors of shielded power (not instrumentation) cables shall be grounded at BOTH ends (at VFD/starter and at motor) with a termination kit provided by the cable supplier. This termination kit shall include a connection ring that makes contact around the full circumference of the braided shield, and connects all internal grounds to a common external ground point.
 - 3. Cabling within motor terminal boxes shall be trained such as to prevent any splice/termination/connection kits from contacting inside edge(s) of the motor terminal boxes (to prevent chaffing of the insulation/splice/wiring which could lead to faults). Contractor shall carefully coordinate all required motor terminal box sizes to ensure proper capacity for all required conductors/splices.
- C. Other Dry locations:
- 1. On Wire larger than #10: shall be made with solderless, non-insulated compression-type connectors meeting requirements of Federal Specification WS-610e for Type II, Class 2 and shall be covered with Scotch #33 electrical tape so that insulation is equal to 150% of conductor insulation.
 - 2. On Wire #10 and smaller: shall be made with one of the following:
 - a. Ideal Wing Nuts or equal by 3M .
 - b. Ideal Push-In Wire Connectors (for #12 and smaller only).
- D. Other Wet/Damp locations:
- 1. On Wire larger than #10: shall be made with underground/direct-burial, waterproof rated EPDM or TPE-insulated connectors by IIsco, Burndy or T&B.
 - 2. On Wire #10 and smaller: shall be made with one of the following:
 - a. Ideal Weatherproof or Underground Wire Connectors pre-filled with 100% silicone sealant as required by the application.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise.
- B. All joints and splices on wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation.
- C. No splices shall be pulled into conduit.
- D. No conductor shall be pulled until conduit is cleaned of all foreign matter.
- E. Wire and cable shall be neatly formed, bundled and tied in all panelboards, wireways, disconnect switches, pullboxes, junction boxes, cabinets and other similar electrical enclosures.
- F. All wires and cables installed in underground or other wet locations shall be rated by the manufacturer for wet locations.
- G. Network cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER CONDUCTORS AND CABLES**

SECTION 26 0519 – PAGE 4 OF 6

- H. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See above for general termination hardware requirements.

3.2 POWER WIRE AND CABLE INSTALLATION:

- A. No power conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.
- B. Multi-wire lighting branches shall be used as indicated.
- C. Where more than three current-carrying conductors are installed in a single raceway or cable, conductors shall be derated as indicated in NEC Table 310.15(B)(3)(a).
- D. Raceways/cables shall generally not be installed exposed to sunlight on roofs unless specifically required. Where raceways or cables are installed exposed to sunlight on roofs, conductors shall be derated with ampacities adjusted per NEC Table 310.15(B)(3)(c).
- E. In installing parallel power conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size, the same type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded at both ends in an approved manner.
- F. In installing overhead main power services, a minimum of 5'-0" of cable per run shall be extended beyond the weatherhead(s) for connection to service drop. Confirm exact requirements with local utility company.

3.3 WIRE CONNECTIONS

- A. See Part 2 above for material types.
- B. Aluminum Wire Connections:
 - 1. Where aluminum wiring is allowed, connections shall utilize compression fittings, no exceptions (Anderson Versa Crimp or equal).
- C. Any stranded wire connection to wiring devices shall be made with crimp type terminals.
- D. All electrical connections and terminals shall be tightened according to manufacturer's published torque-tightening values with calibrated torque wrenches as required to clearly indicate final torque value to the contractor. Where manufacturer's torque values are not provided, those specified in UL 486A & 486B shall be used.
- E. All connections and connector types shall be installed in strict compliance with all requirements of the connector manufacturer.
- F. Under no condition shall the specified conductors be connected to terminals rated less than 75°C. Where conductors sized #1 or smaller are shown to be terminated at equipment and the terminals of that equipment are rated for less than 75°C, contractor shall install junction box near equipment to capture the specified conductors, splice with compression connections (rated for a least 75°C) and extend conductors with ampacity rating as required by NEC (based on terminal temperature rating) to equipment terminals. The length of the conductors to be terminated shall be as directed by the AHJ but not less than 48 inches.

3.4 LOW VOLTAGE (LESS THAN 50V) CONTROL AND NETWORK CABLE INSTALLATION:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER CONDUCTORS AND CABLES**

SECTION 26 0519 – PAGE 5 OF 6

- A. All wires and cables shall be installed in conduit unless specifically noted otherwise. Low voltage control and/or network cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
1. Cabling shall be plenum-rated, multi-conductor.
 2. Cabling shall be supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
 3. Cabling shall be properly bundled with plenum-rated Velcro straps on intervals not to exceed 30" on center.
 4. Properly-sized conduit(s) shall be provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings or through walls). End bushings shall be provided on both ends of all raceway terminations. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.

3.5 CIRCUITS AND BRANCH CIRCUITS

- A. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

3.6 LABELING AND COLOR CODING OF WIRE AND CABLE

- A. Refer to Specification Section 260553 for all labeling requirements.
- B. A color coding system as listed below shall be followed throughout the network of branch power circuits as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
A	BLACK	BLACK	BROWN
B	RED	ORANGE (FOR HI- LEG)	ORANGE
C	BLUE	BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

- C. Where dedicated neutrals are installed for multi-wire branch circuits, the neutral conductors shall be color coded as follows:

PHASE	120/208/240/ COLOR	120/240 HIGH LEG DELTA COLOR	277/480 VOLT COLOR
NEUTRAL A	WHITE W/ BLACK TRACER	WHITE W/ BLACK TRACER	GRAY W/ BROWN TRACER
NEUTRAL B	WHITE W/ RED TRACER	WHITE W/ ORANGE TRACER (FOR HI-LEG NEUTRAL)	GRAY W/ ORANGE TRACER
NEUTRAL C	WHITE W/ BLUE TRACER	WHITE W/ BLUE TRACER	GRAY W/ YELLOW TRACER

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER CONDUCTORS AND CABLES**

SECTION 26 0519 – PAGE 6 OF 6

- D. Control Conductors: Shall be color coded by use of colored “tracers”. No control circuit shall contain two identical conductors. For example, a set of five (5) control conductors for a pushbutton station represents one (1) control circuit which would require five (5) uniquely-colored control conductors.

3.7 TESTING

- A. The insulation resistance of all feeder conductors (feeding electrical distribution equipment such as switchboards, panelboards, transfer switches, transformers, etc.) shall be tested at the load side of the feeder breaker with a 1000-volt DC Megger Tester prior to energization or final termination. Any feeder conductor with an insulation resistance less than the recommended minimums in the latest version of NETA Acceptance Testing Specification (“ATS”) standard shall be replaced by the contractor at the contractor’s expense. All final test results shall be clearly documented (with date, time, feeder, results, test equipment, etc.), and the final test results shall be submitted to the design team for review.

END OF SECTION 260519

PART 1 GENERAL

1.1 GENERAL

- A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO GROUNDING OF THE FOLLOWING:
 - 1. Service Equipment.
 - 2. Transformers.
 - 3. Non-current carrying conductive surfaces of equipment.
 - 4. Metal Buildings.
 - 5. Structures.
 - 6. Other Equipment.

1.2 GENERAL REQUIREMENTS

- A. All equipment, building steel, and main service shall be effectively and permanently grounded with a conductor cross section as required by the National Electrical Code and of capacity sufficient to ensure continued effectiveness of the ground connections for fault current. Ground conductors shall be as short and straight as possible, protected from mechanical injury and, if practicable, without splice or joint.
- B. All grounding connections shall be installed in accordance with the National Electrical Code and all local codes and requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall ensure freedom from dangerous shock voltage exposure and provide a low impedance ground fault path to permit proper operation of overcurrent and ground fault protective devices.

PART 2 PRODUCTS

2.1 CONDUCTORS

- A. All grounding conductors shall be insulated with green colored, 600 volt insulation unless noted otherwise.
- B. Motors having power supplied by single conductor wire in conduit shall be grounded through the conduit system. Flexible conduit shall be "jumped" by an appropriate bonding conductor.

2.2 GROUNDING ELECTRODES

- A. Grounding electrodes shall be copper-clad steel rods 3/4 inch in diameter and ten feet long. Where longer electrodes are necessary to reduce the ground resistance, Contractor shall provide sectional rods, connectors, drive heads, etc.

2.3 CONNECTIONS

- A. All conductor-to-conductor, conductor-to-ground rod, conductor-to-structure, conductor-to-fence connections of #6 and larger sized conductors and underground ground connections shall be permanent exothermic welded connections (Cadweld or equal) unless otherwise noted on applicable drawings.
- B. Connections to equipment shall be by bolted compression type lugs (except for motors). When the conductor is #6 and larger, the lug shall be joined to the conductor by an exothermic weld (Cadweld or equal).

- C. Motors to be grounded by the grounding conductors run with the power conductors shall have a split-post grounding stud installed in the connection box.
- D. Each cast pull box or junction box shall have a ground lug, connected to largest ground conductor to enter box.
- E. Ground connections at conduit terminations shall be made by approved grounding bushings (see Raceways Specification Section for additional requirements).

2.4 MANUFACTURERS

- A. Conduit clamps and connectors shall be manufactured by Raco, OZ., or Ercon.
- B. Lugs shall be as manufactured by Square "D", Burndy, or T and B.
- C. Exothermic weld connections shall be as manufactured by Cadweld, or approved equal.
- D. Ground rods shall be as manufactured by Joslyn or McGraw Edison.
- E. Split post grounding shall be as manufactured by Burndy or T and B.

PART 3 EXECUTION

3.1 MAIN SERVICE GROUND

- A. The main service grounding electrode system shall consist of the following items bonded together by the grounding electrode conductor:
 - 1. The main underground cold water pipe (metal).
 - 2. The metal frame of the building.
 - 3. Driven ground rods. Ground rods shall be embedded at the lowest point in the building and below the permanent moisture level. Ground rods shall be spaced a minimum of ten (10) feet apart and connected in parallel until resistance to ground does not exceed five (5) ohms.
- B. The grounding electrode system shall be connected to the grounded conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor not smaller than that shown in Table 250.66 of the N.E.C. The main service equipment grounding conductor shall be connected to the grounding conductor on the supply side of the service disconnecting means in accordance with Table 250.122 of the N.E.C. for the ampere rating of the service entrance equipment. Where in a service entrance switchboard, the equipment grounding conductor shall not be less than 25% of the main bus rating. These connections shall be made inside the service entrance equipment enclosure.

3.2 TRANSFORMER GROUNDS

- A. Dry type insulation transformers with a grounded conductor in the secondary shall be grounded in accordance with N.E.C. Section 250-30.

3.3 EXPOSED NON-CURRENT-CARRYING METAL PARTS

- A. General: Ground connections to equipment or devices shall be made as close to the current carrying parts as possible, that is, to the main frame rather than supporting structures, bases or shields. Grounding connections shall be made only to dry surfaces that are clean and dry. Steel surfaces shall be ground or filed to remove all scales, rust, grease, and dirt. Copper and galvanized steel shall be

cleaned to remove oxide before making welds or connections. Code size ground conductors shall be run in all power conduits and properly terminated at each end.

- B. Ground conductors shall be routed as straight as possible. Where possible, ground conductors shall be routed such as to avoid bends exceeding 90 degrees or with a radius of less than 8”.
- C. Motors: Exposed non-current-carrying metal parts, shall be grounded by a grounding conductor either run with power conductors, and/or separate grounding conductors. Drawings will show method(s) to be used. The ground conductors with all motor conductors shall be connected to the ground buss in the motor connection box. Jumper connections shall be installed between frames and rigid conduit for equipment having flexible conduit connections (sealtight). All AC motor grounds shall provide a low impedance path to ground.
- D. Raceways & boxes: All raceways, conduits, armored or shielded cable and all exposed non-current carrying metal parts shall be grounded. Such items shall be bonded together and permanently grounded to the equipment ground buss. Metallic conduits shall be connected by grounding or clamps to ground buss. Flexible “jumpers” shall be provided around all raceway expansion joints. Bonding straps for steel conduit shall be copper. Jumper connections shall be provided to effectively ground all sections or rigid conduit connected into plastic pipe. No metallic conduit shall be left ungrounded. In conduit systems interrupted by junction or switch boxes where locknuts and bushings are used to secure the conduit in the box, the sections of conduit and box must be bonded together. If conduit, couplings or fittings have a protective coating or non-conductive material, such as enamel, such coating must be thoroughly removed from threads of both couplings and conduit and the surface of conduit or fitting where the ground clamp is secured.
- E. Enclosures: Metal conduits entering free standing motor control centers, switchboards or other free standing equipment shall be grounded by bare conductors and approved clamp. Any conduits entering low voltage (480 volts or below) equipment through sheet metal enclosure and effectively grounded to enclosure by double locknut or hub need not be otherwise bonded.
- F. Equipment: In addition to equipment grounding provisions mandated by code requirements, additional equipment grounding provisions (including local ground rods, connections, etc.) shall be provided by the contractor as directed by equipment suppliers.
- G. Both ends of ground busses in motor control centers, switchboards, etc., shall be separately connected to the main ground buss to form two separate paths to ground.
- H. Fences and Grills: Fences and metal grills around equipment carrying voltage above 500 volts between phases shall be bonded together and to ground. Fences and grill work shall be grounded at every post, column, or support, and on each side of every gate.

3.4 ACCEPTANCE DOCUMENTATION AND TESTING

- A. Contractor shall take and store photographs of all underground grounding system connections prior to burial of connections, for review by Engineer.
- B. Upon completion of work, the entire ground system shall be shown to be in perfect working condition, in accordance with the intent of the Specifications.
- C. Contractor shall measure the resistance between the main ground bonding jumper to true earth ground using the Fall of Potential method as described by ANSI/IEEE Standard 81 (“Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of an Earth System”). If the measured value is greater than five ohms, additional grounding electrodes shall be installed as described in Part 3.1 above. The final ground resistance value shall be submitted in writing, and documented via picture of the meter reading from the Fall of Potential test, to the Architect prior to the final observation, and shall be included in final O&M documentation.

END OF SECTION 260526

PART 1 GENERAL

1.1 DESCRIPTION

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Conduits
2. Conduit Fittings
3. Couplings & Connectors
4. Bushings
5. Raceway Hardware, Conduit Clamps & Supports
6. Watertight Entrance Seal Devices

PART 2 PRODUCTS

2.1 CONDUITS

A. Rigid Galvanized Steel and I.M.C.:

1. Shall be galvanized outside and inside by hot dipping.
2. Shall be as manufactured by Republic, Wheatland, Pittsburg Standard, Youngstown, Allied or equal.

B. E.M.T.:

1. Shall be Electro-Galvanized.
2. Shall be as manufactured by Republic, Wheatland, Pittsburg Standard, Youngstown, Allied or equal.

C. Rigid Aluminum:

1. Shall be manufactured of 6063 Alloy, T-1 temper.
2. Shall be manufactured by Republic (Nucor), Wheatland, Allied (Atkore), Penn or equal.

D. Schedule 40 and 80 PVC:

1. Shall be composed of polyvinyl chloride and shall be U.L. rated type 40 or 80 for use with 90 degree rated conductors. Conduit shall conform to NEMA Standards and applicable sections of N.E.C.
2. The conduit manufacturer shall have had a minimum of 5 years experience in the manufacture of the products. Non-metallic raceways shall be as manufactured by Carlon, Triangle, Can-Tex, Allied or equal.

E. HDPE Innerduct

1. Shall be composed high density polyethylene and shall be orange in color, unless noted otherwise.
2. Shall be corrugated unless noted otherwise.
3. Shall be manufactured by Carlon, Ipex or equal.

F. Flexible Metallic Conduit:

1. Shall be continuous spiral wound and interlocked galvanized material, code approved for grounding.

G. Liquidtight Flexible Metallic Conduit:

1. Shall be galvanized steel-core sealtite, code approved for grounding.
2. Shall have an outer liquidtight, nonmetallic, sunlight-resistant jacket over an inner flexible metal core.
3. Shall be as manufactured by Electric-Flex, Anaconda or equal.

2.2 FITTINGS, COUPLINGS & CONNECTORS

- A. Rigid Galvanized Steel and I.M.C. couplings and connectors shall be standard threaded type, galvanized outside and inside by hot dipping. Threadless and clamp type are not acceptable. Couplings/connectors shall be as manufactured by Racor, Efcor, or Appleton or equal.
- B. All rain tight connectors shall be threaded Myers or approved equal, rated for outdoor application.
- C. E.M.T. couplings and connectors shall be set screw, or steel compression type. All couplings and connectors shall be 720B, 730, 750B, or 760 series of Efcor or equal series of Racor. Pressure indented type connectors or cast metal will not be approved for any location. E.M.T. couplings and connectors shall be as manufactured by O-Z/Gedney, T&B, Efcor, Racor, Midwest or equal. E.M.T. fittings, couplings and connectors located within concrete (where allowed) shall be compression type and shall be adequately sealed with tape to ensure a concrete-tight seal.
- D. Rigid Aluminum couplings and connectors shall be standard threaded type, of the same alloy as the associated conduit. Threadless and clamp type are not acceptable. Fittings shall be as manufactured by Thomas & Betts, Crouse-Hinds, Appleton, Pyle-National or equal.
- E. All PVC couplings, adapters, end bells, reducers, etc., shall be of same material as conduit.
- F. Liquidtight Flexible Metallic Conduit connectors shall be liquidtight with insulating throat or end bushing, designed for application with Liquidtight Flexible Metallic Conduit. Fittings shall be as manufactured by Efcor, Racor, Midwest or equal.
- G. All LB unilets sizes 1 1/4" or larger shall have rollers.
- H. Miscellaneous conduit fittings shall be as manufactured by Appleton, Crouse-Hinds, Pyle-National, Russell & Stoll or equal.

2.3 BUSHINGS

- A. All non-grounding rigid bushings 1-1/4" and larger shall be the insulating type (O-Z/Gedney type "BB" or equal by T&B, Midwest Electric or Penn Union).
- B. All non-grounding rigid bushings 1" and smaller shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. Non-grounding rigid conduit bushings shall be O-Z/Gedney type "B" or equal by T&B, Midwest Electric or Penn Union.
- C. All grounding rigid bushings shall be threaded malleable iron with integral noncombustible insulator rated for 150°C. All grounding rigid conduit bushings shall be O-Z/Gedney type "BLG" or equal by T&B, Midwest Electric or Penn Union.

2.4 HARDWARE, CONDUIT CLAMPS AND SUPPORTS

- A. All hardware such as expansion shields, machine screws, toggle bolts, "U" or "J" bolts, machine bolts, conduit clamps and supports shall be of corrosion resistant materials (stainless steel, aluminum, galvanized or plated steel, or other approved materials).

- B. Hardware in contact with aluminum handrails, plates or structural members and all hardware in exterior, wet or corrosive areas shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- C. Supports in exterior, wet or corrosive locations shall be type 316 stainless steel or aluminum (with bitumastic paint coating to isolate aluminum from contact with concrete where necessary) unless specifically noted otherwise.
- D. Supports in extremely corrosive environments (such as chlorine or fluoride storage rooms) shall be PVC-Coated steel unless specifically noted otherwise.
- E. Hardware and conduit clamps shall be as manufactured by Efcor, Steel City, G.A., Tinnerman or equal.

2.5 WATERTIGHT ENTRANCE SEAL DEVICES

- A. For new construction, seal devices shall consist of oversized sleeve and malleable iron body with sealing rings, pressure rings, sealing grommets and pressure clamps as required (O-Z/Gedney type FSK/WSK or equal).
- B. For cored-hole applications, seal devices shall consist of assembled dual pressure disks with neoprene sealing rings and membrane clamps as required (O-Z/Gedney type CSM or equal).

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

- A. Minimum Diameter: 1/2-inch.
- B. Raceway Type: Raceway types shall be as specified below, unless indicated otherwise on drawings:
 - 1. Exterior, Exposed: Rigid Galvanized Steel or I.M.C. unless otherwise noted.
 - 2. Other Exterior (Concrete-Encased or Direct Earth Buried): Schedule 40 PVC. PVC conduit shall convert to metallic conduit prior to exiting concrete-encasement or direct earth burial. See "transition" items below for additional requirements. Conduits shall be left exposed until after Architect's observation.
 - 3. Interior, Exposed:
 - a. Hazardous Locations: Rigid Galvanized Steel .
 - b. Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Rigid Galvanized Steel or I.M.C. .
 - c. Dry Locations Where Subject to Mechanical Damage (including, but not limited to, below 10'-0" A.F.F. in shop, storage, warehouse and other similar areas): Rigid Galvanized Steel or I.M.C..
 - d. Extremely Corrosive Locations (Chlorine Storage Rooms, Fluoride Storage Rooms and other similar areas): Schedule 80 PVC.
 - e. Other Dry Locations: E.M.T.
 - 4. Interior, Concealed:
 - a. Embedded inside Poured Concrete Walls, Ceilings or Floors, with a minimum of 2" of concrete between finished surface and outer wall of conduit on all sides, where no anchor bolts, screws or other similar items will be installed: Schedule 40 PVC. PVC conduit shall convert to metallic conduit (exact type as specified elsewhere within this section) prior to

- exiting poured concrete-encasement of wall, ceiling, floor or ductbank. See “transition” items below for additional requirements.
 - b. Other Raceways Embedded inside Poured Concrete Walls, Ceilings or Floors (not meeting requirements above): Rigid Galvanized Steel or I.M.C. (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete).
 - c. Other Raceways: E.M.T.
5. Terminations at motors, transformers and other equipment which has moving or vibrating parts:
- a. Exterior or Wet Locations (including, but not limited to, Pump Rooms, Wet Wells, Underground Vaults, and other similar locations): Liquidtight Flexible Metallic Conduit (shall generally not exceed 24 inches in length) with watertight fittings.
 - b. Dry, Interior Locations: Flexible Metallic Conduit (shall generally not exceed 24 inches in length).
6. Terminations at fixtures mounted in grid-type ceilings:
- a. Flexible Metallic Conduit or MC cabling (shall generally not exceed 72 inches in length and shall run from junction box to fixture, not from fixture to fixture).
7. Transition from underground or concrete-encased to exposed:
- a. Convert PVC to Rigid Galvanized Steel (coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint where below grade or within concrete) utilizing Rigid Galvanized Steel 90 degree bends (and vertical conduits as required by application) prior to exiting concrete/grade (except at outdoor pull boxes and under freestanding electrical equipment, where terminations shall be by PVC end bells installed flush with top of slab). Exposed portions of these coated conduits shall extend a minimum of 6” above floor level, and shall be installed at uniform heights.

3.2 RACEWAY INSTALLATION

A. General:

- 1. Follow methods which are appropriate and approved for the location and conditions involved. Where not otherwise shown, specified, or approved in a particular case, run all wiring concealed.
- 2. Where conduit crosses a structural expansion joint an approved conduit expansion fitting shall be installed.
- 3. A non-conductive polypropylene pull string, properly tied/secured at either end, shall be installed in all empty conduits.
- 4. Metal conduit field-cuts shall be cut square with a hacksaw and the ends reamed after threading.
- 5. PVC conduit field-cuts shall be made with hacksaw, and ends shall be deburred.
- 6. All PVC joints shall be made as follows:
 - a. Clean the outside of the conduit to depth of the socket, and the inside of socket with an approved cleaner.
 - b. Apply solvent cement as recommended by the conduit manufacturer to the interior of the socket and exterior of conduit, making sure to coat all surfaces to be joined.
 - c. Insert conduit into the socket and rotate 1/4 to 1/2 turn and allow to dry.
- 7. All metallic conduit installed below grade or within concrete shall be coated with two (2) spiral-wrapped layers of 3M Scotchrap 50 PVC tape or two coats of asphaltum paint prior to installation.

8. Install ground wire sized per N.E.C. Table 250.122 in all conduits.
9. Use of running threads is absolutely prohibited. Conduit shall be jointed with approved threaded conduit couplings. Threadless and clamp type not acceptable.
10. Conduits shall be sized in accordance with latest National Electrical Code except when size shown on drawings. 1/2-inch conduit shall not contain conductors larger than No. 12 or more than four (4) No. 12 conductors.
11. Exposed, field-cut threads on all metal conduits shall be painted with zinc primer (for Galvanized Rigid or I.M.C.) .

B. Routing/Locating:

1. Exposed conduit runs shall be run level and plumb and shall, on interior of buildings, be run parallel and/or at right angles to building walls and/or partitions.
2. Conduit with an external diameter larger than 1/3 the thickness of a concrete slab shall not be placed in the slab. Conduits in slab shall not be spaced closer than 3 diameters on center.
3. Conduit run in ceiling spaces shall be run as high as possible, all at same level, and shall be supported from building structure. Do not support conduit from any other installation.
4. Conduit run within exterior CMU, concrete or other similar walls shall be run within the CMU cells / concrete structure / etc. Conduits shall not be run on the outside surface of CMU cells / concrete structure / etc. underneath exterior veneers / etc., which could cause a thermal break in the wall insulation or a future water intrusion problem.
5. Install conduit runs to avoid proximity to steam or hot water pipes. In no place shall a conduit be run within 6" of such pipes except where crossing is unavoidable, then conduit shall be kept at least 3" from the covering of the pipe crossed.
6. Before installing raceways for motors, HVAC equipment and other fixed equipment, check location of all equipment connections/terminal boxes with equipment supplier and locate and arrange raceways appropriately.
7. A minimum of 12" of clearance (or more as required by associated utility companies) shall be provided between the finished lines of exterior, underground conduit runs and exterior, underground utilities (gas, water, sewer, etc.).
8. Where any portion of raceway is installed in a wet environment (such as below grade) and located at a higher elevation than the raceway termination point in a dry environment, install watertight compound inside raceway at termination around cabling to prevent transfer of water through conduit system. Watertight compound shall be rated for the potential water head pressure, based on the assumption that ground water level would be at grade level.

C. Bends:

1. Do not make bends (in any raceway, including flexible conduits) that exceed allowable conductor bending radius of cable to be installed or that significantly restrict conductor flexibility.
2. All bends within concrete-encased ductbanks installed in exterior locations shall be long radius bends (24" minimum bending radius – varies with conduit diameter).
3. Where numerous exposed bends or grouped together, all bends shall be parallel, with same center and shall be similar in appearance
4. All PVC elbows, bends, etc., shall be either factory bends or made with an approved heat bender.

D. Support:

1. Anchor conduit securely in place by means of approved conduit clamps, hangers, supports and fastenings. Arrangement and methods of fastening all conduits shall be subject to Engineer's direction and approval. All conduits shall be rigidly supported (wire supports may not be used in any location). Use only approved clamps on exposed conduit.
2. Conduit in riser shafts shall be supported at each floor level by approved clamp hangers.
3. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameters of conduits.

4. Where installed in seismic zones, suspended raceways shall be braced in two (2) directions as required to prevent swaying and excessive movement.
5. Raceways installed on top of flat roofing shall be supported a minimum of 3 ½" above roof with rubber block supports (Cooper B-Line Dura-Blok or equal). Installation shall be in strict accordance with support manufacturer's instructions and recommendations.

E. Terminations:

1. All conduit connections to sheet metal cabinets or enclosures located in exterior or wet locations shall terminate by use of rain tight (Meyers) hubs.
2. Where rigid or I.M.C. conduits enter sheet metal boxes, they shall be secured by approved lock nuts and bushings.
3. Where metal conduits enter outdoor pull boxes, manholes, under freestanding electrical equipment or other locations where direct metal-to-metal contact does not exist between enclosure and conduit, grounding bushings shall be installed. Each grounding bushing shall be connected to the enclosure ground and all other grounding bushings with properly sized grounding conductors.
4. Where E.M.T. enters sheet metal boxes they shall be secured in place with approved insulating fittings.
5. Where PVC enters outdoor pull boxes, manholes or under freestanding electrical equipment, PVC end bells shall be installed.
6. Contractor shall be responsible for coordinating required conduit sizes with equipment hubs/conduit entry provisions (such as at motor tap boxes) prior to installation of conduit systems. Contractor shall field adjust final conduit sizes at terminations where so required (only as allowed by code) from those indicated on plans to coordinate with equipment hubs/conduit entry provisions.
7. Where conduit terminates in free air such that associated cabling/circuitry becomes exposed (such as at cable trays, etc.), conduit shall generally terminate in a horizontal orientation (to prevent dust/debris/etc. from entering conduit system). Where vertical conduit termination is necessary, the termination shall be provided with cord-grip conduit terminations to seal the conduit system.
8. Conduit ends shall be carefully plugged during construction.
9. Permanent, removable caps or plugs shall be installed on each end of all empty raceways with fittings listed to prevent water and other foreign matter from entering the conduit system.

F. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly. Refer to drawings and other specifications for additional requirements.
2. All penetrations shall be at right angles unless shown otherwise.
3. Structural members (including footings and beams) shall not be notched or penetrated for the installation of electrical raceways unless noted otherwise without specific approval of the structural engineer.
4. Dry-packed non-shrink grout or watertight seal devices shall be used to seal openings around conduits at all penetrations through concrete walls, ceilings or aboveground floors.
5. All raceways entering structures, or where water is otherwise capable of entering equipment/devices through the raceway system, shall be sealed (at the first box or outlet) with foam duct sealant to prevent the entrance of gases or liquids from one area to another or into equipment/devices.
 - a. Where the elevation of the raceway penetration (into the structure) is no more than 15' below the other (higher) end of the same raceway, Polywater FST sealant (rated to hold back up to 22' of continuous water head pressure), or pre-approved equal, shall be used.
 - b. Where the elevation of the raceway penetration (into the structure) is between 15' and 75' below the other (higher) end of the same raceway, Polywater PHRD Custom Mechanical

- Seals (rated to hold back up to 36psi or 83' of continuous water head pressure), or pre-approved equal, shall be used.
- c. Where the elevation of the raceway penetration (into the structure) is more than 75' below the other (higher) end of the same raceway, the contractor shall propose a custom solution designed to hold back or to drain the possible water within the associated raceway. Submittals shall be provided to the engineer for review/approval, including a summary of the anticipated elevations/PSIs, details of the proposed installation, cut-sheets of devices/materials, etc.
6. Additionally, where necessary to ensure that water does not enter equipment/devices through the raceway system (where raceways extend to equipment/devices from wet areas), junction boxes with drain assemblies in bottom shall be located at low point of raceway system near equipment/devices (to drain water out of raceway system before it enters equipment/devices). Contractors shall provide drains in raceway systems where so necessary to prevent water entry into equipment/devices.
 7. All raceways passing through concrete roofs or membrane-waterproofed walls or floors shall be provided with watertight seals as follows:
 - a. Where ducts are concrete encased on one side: Install watertight entrance seal device on the accessible side of roof/wall/floor as directed by equipment manufacturer.
 - b. Where ducts are accessible on both sides: Install watertight entrance seal device on each side of roof/wall/floor as directed by equipment manufacturer.
 8. All raceways passing through walls of rooms containing/storing noxious chemicals (chlorine, ammonia, etc.) or through hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS or equal).
 9. All raceways terminating into electrical enclosures/devices/panels/etc. located in hazardous locations shall be sealed with conduit seals (Crouse-Hinds type EYS, EZS or equal) within 18" of the termination.
- G. Exterior Electrical Ductbanks:
1. Where exterior electrical concrete-encased ductbanks are indicated on drawings, conduit runs between buildings or structures shall be grouped in concrete-encased ductbanks as follows:
 - a. A minimum of 3" of concrete shall encase each side of all ductbanks.
 - b. A minimum of 1 1/2" of separation shall be provided between each conduit within ductbanks. PVC spacers shall be installed at the necessary intervals prior to placement of concrete to maintain the required spacing and to prevent bending or displacement of the conduits.
 - c. Top of concrete shall be a minimum of 30" below grade. A continuous magnetic marking tape shall be buried directly above each ductbank, 12" below grade.
 - d. Exact routing of ductbanks shall be field verified and shall be modified as necessary to avoid obstruction or conflicts.
 - e. Underground electrical raceways shall be installed to meet the minimum cover requirements listed in NEC Table 300.5. Refer to drawings for more stringent requirements.

END OF SECTION 260533

PART 1 GENERAL

1.1 DESCRIPTION

- A. Outlet and Junction Boxes
- B. Pull Boxes
- C. Wireways

PART 2 PRODUCTS

2.1 OUTLET BOXES & JUNCTION BOXES (THROUGH 4-11/16")

- A. Sheet Metal: Shall be standard type with knockouts made of hot dipped galvanized steel as manufactured by Steel City, Raco, Appleton, Bowers or equal.
- B. Cast: Shall be type FS, FD, JB, GS, or SEH as required for application as manufactured by O-Z/Gedney, Appleton, or equal.
- C. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal.

2.2 JUNCTION AND PULL BOXES (LARGER THAN 4-11/16")

- A. Oil-Tight JIC: Shall be Hoffman Type CH box or approved equal.
- B. Galvanized Cast Iron or Cast Aluminum: Shall be O-Z/Gedney or approved equal.
- C. Stainless Steel: Shall be as manufactured by O-Z/Gedney, Hoffman or approved equal. Boxes shall have continuous hinges, seamless foam-in-place gaskets and screw-down clamps.
- D. Nonmetallic: Shall be type Polycarbonate/ABS construction as required for application with non-metallic quick-release latches as manufactured by Hoffman, O-Z/Gedney, Appleton, or equal. Boxes shall have hinged covers and screw-down clamps.
- E. Wireways: Shall be standard manufacturer's item as manufactured by Hoffman, Square "D", Burns, B & C or equal. Wireways shall have hinged covers and screw-down clamps.
- F. Pre-cast Polymer Concrete Below-Grade Hand Holes & Pull Boxes:
 - 1. Enclosures, boxes and cover are required to be UL Listed and conform to all test provisions of ANSI/SCTE 77 "Specifications For Underground Enclosure Integrity" for Tier 15 applications (15,000lb design load and 22,500lb test load) unless noted otherwise.
 - 2. All covers shall have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level shall be embossed on the top surface.
 - 3. Cover shall be bolt-down include factory-labeling to read "Electric", "Communications" or other as directed.
 - 4. Hardware shall be stainless steel.
 - 5. Shall be Quazite PG/LG Style or approved equal.
- G. Galvanized Cast Iron Below-Grade Pull Boxes:
 - 1. Enclosures, boxes and cover are required to conform to AASHTO H-20 requirements for deliberate vehicular traffic applications unless noted otherwise.

2. Cover shall be checkered, bolt-down include factory-labeling to read "Electric", "Communications" or other as directed.
 3. Hardware shall be stainless steel.
 4. Shall be furnished with grounding kit.
 5. Shall be O-Z/Gedney Type YR or approved equal.
- a.

PART 3 EXECUTION

3.1 APPLICATION

A. General

1. All boxes and wireways shall be of sufficient size to provide free space for all enclosed conductors per NEC requirements. Fill calculations shall be performed by contractor per NEC requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16")

1. Sheet metal boxes shall be used on concealed work in ceiling or walls and exposed work in dry, interior locations
 - a. Exception: Where exposed and installed within finished/public spaces such as offices, corridors, lobbies, etc., cast boxes shall be used for wiring device outlets. Cast boxes are not required in back-of-house areas such as electrical rooms, mechanical rooms, etc. .
2. Cast boxes shall be used wherever Rigid or I.M.C. conduits are installed.
3. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.
4. Except when located in exposed concrete block, switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.
5. When installed in exposed concrete block, switch and receptacle boxes shall be square type designed for exposed block installation.
6. Ceiling outlet boxes shall be 4" octagon 1-1/2" deep or larger required due to number of wires.
7. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.

C. Junction & Pull Boxes (larger than 4-11/16")

1. For all below grade exterior use and elsewhere as shown:
 - a. In areas subject to future vehicular traffic: shall be galvanized cast iron (rated AASHTO H-20 Loading unless noted otherwise).
 - b. In areas not subject to vehicular traffic: shall be galvanized cast iron or pre-cast polymer concrete (rated for Tier 15 Loading unless noted otherwise).
2. All boxes installed exposed in exterior or wet areas shall be powder-coated galvanized steel (NEMA 3R).
3. All boxes installed exposed in corrosive areas shall be stainless steel (NEMA 4X).
4. All boxes installed in extremely corrosive areas (such as chlorine and fluoride storage rooms) where non-metallic raceways are used shall be non-metallic.

5. Boxes installed in hazardous locations shall be explosion-proof rated for the associated application, constructed of copper-free cast aluminum.
6. All others shall be oil tight JIC box not less than 16 gauge.

3.2 INSTALLATION

A. General

1. All boxes and wireways shall be securely anchored.
2. All boxes shall be properly sealed and protected during construction and shall be cleaned of all foreign matter before conductors are installed.
3. All boxes and wireways shall be readily accessible. Contractor shall be responsible for furnishing and installing access panels per architect's specifications. Locations shall be as directed by the architect as required to make boxes, wireways, electrical connections, etc. accessible where above gypsum board ceilings or in other similar locations.
4. All metallic boxes and wireways shall be properly grounded.
5. Refer to Specification Section 260553 for identification requirements.

B. Outlet Boxes & Junction Boxes (through 4-11/16")

1. Boxes shall be provided with approved 3/8" fixture studs were required.
2. Recessed boxes for wiring devices, surface fixtures, or connections, shall be set so that the edge of cover comes flush with finished surface.
3. There shall be no more knockouts opened in any sheet metal box than actually used.
4. Any unused opening in cast boxes shall be plugged.
5. Back to back boxes to be staggered at least 3 inches.
6. Under no circumstances shall through-the-wall boxes be used.

C. Junction & Pull Boxes (larger than 4-11/16")

1. Pull boxes shall be installed as indicated on plans and/or as required due to number of bends, distance or pulling conditions.
2. Boxes to be imbedded in concrete shall be properly leveled and anchored in place before the concrete is poured.
3. All pull boxes and/or junction boxes installed exterior below grade, shall have their tops a minimum of 1-1/2 inches above surrounding grade and sloped so that water will not stand on lid. A positive drain shall be installed, to prevent water accumulation inside.
4. Above grade pull boxes shall be installed on concrete anchor bases as shown on Plans.

D. Wireways and/or wall-mounted equipment

1. Mount each wireway to channels of the same metal type as the wireway.
2. Conductors serving a wireway shall be extended without reduction in size, for the entire length of the wireway. Tap-offs to switches and other items served by the wireway shall be made with ILSCO type GTA with GTC cap.

END OF SECTION 260534

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete cable tray systems as shown on the drawings.
- B. Cable tray systems are defined to include, but are not limited to straight sections of cable trays, bends, tees, elbows, drop-outs, supports and accessories.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
- C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
- D. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low Alloy with Improved Formability (*Formerly ASTM A570 & A607*)
- E. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (*Formerly ASTM A611*)
- F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- G. NEMA VE 1-2002 - Metallic Cable Tray Systems
- H. NEMA VE 2-2006 - Cable Tray Installation Guidelines
- I. TIA 569-A – Commercial Building Standard for Telecommunications Pathways & Spaces

1.3 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the cable tray systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., is directed.
- B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.4 SUBMITTALS

- A. Submittal Drawings: Submit drawings of cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, and fittings, showing accurately scaled components.

- B. Product Data: Submit manufacturer's data on cable tray including, but not limited to, types, materials, finishes, rung spacings, inside load depths and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

1.5 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Provide cable trays and accessories through one source from a single manufacturer.
- C. NEMA Compliance: Comply with NEMA Standards Publication Number VE1, "Cable Tray Systems".
- D. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).
- E. UL Compliance: Provide products that are UL-classified and labeled in their final installed form.
- F. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.
- B. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Wire Mesh Basket type cable tray systems:
 - 1. Subject to compliance with these specifications, wire mesh basket type cable tray systems shall be as manufactured by Eaton B-Line, Inc.; Mono-Systems, Inc, Chalfant or Legrand Cablofil.
- B. Ladder type cable tray systems:
 - 1. Subject to compliance with these specifications, ladder type cable tray systems shall be as manufactured by Eaton B-Line, Inc.; Mono-Systems, Inc or Chalfant.

2.2 CABLE TRAY SECTIONS AND COMPONENTS

- A. Typical Cable Tray Application (applicable unless noted otherwise on plans):
 - 1. Containing only low voltage cabling AND concealed above accessible ceilings, below raised access floors or within telecommunications rooms: Wire mesh basket type with:
 - a. Useable Loading Depth: 4".
 - b. Minimum Load Rating: NEMA 12C.
 - c. Material: Black powder coat painted steel.

- d. Width(s): as shown on plans.
- 2. All other applications: Ladder-type with:
 - a. Rung Spacing: 9" o.c.
 - b. Useable Loading Depth: 4".
 - c. Minimum Load Rating: NEMA 12C.
 - d. Material: Aluminum.
 - e. Width(s): as shown on plans.
- B. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with clamp assemblies, connector/splice plates, splice bars, bolts, nuts and washers for connecting units as required. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.
- C. Cable tray construction:
 - 1. Wire Mesh Basket type cable tray systems:
 - a. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
 - b. Wire mesh basket type cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. Minimum wire diameter shall be 5mm (4.5mm for stainless steel). All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
 - c. All fittings shall be factory-built or shall be formed from straight sections in accordance with manufacturer's instructions to maintain the UL Classification of the system.
 - 2. Ladder type cable tray systems:
 - a. Two longitudinal members (side rails) fabricated as I-beams with transverse members (rungs) welded (for metallic construction) or mechanically-fastened and adhesively bonded (for fiberglass construction) to the side rails.
- D. Materials and Finish: Specific material and finish types for each tray type (as specified elsewhere) shall comply with the following general requirements:
 - 1. Aluminum: All sections and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
 - 2. Pre-galvanized Steel: All sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.
 - 3. Hot-dip Galvanized Steel: All sections and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter and ASTM A510, Grade 1008 for wire mesh basket type, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray. All hot-dip galvanized after fabrication steel cable trays must be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc. Failure to do so can cause damage to cables and/or injury to installers.
 - 4. Stainless Steel: All sections, accessories and fitting side rails and rungs shall be made of AISI Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded

to the side rails with Type 316 stainless steel welding wire. Wire mesh basket type shall meet minimum mechanical properties of ASTM A580.

5. Black Powder Coated steel: All sections/components shall be powder coated black with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns).
6. Fiberglass: All sections/components shall be pultruded from non-conductive glass fiber reinforced polyester or vinyl ester resin. Pultruded shapes shall be constructed with a surface veil to insure a resin-rich surface and UV resistance, and shall meet ASTM E-84, Class 1 flame rating and self-extinguishing requirements of ASTM D-635.

E. Accessories and Supports:

1. General:

- a. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum spans allowed to achieve the specified cable tray load ratings.
- b. Center hung supports shall be manufactured of 12 gauge, 1-5/8 inch by 1-5/8 inch B-Line B22 steel strut with a pipe welded at the middle of the support to provide eccentric loading stability. Support shall withstand 700 pounds in a 60 percent vs. 40 percent eccentric loading condition with a safety factor of 3.
- c. Accessories - special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, conduit-to-tray adapters, etc.

2. Wire Mesh Basket type cable tray systems:

- a. Barrier Strips: Shall be provided where specified on plans or where cables/conductors of varying voltage classes are installed within the same tray (per NEC requirements), shall be manufactured by the tray system supplier and shall be fastened into the tray as directed by the tray system supplier.

3. Ladder type cable tray systems:

- a. Splice plates shall be the bolted type for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.
- b. Barrier Strips: Shall be placed along full length of all tray sections, shall be manufactured by the tray system supplier and shall be fastened into the tray with self-drilling screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Installers of wire mesh basket type cable tray systems shall be certified by the supplier of the cable tray system.
2. Install cable trays as indicated: Installation shall be in accordance with:
 - a. Equipment manufacturer's instructions.
 - b. Recognized industry practices.
 - c. NEC (Article 392 and others).
 - d. Applicable portions of NFPA 70B.
 - e. NEMA-VE2.

3. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner's representative.
4. Coordinate cable tray installation with other work as necessary to properly interface installation of cable tray with other work.

B. Cabling:

1. All cabling/conductors routed in cable tray shall be rated for cable tray application.
2. Cabling/conductors of varying voltage classes installed within common trays shall be separated by barrier strips per NEC requirements.
3. Cable/conductor securing:
 - a. Cables/conductors shall be secured to the transverse elements of the associated trays at the following minimum intervals:
 - 1) Seismic, high-shock or vibration prone areas (such as mechanical rooms, process areas, etc.):
 - a) All cables/conductors: 24".
 - 2) Non-horizontal cable tray sections:
 - a) All cables/conductors: 36".
 - 3) Horizontal cable tray sections:
 - a) All power cables/conductors: 36"
 - b) Control, instrumentation and network cables in cable trays in exposed areas: 36"
 - c) Control, instrumentation and network cables in cable trays in concealed interior areas (such as above lay-in ceilings): No cable ties required.
 - b. All cable ties used to secure cables to trays in interior areas shall be plenum-rated plastic. Cable ties used in interior exposed areas (subject to light) in interior areas shall be sunlight/UV-resistant. Cable ties used in exterior environments shall be of non-magnetic stainless steel construction.
4. Cable/conductor arrangement:
 - a. Provide separation between power cables/conductors within cable trays for proper heat dissipation (and conductor ampacity ratings) per NEC requirements.

C. Bonding:

1. Ground and bond metal cable tray in accordance with NEC Articles 392, 250.96 and 250.102.
 - a. Provide continuity between all metal cable tray components.
 - b. Make connections to tray using mechanical, compression or exothermic connectors.
2. Cable trays shall be properly bonded with grounding harnesses or other necessary equipment as required to all metal conduits terminating into the cable trays and between cable tray sections.

D. Location/Routing:

1. Location of cable tray shown on plans is for general routing only. Field coordinate exact cable tray locations/routing with all piping, equipment, ductwork, structure, lighting, etc. & other trades prior to ordering cable tray. Provide vertical & horizontal bends as required, maintaining proper clearance around cable trays.

2. Coordinate cable tray with all other work as necessary to properly integrate installation of cable tray work with other work. Any potential conflicts between locations of cable trays and locations of other items shall promptly be brought to the attention of the engineer prior to installation.
3. Provide a minimum of 6" clearance on top of cable trays and 3" clearance on bottom and sides of cable trays to permit access for installing and maintaining cables unless specifically approved or directed otherwise by engineer.

E. Support:

1. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.
2. Trapeze hangers and center-hung supports shall be supported by 1/2 inch (minimum) diameter all-thread rods unless noted otherwise. Trapeze hangers supporting wire mesh basket type cable trays 12" wide or less may be supported by 3/8 inch (minimum) diameter all-thread rods.

F. Penetrations:

1. Where cable trays pathways pass through walls, floors, ceilings or other similar partitions that are fire-rated, smoke-rated, designed to prevent water entry, designed to limit sound transmission, or designed to limit air passage (for environmental or conditioning purposes), cable trays themselves shall not penetrate the partition but shall be terminated on either side of the partition. The partition shall be penetrated with conduit sleeves sealed with suitable fire caulk or other approved material, per specific instructions of the caulk supplier to maintain partition/etc. ratings (such as fire or smoke ratings), after installation of all cabling. Bonding jumpers shall be provided through sleeves to ensure electrical continuity of cable tray system. Interior cross-sectional area of the conduit sleeves shall match or exceed the interior cross-sectional area of the associated cable tray(s).
2. Contractor shall verify arrangement, sizes and locations of all penetrations through load-bearing walls, floors or other structural items with structural engineer. Contractor shall submit sketch of proposed sleeve locations to structural engineer for review prior to rough-in.

G. Marking:

1. Cable trays containing conductors rated over 600 volts shall have a permanent, legible warning notices installed per NEC 392 requirements.

3.2 TESTING

- A. Test cable trays to ensure electrical continuity of bonding and grounding connections. See NFPA 70B, Chapter 18, for testing and test methods.
- B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION 260536

PART 1 GENERAL

1.1 DESCRIPTION

- A. Wire and cable identification.
- B. Pullbox & Junction Box Identification
- C. Electrical distribution & utilization equipment identification.
- D. Emergency and Standby Power receptacle identification.

PART 2 PRODUCTS

2.1 WIRE AND CABLE IDENTIFICATION

- A. Intermediate Locations:
 - 1. Wires and cable labels shall be white, thermal transfer, halogen-free, flame-retardant marker plates (sized to accommodate three lines of text) permanently affixed to the associated cable with UV-resistant plastic wire ties. Labels shall be Panduit #M200X/300X series or equal.
- B. Circuit/Cable Termination Locations:
 - 1. Wires and cable labels shall be non-ferrous identifying tags or pressure sensitive labels unless noted otherwise.

2.2 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

- A. Labels on electrical distribution & utilization equipment shall be black-on-white engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive unless noted otherwise.
- B. Text used on labels on electrical distribution & utilization equipment shall be sufficiently sized to allow user to quickly/easily read labels while standing a normal/reasonable distance from the equipment. Text sizes shall be adjusted based on types of equipment (large switchgear would require larger labels than small toggle-type disconnect switches). If there is any question about what is reasonable, contractor may submit typical physical sample label(s) for each major application to the engineer for review/approval, at its discretion.
- C. Labels on electrical distribution equipment fed from emergency or legally-required standby sources (such as emergency generators) shall be white-on-red engraved Bakelite nameplates permanently affixed to the equipment with rivets or silicone adhesive.

2.3 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

- A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as follows:
 - 1. Emergency System source: Red engraved lettering to read "EMERGENCY".
 - 2. Legally-Required or Optional Standby Generator source:
 - a. If only part of facility is fed with generator backup: Black engraved lettering to read "FED FROM GENERATOR".
 - b. If entire facility is fed with generator backup: No "....GENERATOR..." label required.

PART 3 EXECUTION

3.1 GENERAL

- A. Any proposed deviation in identification methods and materials from those described herein shall be submitted to Architect for review and comment prior to installation.
- B. Contractor shall provide all labeling or identification required by applicable local, state and national codes. These specifications do not intend to itemize all code-required labeling or identification requirements.
- C. All labels/identification shall be positioned such as to be readable from the normal perspective without adjusting wiring/cables/labels. For example, labels/identification of wires/cables within cable trays shall be positioned to point towards the viewer (typically downward for overhead cable trays, or upward for cable trays within trenches).
- D. All labels/identification (except for handwritten labels on concealed pullbox/junction box covers as noted below) shall be typewritten/printed/engraved in a neat, workmanlike, permanent, legible, consistent and meaningful manner. Labels shall not be handwritten unless specific approval is granted by engineer.

3.2 WIRE AND CABLE IDENTIFICATION

- A. General:
 - 1. Where cabling is exposed (such as within cable trays), provide two wire ties per cable (one on either end of marker plate to provide a flush installation). Where cabling is concealed (such as within pullboxes/wireways), one wire tie per cable will be acceptable.
- B. Intermediate Locations:
 - 1. Thermal transfer labels shall be securely fastened to all wiring and cabling in the following locations:
 - a. Wireways
 - b. Pullboxes/Junction boxes larger than 4-11/16"
 - c. Pullboxes/Junction boxes through 4-11/16" where wires and cables are not easily identifiable via the color coding and box labeling
 - d. Vaults & Manholes
 - e. Approximately every 50 feet within cable trays (especially at locations where cables exit or diverge). Labels within cable trays shall be grouped (rather than being pre-labeled on cables and pulled into cable trays).
 - f. Other similar intermediate locations.
 - 2. Labels shall be stamped or printed with the following data so that the feeder or cable can be readily identified and traced:
 - a. From where the circuit originates (including panel designation and circuit number):
 - 1) Ex: "FROM: PP-A CIR. 3 (IN MAIN ELEC ROOM)"
 - b. To where the circuit extends (using the common name of the equipment):
 - 1) Ex: "TO: RTU-6 (ON ROOF)"
 - c. The purpose of the circuit:

- 1) Ex: "POWER"
- d. The set number (If parallel power feeds are used).

C. 1) Ex: "SET NO. 3 OF 4"
Circuit/Cable Termination Locations:

- 1. Where multiple termination points exist within a circuit origination point (panelboard, switchboard, MCC, starter, etc.) or other similar circuit endpoint (control panel, etc.), labels shall be securely fastened to all ungrounded and neutral conductors to clearly identify the terminal and/or circuit number associated with each conductor. For example, within lighting panels, each phase and neutral conductor shall be labeled near the terminals at a clearly visible location with the associated circuit number(s), so that if all conductors were unterminated, the labels would clearly indicate which conductor was associated with each circuit.

- D. Refer to Specification Section 260519 for all color-coding requirements of wires and cables.

3.3 PULLBOX & JUNCTION BOX IDENTIFICATION

A. Concealed pullboxes/junction boxes:

- 1. Front surface of all pullbox/junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be neatly marked with the ID of circuits/cables contained with permanent black marker on cover of box (Ex: "RP-1A Cir. 1, 2 & 3"). Additionally, front surface of box shall be painted red where box contains fire alarm system cabling.

B. Exposed pullboxes/junction boxes:

- 1. Interior surface of all pullbox/junction box covers in exposed areas shall be labeled "Power", "Telecommunications", "Fire Alarm" or with other similar general text neatly with permanent black marker to indicate function of box. Circuit/cable labeling within box (see above) shall identify specific cables contained. Additionally, interior surface of cover shall be painted red where box contains fire alarm system cabling.

- C. Where pullboxes/junction boxes are named on contract documents (Ex: "PULLBOX #3"), an engraved nameplate shall be installed on the front surface of the box to identify the name.

3.4 ELECTRICAL DISTRIBUTION & UTILIZATION EQUIPMENT IDENTIFICATION

A. General:

- 1. All new and existing equipment modified by this project shall include arc-flash warning labels in accordance with NEC article 110.16.

B. All Panels, Motor Control Centers, Switchboards, Switchgear, Transformers, Etc.:

- 1. Engraved nameplates identifying name of equipment, nominal voltage and phase of the equipment and where the equipment is fed from shall be installed on front surface of all panels, motor control centers, switchboards, switchgear, transformers, etc.:
 - a. Ex: First Line: "NAME: RP-A", Second Line: "120/208V-3Ø-4W", Third Line: "FED FROM: PP-A CIR. 4 (IN MAIN ELEC ROOM)"

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ELECTRICAL IDENTIFICATION**

SECTION 26 0553 – PAGE 4 OF 5

2. Refer to Panelboard Specification Sections for additional labeling requirements (circuit directory cards, permanent circuit labels, permanent circuit numbers, etc.) required inside panelboards.
- C. Safety/Disconnect Switches and Utilization Equipment (HVAC Equipment, Pumps, Powered Valves, Control Panels, Starters, Etc.):
 1. Engraved nameplates identifying equipment being fed and where the equipment is fed from shall be installed on front surface of all disconnect switches (including both visible blade type switches and toggle-type switches) and on utilization equipment (where not clearly identified by immediately adjacent local disconnect switch):
 - a. Ex: First Line: "RTU-6", Second Line: "FED FROM: PP-A CIR. 5"
 2. Where safety/disconnect switches are installed on the load side of variable frequency drives, the safety/disconnect switch shall be furnished with an additional engraved nameplate to read: "WARNING: TURN OFF VFD PRIOR TO OPENING THIS SWITCH".
 3. Safety/Disconnect switches feeding equipment that is fed from multiple sources (such as motors with integral overtemperature contacts that are monitored via a control system) and Utilization Equipment fed from multiple sources shall be furnished with an additional BLACK-ON-YELLOW engraved nameplate to read: "WARNING: ASSOCIATED EQUIPMENT FED FROM MULTIPLE SOURCES – DISCONNECT ALL SOURCES PRIOR TO OPENING COVER".
- D. Emergency Systems:
 1. A sign shall be placed at the service entrance equipment (and at any remote shunt trip operators, or similar, for service equipment) indicating the type and location of on-site emergency power sources (such as generators, central battery systems, etc.) per NEC requirements.
 2. All boxes and enclosures (including transfer switches, generators, power panels, junction boxes, pullboxes, etc.) dedicated for emergency circuits shall be permanently marked with white-on-red engraved nameplates so they will be readily identified as a component of an emergency circuit or system.
 3. Where an Essential Electrical System (EES) is installed, all enclosures, raceways and equipment that are components of the EES shall be readily identified as such. Raceway shall be identified at intervals not exceeding 25 ft.
- E. Services:
 1. All Service Equipment:
 - a. Engraved nameplates identifying maximum available fault current, including date the fault current calculation was performed, in accordance with NEC article 110.24.
 - 1) Ex: First Line: "AVAILABLE FAULT CURRENT: 16,154 AMPS", Second Line: "DATE CALCULATED: JULY 8, 2013"
 - b. All service entrance equipment shall be clearly labeled as being service entrance rated.
 2. Where a building or structure is supplied by more than one service (or any combination of branch circuits, feeders and services), a permanent plaque or directory shall be installed at each service disconnect location denoting all other services, feeders & branch circuits supplying that building or structure and the area served by each, per NEC requirements.
- F. Generators:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ELECTRICAL IDENTIFICATION**

SECTION 26 0553 – PAGE 5 OF 5

1. Generators shall be labeled with engraved nameplates identifying name of equipment.

3.5 EMERGENCY AND STANDBY POWER RECEPTACLE IDENTIFICATION

- A. Receptacles fed from emergency or standby power sources (such as emergency generators) shall be provided with factory-marked engraved coverplates as described above.

3.6 OTHER IDENTIFICATION

- A. Factory-engraved coverplates identifying functions of light switches and other similar devices shall be installed where so required by plans/specifications.

END OF SECTION 260553

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES**

SECTION 26 0573 – PAGE 1 OF 5

PART 1 GENERAL

1.1 SCOPE OF WORK

A. THE WORK UNDER THIS SECTION INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

1. Power Distribution System Electrical Studies.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Short Circuit Studies, Protective Devices Evaluation Studies, Protective Device Coordination Studies and Arc Flash Hazard Studies shall be performed by the same entity, which shall be a Professional Engineer registered in the state where the equipment will be installed. The studies shall be per the requirements set forth in the latest edition of NFPA 70E-Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.
- B. The studies shall be submitted to the Architect prior to shipment of any electrical distribution equipment.
- C. The studies shall include all portions of all electrical systems affected by the project (including any existing systems/equipment) from the utility service to any existing equipment at the facility (including all existing equipment fed from the same service point as any new equipment) and to all new equipment installed under this contract. All induction motors 50 HP or below and fed from the same bus may be grouped together. All induction motors greater than 50 HP shall be included individually with associated starters and feeder impedance. See individual study sections below for additional scope requirements.
- D. The studies shall be performed using the latest revision of the SKM Systems Analysis Power*Tools for Windows (PTW) or EasyPower software program.
- E. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- F. The contractor shall be responsible for collecting data on any existing or proposed electrical equipment, devices, conductors, etc. as required to prepare the study, and shall supply pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the studies to be completed prior to shipment of equipment.
- G. The Power Distribution System Electrical Studies shall be performed by Square 'D', G.E., Siemens or Cutler Hammer; or a third-party vendor if specifically approved by the engineer prior to preparation of the studies.
- H. The proposed vendor shall have completed a minimum of five (5) equivalent Arc-Flash Hazard Studies in the past three (3) years.

2.2 SHORT CIRCUIT STUDY

- A. The Short Circuit Study shall be performed with aid of a computer program. The study input data shall include the power company's short circuit contribution, resistance and reactive components of the branch impedances, X/R ratios, base quantities selected, and other source impedances.

- B. Short circuit momentary duty values and interrupting duty shall be calculated on each individual basis with the assumption that there is a three-phase bolted short circuit at the respective switchgear bus, switchboard, low voltage motor control center, distribution panelboard, and other significant locations throughout the system.
- C. The short circuit tabulation shall include symmetrical and asymmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contributions from each connected branch, including motor back EMF current contributions shall be listed with its respective X/R ratio.

2.3 PROTECTIVE DEVICE EVALUATION STUDY

- A. The Protective Device Evaluation Study shall be performed to determine the adequacy of circuit breakers, switches, transfer switches, and fuses by tabulating and comparing the short circuit rating of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied.
- B. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Architect's attention.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. The Protective Device Coordination Study shall be performed to provide the necessary calculation and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. The objective of the study is to obtain optimum protective and coordination performance from these devices.
- B. The coordination study shall show the best coordination attainable for all breakers down through the largest breaker at each piece of distribution equipment. Coordination study shall demonstrate selective coordination where required by applicable codes or contract documents.
- C. Phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices. Where ground fault protection is used, coordination of the ground fault protection with the first downstream overcurrent phase protection device shall be demonstrated.
- D. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves be maintained.

2.5 ARC-FLASH HAZARD STUDY

- A. The Arc-Flash Hazard Study shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
- B. The Arc-Flash Hazard Study shall be performed in conjunction with a short-circuit Study and a time-current coordination Study.
- C. The Arc-Flash Hazard Study shall be performed for the following equipment:
 - 1. All Distribution Equipment – This includes but is not limited to the following:
 - a. Switchgear
 - b. Switchboards

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES**

SECTION 26 0573 – PAGE 3 OF 5

- c. Motor Control Center
 - d. All Lighting and Power Panelboards
 - e. Fused Disconnect Switches rated greater than 100A
- 2. Separately enclosed devices fed from protection device rated greater than 100A - This includes but is not limited to the following:
 - a. Control Panels
 - b. VFD's
 - c. RVSS
- D. A generic Arc-Flash label shall be applied to other electrical equipment that has not been included in the study. This includes but is not limited to the following equipment:
 - 1. Non-fused Disconnect Switches
 - 2. Fused Disconnect Switches rated 100A or less
 - 3. Transformers
 - 4. Control Panels, VFD's, RVSS, etc. rated 100A or less
- E. Where a main protective device is provided, the study shall be performed on the line side and load side of the main. The worst-case result shall be used for the study result and label.
- F. The Study shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- G. Where incident energies are calculated to fall within the high marginal region of a given Hazard/Risk Category Level, the Hazard/Risk Category Level shall be increased one level.
- H. The Arc-Flash Hazard Study shall be performed in compliance with the latest IEEE Standard 1584, the IEEE Guide for Performing Arc-Flash Calculations. Where IEEE 1584 does not have a method for performing the required arc-flash calculations (such as for single phase equipment), calculations shall be performed and system shall be modeled using modules/methods as recommended by the arc flash software supplier (for example, using SKM Unbalanced/Single Phase Studies module for modeling single phase systems).
- I. Equipment labels to identify AFIE and appropriate Hazard/Risk Category in compliance with NFPA 70E and ANSI Z535.4 (latest version of these requirements) shall be provided to the Electrical Contractor. The Electrical Contractor shall affix the labels to the distribution equipment devices as directed by the equipment manufacturer. These labels shall, at a minimum, include the following:
 - 1. WARNING label.
 - 2. Hazard/Risk Category.
 - 3. Arc Flash Boundary Distance.
 - 4. Incident Energy (in cal/cm²) at Working Distance.
 - 5. Shock Hazard Voltage.
 - 6. Limited Approach Boundary Distance.
 - 7. Restricted Approach Boundary Distance.
 - 8. Prohibited Approach Boundary Distance.
 - 9. Equipment Name.
 - 10. Name of Firm who prepared the Study.
 - 11. Project Number of the Firm who prepared the Study.
 - 12. Date that the Study was prepared.
 - 13. Method for calculating analysis data.
 - 14. Statement to read: "Any system modification, adjustment of protective device settings, or failure to properly maintain equipment will invalidate this label" (or equivalent).

PART 3 EXECUTION

3.1 SUBMITTAL REQUIREMENTS

- A. The results of the studies shall be summarized in a final report. The report shall include the following sections:
1. General:
 - a. Description, purpose, basis and scope of the studies
 - b. Single line diagram of the portion of the power system which is included within the scope of the work. The single line diagram shall fit on one sheet of paper (size as required) unless approved otherwise by engineer. The following information shall be shown on the single line diagram:
 - 1) Device Name
 - 2) Branch Fault Currents with directional indicators
 - 3) General Location (for busses only)
 - 4) Other basic component information such as cable type, cable length, breaker rating, buss short circuit rating, transformer voltages, transformer size, fuse size, etc..
 2. Short Circuit Study:
 - a. Tabulation of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 3. Protective Device Evaluation/Coordination Study:
 - a. Protective devices time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - b. Fault current calculations including definitions of terms and a guide for interpretation of computer printout.
 - c. Documentation from utility company on their letterhead showing their anticipated values of available short circuit currents X/R ratios and protective devices with which the power distribution system will coordinate.
 - d. Time-current characteristics of the respective protective devices shall be plotted on log-log paper. Plots shall be printed in color with a dedicated color and pattern for each curve for clear identification.
 - e. Plots shall include complete titles, respective single line diagrams and legends, and associated power company's relay or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breakers trip curves and fuses.
 - f. The coordination plots shall indicate the type of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents.
 - g. The coordination plots for phase and ground protective devices shall be provided on a system basis.
 - h. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.
 4. Arc-Flash Hazard Study:
 - a. Tabulation of device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER DISTRIBUTION SYSTEM ELECTRICAL STUDIES**

SECTION 26 0573 – PAGE 5 OF 5

- b. Recommendations for reducing AFIE levels and enhancing worker safety.
- B. Furnish all labor, materials, calculations, electrical equipment, technical data and incidentals required to provide a complete short circuit study, coordination study and arc flash hazard study of protective devices, busses, etc. from the utility service to any existing equipment at the facility and all new equipment installed under this contract.
- C. The study shall comply with the following applicable provisions and recommendations of the latest revisions of the following: ANSI C37.5, IEEE Standard No. 399, and IEEE Standard No. 141.
- D. Submit calculations and results of the short circuit, protective device evaluation and coordination and arc flash hazard studies prior to submitting shop drawings for new equipment. Contractor shall verify that all proposed equipment is properly rated per the short circuit and protective device evaluation portions of the study prior to releasing equipment for manufacturing.
- E. Submit a copy of a sample typical arc flash label layout (meeting requirements outlined above) that will be used for the project.
- F. Submit final electronic copies of all SKM program files/models/input data/etc. used to perform the study to the owner with final close-out documents. These files shall be complete as required to allow future users to recreate the study.

3.2 INSTALLATION

- A. Contractor shall adjust all breaker settings as recommended by the coordination study prior to energizing equipment.
- B. Contractor shall affix arc flash hazard notification labels (as determined by the results of this study) to each piece of distribution equipment prior to energization of equipment. A generic arc-flash warning label shall be affixed to any electrical equipment not included in the analysis as outlined above.
- C. Where short circuit rating of equipment is dependent on setting of upstream overcurrent device, provide and install label for equipment indicating the required settings of the associated device.

END OF SECTION 260573

PART 1 GENERAL

1.1 INTRODUCTION

- A. The work covered in this section is subject to the requirements in the General Conditions of the Specifications. Contractor shall coordinate the work in this section with the trades covered in other sections of the specification to provide a complete and operable system.

1.2 SYSTEM DESCRIPTION

- A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. Contractor shall furnish and install a complete, integrated, stand alone automatic lighting control system including programmable Lighting Control Panels with internal astronomic timeclock(s), Networking between panels, Dataline low voltage control switch inputs for zone control, Photocell input for outdoor lighting control, Occupancy Sensors, and Daylighting Controls from a single supplier. Contractor is responsible for confirming that the panels and sensors interoperate as a single system.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.
- C. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.

1.4 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
 - 1. Shop Drawings: Building floorplans showing all proposed devices and composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
 - 2. Product Data: Catalog sheets, specifications and installation instructions.

1.5 APPROVED MANUFACTURERS

- A. Watt Stopper/Legrand – Lighting Integrator series
- B. Equal by Acuity Lighting
- C. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL PANELS

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING CONTROL SYSTEM**

SECTION 26 0943 – PAGE 2 OF 8

- A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
1. Enclosure/Tub shall be NEMA 1, NEMA 3R, or NEMA 4 as indicated on the plans, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors, per enclosure. Multiple enclosures shall be provided where required for the specified quantities of relays/contactors.
 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
 - a. Provision for one or two optional control and automation cards.
 - b. Removable, plug-in terminal blocks with screw less connections for all low voltage terminations.
 - c. Individual terminal block, override push button, and LED status light for each relay
 - d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches or 24VDC input from occupancy sensors.
 - e. Automatic support for occupancy sensor sequence of operation. Low voltage inputs automatically reconfigure when connected to a Watt Stopper occupancy sensor head. Occupancy sensor shall switch lighting on and off during unoccupied periods but shall not turn lighting off during scheduled occupancy periods.
 - f. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
 - g. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
 - h. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
 - i. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.
 - j. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
 - k. Single pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - 1) Electrical:
 - a) 30 amp ballast at 277V
 - b) 20 amp ballast at 347V
 - c) 20 amp tungsten at 120V
 - d) 30 amp resistive at 347V
 - e) 1.5 HP motor at 120V
 - f) Short circuit current capacity equal to (or greater than) that of the associated circuits (see associated panelboard schedules on drawings)

- 2) Mechanical:
 - a) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
 - b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
 - c) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
 - d) Tested to 300,000 mechanical on/off cycles
- 3) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- I. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

2.2 LONWORKS® BASED DIGITAL COMMUNICATIONS

- A. The lighting control panel shall support digital communications to facilitate the extension of control to include multiple panels and other intelligent field devices. Digital communications shall be LonWorks® based and use the LonTalk® protocol in an open topology architecture.
 - 1. Dataline communications wire shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline shall be topology free and can be run in a serial, "T" or star configuration.
 - 2. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturers name, catalog number printed on the wire jacket. The contractor, at their own expense will, replace an improper dataline wire.
 - 3. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
 - 4. Intelligent field devices supported shall include digital dataline switches, network clock/programmer, telephone interface module, BMS interface module, photocell control module, programmable thermostat, and universal switch module.

2.3 BROWSER BASED PROGRAMMING AND CONTROL

- A. The lighting control system shall include a web browser based user interface that shall allow programming and override of the system from any PC browser with network connectivity to the lighting controls. The Automation Appliance shall include as a minimum the following features:
 - 1. The interface shall be a TCP/IP based server device that is connected to the lighting control system global dataline and shall not require that software be installed on the client PC(s) for operation.
 - 2. Provide support for connection of one or more personal computers directly via Ethernet or enterprise connectivity via a local area network, wide area network or internet connection.
 - 3. Provide the option for a plug-in 56K baud modem to enable dial in connection via standard telephone line. All functionality of the browser interface shall be available through the dial-up connection.
 - 4. Log in to the lighting control system through the browser interfaced shall provide multi-level security. Users shall be assigned log in access levels to restrict program modification to authorized users.
 - 5. User programming shall include eight independent schedules for each lighting control panel, as well as, eight global schedules that affect channels in all panels on the network. Schedules shall overlap such that a panel specific schedule for any channel will override a global schedule for that channel.
 - 6. Schedules shall be capable of seven day repeating and calendar date event based formats.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING CONTROL SYSTEM**

SECTION 26 0943 – PAGE 4 OF 8

7. User programming shall be scenario based and shall include the following options:
 - a. Scheduled ON / OFF
 - b. Manual ON / Scheduled OFF
 - c. Manual ON / Auto Sweep OFF (for AS-100 Switches)
 - d. Astro ON / OFF (or Photo ON / OFF)
 - e. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
8. It shall be possible to view the status of and override any relay or channel group via the browser interface screens.
9. Provide support and user interface screens for integration of the photocontrol module, dataline switches, touch-tone telephone module, and universal switch module.
10. Provision for integration with the building automation system shall be via the industry standard BACnet protocol. Any of the eight global schedule channels shall individually be set to follow the BAS schedules rather than the internal Automation Appliance schedules. Relays in all panels shall be exposed to the BAS as binary output objects. It shall be possible for the BAS to read the status of each relay and to override each relay via BACnet.
11. The interface shall monitor all networked components and automatically generate alarms if any component fails to properly respond to control. Alarms shall be annunciated via the browser screens and via email to selected recipients where a proper SMTP server connection has been set up.
12. The user programming in the lighting control panels and dataline switches shall be available for viewing or download to the client PC as a standard PDF file.
13. A backup function shall permit the complete system program to be saved to the hard drive of any client PC connected to the lighting control system through the browser interface. A restore function shall allow a saved program to be reloaded to the interface.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

- A. Provide a weatherproof Class 2 photocell for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photocell shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.
 1. The photocontrol Module shall integrate seamlessly with either the Network Clock, Automation Appliance, or the BMS Interface Module. The control module shall measure the actual exterior light and display this level in foot candles (fc) on the unit LCD display.
 2. The controller shall have eight individual set point adjustments that are available to the lighting control network over the dataline communications wire.
 3. Features
 - a. Real time, 2 line LCD display of actual exterior light level up to 200 fc.
 - b. Channel set points and parameters programmed via the Network Clock or BMS Interface Module.
 - c. Choice of OPERATE or TEST modes, with simulated light level for testing.
 - d. Automatic dead band and 5 minute time delay to avoid cycling.

2.5 DIGITAL DATALINE SWITCHES

- A. Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING CONTROL SYSTEM**

SECTION 26 0943 – PAGE 5 OF 8

1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
 - c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
3. Switches shall be constructed of non-breakable grey Lexan on all exposed parts and shall include a stainless steel wall plate, unless noted otherwise on plans.
4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.
10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.
11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.

2.6 AUTOMATIC LIGHTING CONTROLS

- A. System shall provide automatic lighting shutoff for all interior lighting circuits controlled by the system (excluding night lights and other similar circuits) per latest ASHRAE 90.1 & IECC standards, unless specifically shown otherwise on plans.
- B. System shall provide blink-warnings for interior lighting circuits (excluding circuits with HID light fixtures) controlled by the control panel 5 minutes prior to automatic shutoff.
- C. System shall include provisions for holiday scheduling, to allow automatic "ON" programming to be skipped on holidays and other scheduled off days per applicable energy code requirements.
- D. Low voltage remote override switches shall be provided as shown on drawings.
- E. Exact preset times for lighting control zone controls (where applicable) and lighting control system operation shall be per owner's direction. Contractor shall submit a proposed lighting control schedule indicating type of "ON" control (occupancy, time-of-day, manual, etc.), type of "OFF" control (occupancy, time-of-day, manual, etc.) and proposed preset times for all zones to owner for review prior to implementation. The following general control schemes shall generally be used where the owner has no preferences unless shown otherwise on plans:

1. Exterior Security Lighting (at doorways, etc.):
 - a. On: Photocell or Astronomic – dusk.
 - b. Off: Photocell or Astronomic – dawn.
2. Other Exterior Lighting:
 - a. On: Photocell or Astronomic – dusk.
 - b. Off: Preset Time (as directed by the facility operator).
3. Interior Lighting with Occupancy Sensor Controls:
 - a. Corridors, restrooms, lobbies and other similar public spaces
 - 1) On: Occupancy Sensor.
 - 2) Off: Occupancy Sensor.
 - b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
 - 1) On: Manual Local Switch.
 - 2) Off: Occupancy Sensor.
 - c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
 - 1) On:
 - a) Manual Local Switch (if digital controls are provided) or
 - b) Occupancy Sensor (if hardwired controls are provided). Partial on only where required by code.
 - 2) Off: Occupancy Sensor (A "grace period" shall be provided, in which the occupancy sensor can turn lights back "on" for a short period of time (approximately 15 seconds) after lights are turned off automatically).
4. Interior Lighting with Time-of-Day Controls:
 - a. Corridors, restrooms, lobbies and other similar public spaces
 - 1) On: Preset Time (as directed by the facility operator).
 - 2) Off: Preset Time (as directed by the facility operator).
 - b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
 - 1) On: Manual Local Switch
 - 2) Off: Preset Time (as directed by the facility operator).
 - c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
 - 1) On: Manual Local Switch
 - 2) Off: Preset Time (as directed by the facility operator).

2.7 WIRING

- A. See Specification Section 270500 for additional requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Refer to Specification Section 270500 for additional cable installation requirements.
- B. Master/centralized lighting control switches (particularly switches located in areas where not all associated lighting fixtures are visible from the switch) and individual buttons of other lighting control stations with more than two (2) buttons shall be labeled (on switch coverplate or directly on buttons) with factory-engraved labeling. Exact wording of labeling shall be per owner's direction unless shown otherwise on plans.

3.2 SUPPORT SERVICES

- A. Pre-installation Coordination
 - 1. Exact occupancy sensor and daylight sensor types and locations shall be determined by the lighting control system supplier for a fully-functional system with adequate coverage throughout areas controlled by occupancy sensors. Exact locations shall be coordinated with actual HVAC register locations, furniture/casework/etc. locations, sensor coverage patterns, etc. for proper coverage in all areas. In no case may fewer devices or lower-quality devices be used in each area than indicated on contract documents.
- B. System Start Up and Commissioning
 - 1. The electrical contractor shall provide the manufacturer, the facility owner and the electrical engineer with ten working days written notice of the system startup and adjustment date.
 - 2. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
 - a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
 - b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
 - c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
 - 3. Manufacturer to provide a written statement verifying that the system meets the above requirements.
- C. Re-commissioning – After 30 days from occupancy re-calibrate all preset times, sensor time delays and sensitivities and relocate occupancy sensors if so required to meet the Owner's Project Requirements. Provide a detailed report to the Design Team and Owner of re-commissioning activity.
- D. System Training
 - 1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.
- E. System Programming
 - 1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Telephone overrides.

- d. Operating schedules.

3.3 WARRANTY

- A. The contractor shall warrant the completed lighting control system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 260943

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Occupancy and Daylighting Sensor Control
2. Emergency Lighting Control (if applicable)

B. Related Section

1. Section 260943 – Lighting Control System
2. Section 262726 - Wiring Devices
3. Section 270500 – Auxiliary System Cables, 0-50V
4. Section 265000 – Lighting Materials and Methods
5. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
6. Electrical Sections, including wiring devices, apply to the work of this Section.

C. Control Intent – Control Intent includes, but is not limited to:

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control (if applicable)

1.2 REFERENCES

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- B. Underwriter Laboratories of Canada (ULC)
- C. International Electrotechnical Commission
- D. International Organization for Standardization (ISO)
- E. National Electrical Manufacturers Association (NEMA)
- F. WD1 (R2005) - General Color Requirements for Wiring Devices.
- G. Underwriters Laboratories, Inc. (UL):
 1. 916 – Energy Management Equipment.
 2. 924 – Emergency Lighting
 3. 2043 – Plenum Rating

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Room Controllers – Self configuring, digitally addressable one, two or three relays controllers with 0-10v control for ballasts (if applicable) and single relay application specific plug load controllers.

SHELBY COUNTY EMA & IT BUILDING PROJECT DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM

SECTION 26 0944 – PAGE 2 OF 9

2. Digital Occupancy Sensors connected to Digital Room Controllers – Self configuring, digitally addressable and calibrated occupancy sensors with LCD screens and two way active Infra-Red (IR) communications.
3. Digital Switches connected to Digital Room Controllers – Self configuring, digitally addressable push button switches, dimmers, and scene switches with two way active Infra-Red (IR) communications.
4. Analog and digital closed loop daylighting sensors connected to Digital Room Controllers - self-calibrating daylighting sensors that provide closed loop control to Room Controllers. Sensors and Room Controllers can provide single or multi-zone, on/off or dimming control for daylight harvesting.
5. Hand held remotes for room configuration – provides two way infrared communications to digital devices and allows complete configuration and reconfiguration of the device / room from 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send / receive / store of room variables.
6. Hand held remotes for personal control – One, two, or four (scene) button remotes provide Infrared communications to a room. Remote controls will support ON/OFF, dimming, scene control and may be configured in the field to provide specific occupant requirements without special tools.
7. Digital Lighting Management (DLM) local network – Free topology, plug in wiring system (Cat 5e) for power and data to room devices.
8. Network Bridge - provides BACnet MS/TP compliant digital networked communication between rooms, panels and the Segment Manager or BAS.
9. Segment Manager - provides web browser based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
10. Emergency Lighting Control Unit (ELCU)- allows any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.4 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:

1. Space Control Requirements – Provide occupancy/vacancy sensors with manual-on functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and automatic-on occupancy sensors are more appropriate. Provide manual ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors with manual-on switches.
2. Bi-Level Lighting – Provide multi –level switched dimming controls where indicated on plans.
3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting where indicated on plans. Provide automatic ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
4. Daylighted Areas. Provide daylighting controls where indicated on plans. Daytime set points for total illumination (combined daylight and electric light) level that initiate dimming shall be programmed to be not less than 125% of the nighttime maintained designed illumination levels.
5. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
6. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylight system may be designed to turn off ambient lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

1.5 SUBMITTALS

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM**

SECTION 26 0944 – PAGE 3 OF 9

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
 - 1. Shop Drawings: Building floorplans showing all proposed devices and composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
 - 2. Product Data: Catalog sheets, specifications and installation instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

1.7 PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1. Ambient temperature: 0° to 40° C (32° to 104° F).
 - 2. Relative humidity: Maximum 90 percent, non-condensing.

1.8 WARRANTY

- A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.9 MAINTENANCE

- A. Spare Parts:
 - 1. Provide two (2) of each product to be used for maintenance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Watt Stopper Digital Lighting Management (DLM)
 - 2. Equal by Acuity Lighting
- B. Basis of design product: Watt Stopper Digital Lighting Management (DLM) or subject to compliance and prior approval with specified requirements of this section, one of the following:
 - 1. Watt Stopper Digital Lighting Management (DLM)
 - 2. Acuity
 - 3. Substitutions:
 - a. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 - b. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power wiring) with deviations for

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM**

SECTION 26 0944 – PAGE 4 OF 9

the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 SINGLE / DUAL RELAY WALL SWITCH VACANCY SENSORS

- A. Type PW: Manual ON, Automatic OFF Wall switch type passive infrared occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper PW-100, PW-200 .
- B. Type UW: Manual ON, Automatic OFF Wall switch type ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper UW-100, UW-200.
- C. Type DW: Manual ON, Automatic OFF Wall switch type dual technology, passive Infrared and ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper DW-100, DW-200.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Wall or ceiling mounted (to suit installation) passive infrared, ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square footage coverage requirements for each area controlled, utilizing Room Controller modules and accessories which suits the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation . Features include the following:
 - 1. Digital calibration and LCD entry for the following variables:
 - a. Sensitivity 0-100% in 10% increments
 - b. Time Delay – Fixed (1-30 minutes in 1 minute increments), and automatic
 - c. Test mode – Five second time delay
 - d. PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including auto/manual ON, blink warning, and daylight enable/disable.
 - 2. RJ-45 digital connections for DLM local network.
 - 3. Two-way infrared communications port to allow remote programming through hand held commissioning tool.
 - 4. Self contained push buttons for programming and control of room devices.
 - 5. Device Status LED's including:
 - a. PIR Detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 6. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM**

SECTION 26 0944 – PAGE 5 OF 9

- C. Units will provide for digital calibration and commissioning and will not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required
- E. Watt Stopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.4 DIGITAL WALL SWITCHES

- A. Low voltage (RJ-45) momentary push button switches in 1,2,3,4 and 8 button configuration, decorator opening. Wall switches will include the following features:
 - 1. Two way infrared communications port for use with personal and configuration remote controls.
 - 2. Engraveable buttons
 - 3. Dimming switches shall include seven LED's to indicate load levels.
 - 4. Scene switches shall include pilot indication of scene selection.
 - 5. Device Status LED's including:
 - a. One pilot LED for each button.
 - b. Power Indication
 - c. One locator LED per switch
 - d. Network status LED to indicate data transmission
 - e. Power LED to indicate the device has power
 - f. Configuration mode
- B. Switches shall have two RJ-45 ports to allow connection to any other digital room device.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching
- D. Watt Stopper product numbers: LMSW-101 / LMSW-102 / LMSW-103 / LMSW-104 / LMSW-108.

2.5 ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without any tools or configuration requirements. Room Controllers shall be provided to match the room lighting load and control requirements and sequences. The controllers will be simple to install and will not have screw type connections, dip switches, potentiometers or require special mounting or configuration. The control units will include the following features:
 - 1. Automatic room configuration to the most energy efficient sequence of operation based upon the devices in the room.
 - 2. One or two relay configuration
 - 3. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an Off-the-Shelf unit without requiring any configuration or setup.
 - 4. Device Status LED's to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 - 5. Quick installation features including:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM**

SECTION 26 0944 – PAGE 6 OF 9

- a. Standard junction box mounting (inside or outside)
 - b. Quick low voltage connections using standard RJ-45 patch cable
 - 6. Plenum rated
 - 7. Manual override and LED indication for each load
 - 8. Universal voltage (120/230/277 VAC, 50-60 Hz)
 - 9. Zero cross circuitry for each load.
 - 10. Efficient 150 ma switching power supply
 - 11. Three RJ-45 DLM local network ports
 - 12. Watt Stopper product numbers: LMRC-101 / LMRC-102
- B. 0-10 Volt enhanced Room Controllers shall include all the features of the Room Controller plus the following enhancements:
- 1. One, two or three relay configuration
 - 2. Efficient 250 ma switching power supply
 - 3. Four RJ-45 DLM local network ports.
 - 4. One zero to 10 volt analog output per relay for control of dimmable ballasts.
 - 5. Optional BACnet MS/TP communications port.
 - 6. Current monitoring
 - 7. Watt Stopper product numbers: LMRC-301 / LMRC302 / LMRC303.
- C. Plug Load Room Controllers provide dedicated control of plug loads within the space. The controllers plug into the DLM local network using the RJ-45 free topology network. The room controllers include the following features
- 1. One relay configuration only
 - 2. Automatic ON/OFF configuration
 - 3. Default 30 minute (adjustable) time delay from lighting shut off to allow for electronic component use after an area is vacant
 - 4. Watt Stopper product number: LMPL-101.

2.6 DIGITAL PHOTOSENSORS

- A. Provide automatic daylight harvesting capabilities to the Room Controllers. The photo sensor / room controller configuration automatically configures the daylighting set points for ON/OFF or Dimming control. Using the automatic configuration replacing a photo sensor or room controller can be done without any special tools, programming or configuration. Photosensors include the following features:
- 1. The digital photosensor shall utilize an internal photodiode that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone
 - 2. The digital photosensor shall be capable of turning lighting on and off or Raise / Lower depending on the type of Room Controller (on/off or dimming). Sensor range shall be from 1 - 1400fc.
 - 3. For ON/OFF daylight harvesting the controller provides a "hold on while occupied" feature that prohibits high levels from turning OFF the controlled lights as long as the space remains occupied.
 - 4. The sensor has a threaded nipple that mounts on a ceiling tile and for more challenging applications such as a side wall or hard rock ceiling the nipple pops off and the unit can be screwed down
- B. Watt Stopper Product Numbers: LMLS-400 or equivalent.

2.7 ROOM NETWORK

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISTRIBUTED DIGITAL LIGHTING MANAGEMENT SYSTEM**

SECTION 26 0944 – PAGE 7 OF 9

- A. The DLM local network is a free topology lighting control network and protocol designed to control a small area of a building. Digital room devices connect to the network using RJ-45 patch cords which provide both data and power to room devices. Features of the DLM local network include
1. Automatic configuration and binding of sensors, switches and lighting loads to the most energy efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 3. Push and Learn configuration that can change the automatic binding process and load parameters by using only the digital devices in the room.
 4. Two way infrared communications that allow load parameters, sensor configuration and binding operations to be configured through a hand held configuration tool up to 30 feet from any device

2.8 NETWORK BRIDGE

- A. Each local network shall include a network bridge component to provide a connection between the room devices and the segment network. The network bridge shall use industry standard BACnet MS/TP network communication and allow direct connection to the Segment Manager or BAS where required.
- B. The network bridge may be incorporated directly into the room controller hardware or be provided as a separate module connected on the local network through an available RJ local network port
- C. Provide Plug and Go operation to automatically discover all room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
- D. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided .

2.9 SEGMENT MANAGER

- A. The Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser. Each segment manager shall have support for one, two or three segment networks as required and allow for control of a maximum of 127 local networks (rooms) and or lighting control panels per segment network.
- B. Operational features of the Segment Manager shall include the following:
1. Connection to PC or LAN via standard Ethernet TCP/IP
 2. Easy to learn and use Adobe Flex based GUI compatible with Internet Explorer 8 or equal browser
 3. Log in security capable of restricting some users to view-only or other limited operations
 4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.
 5. After discovery all rooms and panels shall be presented in a standard navigation tree format
 6. View and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation.
 7. Set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation.

8. Group rooms and loads for common control by schedules, switches or network commands. Monitor connected load current for rooms or zones equipped with room controllers incorporating the current monitoring feature
9. Provide seamless integration with the BAS via BACnet IP

2.10 EMERGENCY LIGHTING

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include
 1. 120 - 277 volts, 50/60 Hz., 20 amp ballast rating
 2. Push to test button
 3. Auxiliary contact for test / Fire Alarm system

2.11 WIRING

- A. Refer to Specification Section 270500 for additional requirements.

PART 3 EXECUTION

3.1 PRE-INSTALLATION COORDINATION

- A. Exact occupancy sensor and daylight sensor types and locations shall be determined by the lighting control system supplier for a fully-functional system with adequate coverage throughout areas controlled by occupancy sensors. Exact locations shall be coordinated with actual HVAC register locations, furniture/casework/etc. locations, sensor coverage patterns, etc. for proper coverage in all areas. In no case may fewer devices or lower-quality devices be used in each area than indicated on contract documents.

3.2 INSTALLATION

- A. When using wire other than RJ-45 connections provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements
- B. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- C. Provide all connections between system components and network connections to building LAN (via Ethernet cabling) as directed by system supplier for a fully functional networked system.
- D. Calibrate all sensor time delays and sensitivity to guarantee proper coverage of occupants and energy savings.
- E. Provide written or computer generated documentation on the commissioning of the system including room by room description including:
 1. Sensor parameters, time delays, sensitivities, daylighting set points.
 2. Sequence of operation, manual ON, Auto OFF. Etc.
 3. Load Parameters - blink warning, etc.
- F. Refer to Specification Section 270500 for additional installation requirements.

3.3 SUPPORT SERVICES

A. System Start Up and Commissioning

1. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
2. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
 - a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
 - b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
 - c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
3. Manufacturer to provide a written statement verifying that the system meets the above requirements.

B. Re-commissioning – After 30 days from occupancy re-calibrate all preset times, sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Design Team and Owner of re-commissioning activity.

C. System Training

1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

D. System Programming

1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Telephone overrides.
 - d. Operating schedules.

END OF SECTION 260944

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER PANELBOARDS – CIRCUIT BREAKER TYPE**

SECTION 26 2416 – PAGE 1 OF 3

PART 1 GENERAL

1.1 GENERAL

- A. The work under this section includes but is not limited to the following:
 - 1. Power Panelboards
 - 2. Power Circuit Breakers

PART 2 PRODUCTS

2.1 PANELBOARDS - GENERAL

- A. Panelboards shall be dead front type, having lugs only or circuit breaker in mains as shown in panelboard schedule with circuit breaker branches.
- B. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on plans. Such rating shall be established by heat rise test with Maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C rise above ambient at full rated load. Heat rise test shall be conducted in accordance with UL Standard UL67. Bus structure shall be tin-plated aluminum or tin-plated copper. All neutral busses shall be full size. All panelboards shall contain ground buss.
- C. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- D. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. Panelboards shall be suitable for use as service equipment when required.
- E. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
- F. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

2.2 CIRCUIT BREAKERS

- A. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated (or can be adjusted to is 1200A or higher, breakers shall be electronic trip and shall be provided with arc energy-reducing maintenance switching (with local status indicator) to reduce arc flash energy per NEC 240.87 requirements.
- B. Circuit breakers shall be quick-make and quick-break, whether actuated automatically or manually. Circuit breakers shall have inverse time tripping characteristics with automatic release which shall trip free of the handle. Circuit breaker handles shall be three distinct positions—"OFF", "ON", and "TRIPPED". When a circuit breaker opens on overload or short circuit, the operating handle shall automatically assume the "TRIPPED" position.
- C. Multipole breakers shall be internal common trip with single operating handle. External handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).
- D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER PANELBOARDS – CIRCUIT BREAKER TYPE**

SECTION 26 2416 – PAGE 2 OF 3

handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.

- E. Circuit breakers shall be of the bolt-on type.
- F. Circuit breakers shall be "FA" frame and larger.
- G. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- H. The front face of all circuit breakers shall be flush with each other. Breaker numbers shall be permanently attached to trim.
- I. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 CABINETS, TRIM AND WIREWAY SPACE

- A. Clear space from bottom of lugs to bottom of wireway shall be not less than 6 inches for 400 amps and below, 10 inches for 600 amps, 12 inches for 800 amps and above.
- B. Panelboard interiors shall be fastened to cabinets by adjustable aligning supports.
- C. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.
- D. Fronts of cabinets shall be made from a single sheet of full finished steel having the door cut out. Doors shall have flush hinges, and lock utilizing all metal construction (with all locks keyed alike). Front shall be attached to cabinets with hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim. Front shall be provided with a metal directory and holder with clear plastic covering welded to the inside of the door. Fronts shall be code gauge full-finished steel with rust inhibiting primer and baked enamel finished in ASA #49 gray. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.
- E. Each section of multi-section panelboards shall be of matching heights and depths.
- F. Panelboard enclosures shall be furnished as shown on panel schedule on plans for surface, flush or motor control center mounting.

2.4 MANUFACTURER

- A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6'-7" A.F.F..
- B. Wiring in panelboard gutters shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.

3.2 PERFORMANCE TESTING

**SHELBY COUNTY EMA & IT BUILDING PROJECT
POWER PANELBOARDS – CIRCUIT BREAKER TYPE**

SECTION 26 2416 – PAGE 3 OF 3

- A. The ground-fault protection system when provided shall be performance tested after installation by a qualified person(s) using primary current injection in accordance with the instructions provided with the equipment and NEC requirements. A written record of the testing shall be provided.
- B. The arc energy reduction protection system when provided shall be performance tested after installation by a qualified person(s) using primary current injection in accordance with the instructions provided with the equipment and NEC requirements. A written record of the testing shall be provided.

3.3 PANEL IDENTIFICATION

- A. Refer to Specification Section 260553.

END OF SECTION 262416

PART 1 GENERAL

1.1 GENERAL

A. The work under this section includes but is not limited to the following:

1. Lighting Panelboards
2. Circuit Breakers

PART 2 PRODUCT

2.1 PANELBOARDS

A. Enclosure:

1. Panelboards shall be dead front type and shall be in accordance with Underwriter's Laboratories, Inc., standard of panelboards and enclosing cabinets and so labeled.
2. Panelboards installed in dry locations shall have enclosures fabricated from sheet steel and shall be finished in ASA #49. Panelboards installed in exterior or wet locations shall have NEMA 3R enclosures.
3. The door shall have a cylinder type lock. Lock shall be held in place by concealed screw to a captive nut, welded to inside of door. All locks shall be keyed alike.
4. A metal framed circuit directory card holder with clear plastic covering shall be factory-mounted on the inside of door.
5. Panels for 20 or more circuits, including spares and spaces, shall be 20 inches wide.
6. Panelboards enclosures shall be as shown on panel schedule on plans for surface, flush or motor control center mounting.
7. Provide hinged trim with piano-hinge down full length of one side to allow access to wiring without complete removal of outer trim.
8. Each section of multi-section panelboards shall be of matching heights and depths.

B. Bussing/Lugs:

1. Ampacity and service voltage of main buss, lugs or main breakers and branch circuit breakers shall be as shown on drawings.
2. All bussing and associated connectors shall be tin-plated aluminum or tin-plated copper.
3. All panelboards shall contain ground buss.
4. Entire panelboard shall be capable of withstanding a short circuit not less than the interrupting capacity of any breaker in the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. Interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
5. Buss connectors shall be for distributed phase arrangement.
6. Top/bottom feed arrangement and lug sizes/quantities shall be coordinated by the contractor.
7. Entire panelboard assembly, including all bussing, shall have SCCR ratings meeting or exceeding the minimum AIC ratings listed on the plans for the panel. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. All ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
8. Service entrance panelboards shall be provided with barrier such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations

C. Breaker arrangement and numbering:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING PANELBOARDS**

SECTION 26 2417 – PAGE 2 OF 3

1. Panelboards shall be factory assembled with branch breakers arranged exactly as indicated on plans.
2. Breakers shall be numbered vertically beginning top left. Multi-section panelboards shall be numbered consecutively through all sections.
3. Breaker numbers shall be permanently attached to trim.
4. Main breakers shall be vertically-mounted (branch-mounted or back-fed main breakers will not be acceptable unless specifically so shown on plans).

2.2 CIRCUIT BREAKERS

- A. Circuit breakers shall be quick break, quick make, thermal magnetic type, for alternating current. Breakers shall trip free for the handle and tripping shall be indicated by the handle assuming a position between OFF and ON.
- B. Circuit breakers shall be of the bolt-on type.
- C. Multi-pole breakers shall be internal common trip with single operating handle; external handle ties are not acceptable, unless specifically noted otherwise (such as for multi-wire branch circuits described below).
- D. Circuit breakers feeding multiwire branch circuits (as defined by NEC) consisting of separate single phase loads sharing a common neutral shall be provided with multi-pole breakers or handle ties to simultaneously disconnect all ungrounded conductors per NEC Article 210.4(B). The necessary locations of these multi-pole breakers or handle ties shall be coordinated by the contractor. Where necessary, the contractor may rearrange circuit breakers (as minimally as possible) as required to meet this requirement.
- E. All breakers shall meet the minimum RMS symmetrical interrupting capacity ratings shown on plans for the associated panel. All interrupting ratings shall be full ratings. Series ratings will not be allowed unless shown otherwise on drawings.
- F. All branch circuit breakers shall be listed to UL489 or shall be specially-tested to be HACR listed.

2.3 SPECIAL REQUIREMENTS

- A. Any special requirements on the drawings, such as for increased interrupting rating, ground fault protection, etc., shall supersede these specifications, but only insofar as that particular requirement is concerned.
- B. Lighting panels larger than 400A shall conform to the requirements for power panels.

2.4 MANUFACTURER

- A. Panelboards shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All panelboard dimensions and clearances shall be carefully checked and coordinated with the proper trades to ensure proper mounting space and support prior to roughing in equipment. In no case shall any circuit breaker be located above 6'-7" A.F.F..

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING PANELBOARDS**

SECTION 26 2417 – PAGE 3 OF 3

- B. Wiring in panelboard wireways shall be done in a neat and workmanlike manner. Wiring shall be grouped into neat bundles and secured with approved tie wraps.
- C. For all flush-mounted panelboards, a minimum of three (3) one-inch empty conduits shall be stubbed out above the nearest accessible ceiling space for future use.

3.2 PANEL IDENTIFICATION

- A. Refer to Specification Section 260553.

END OF SECTION 262417

PART 1 GENERAL

1.1 DESCRIPTION

- A. Wiring Devices
- B. Plates
- C. Finishes

PART 2 PRODUCTS

2.1 WIRING DEVICES AND PLATES

- A. Switches shall be AC type, extra-heavy duty industrial grade (unless otherwise shown) of ratings shown on drawings. Switches shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- B. Receptacles shall have blade configuration and shall be heavy duty industrial grade (unless otherwise shown) of current and voltage rating as shown on drawings. Receptacles shall be as manufactured by Hubbell, P & S, Sierra, Bryant, GE, Arrow Hart or equal.
- C. All GFCI-type receptacles shall continuously self-test and shall trip/deny power if the receptacle does not provide proper GFCI protection or if the line/load terminations are miswired and shall provide visual indication of power status, trip conditions, ground fault conditions and end-of-life status.
- D. Each wiring device shall have a plate (see "Finishes" section below for specific requirements).

2.2 FINISHES

- A. All wiring devices (switches, receptacles, etc.) shall be colored to match the coverplates described below. For instance, all items covered by stainless steel, aluminum or malleable iron plates shall be gray in color.
 - 1. Exceptions:
 - a. Emergency wiring devices shall be red.
 - b. Isolated ground wiring devices shall be orange.
- B. Coverplates for recessed, wall-mounted electrical items (switches, receptacles, telephone outlets, etc.) shall be stainless steel unless shown otherwise.
- C. Coverplates, trim rings, etc. for recessed, floor-mounted electrical items (floor outlets, underfloor duct junctions, etc.) shall match finish of building hardware (302/304 stainless steel, brass, etc.) in area installed.
- D. Coverplates for exposed electrical items (switches, receptacles, telephone outlets, etc.) shall be of same material as exposed boxes (see Outlet Box Specification for required material type) and shall have beveled edges.
- E. Coverplates for receptacles in wet locations shall be metallic, in-use type, rated for wet locations per NEC requirements unless noted otherwise.
- F. See "Electrical Identification" specification section for coverplate labeling requirements.

PART 3 EXECUTION

3.1 GENERAL MOUNTING

- A. Symbols on drawings and mounting heights are approximate. The exact locations and mounting heights shall be determined on the job, and it shall be the Contractor's responsibility to coordinate with all trades to secure correct installation. For example, Contractor shall coordinate exact mounting heights over counters, in or above backsplashes, in block walls, and at other specific construction features.
- B. Verify all door swings with Architectural. Locate boxes for light switches within four inches of door trim on swing side (not hinge side) of door.
- C. Devices and associated plates shall not be used as support; outlet boxes shall be rigidly supported from structural members.
- D. Mount all straight-blade receptacles vertically with ground pole up, unless specifically noted otherwise.
- E. Unless otherwise shown or required by local handicap codes, outlet boxes shall be the following distances above the finished floor unless otherwise noted.
 - 1. Receptacles and telephone outlets in offices and other finished areas: 1'-6" to the center of the box.
 - 2. Receptacles and telephone outlets in equipment rooms and other unfinished areas: 4'-0" to the center of the box.
 - 3. Receptacles over counters: As Noted
 - 4. Switches, general: 4'-0" to the top of the box.
 - 5. Fire Alarm Pull Stations: 4'-0" to the top of the box.
 - 6. Fire Alarm Audio/Visual Devices: As shown on fire alarm shop drawings (Entire lens shall be above 80" and below 96" per NFPA 72).
 - 7. Push-button, etc., general: 4'-0" to the top of the box.
 - 8. Other device types: verify with engineer prior to rough-in.

END OF SECTION 262726

PART 1 GENERAL

1.1 DESCRIPTION

- A. Safety Switches
- B. Fuses
- C. Branch Feeders
- D. Feeders

PART 2 PRODUCTS

2.1 SAFETY SWITCHES

- A. Safety switches shall be quick-make, quick-break, NEMA heavy duty type HD, fused or nonfused as shown. Switch blades shall be fully visible in the off position.
- B. Safety switches shall be furnished with transparent internal barrier kits to prevent accidental contact with live parts. Barriers shall provide finger-safe protection when the switch door is open and shall allow use of test probes and removal of fuses without removing barrier.
- C. Fused switches shall have provisions for class R, rejection type fuses.

2.2 FUSES (600V)

- A. Fuses for all branch switches shall be Bussman Mfg. Co., Dual Element, Class "R" Fusetron.
- B. Fuses for main switch/switches shall be Bussman Mfg. Co. Hi-Cap.

2.3 MANUFACTURER

- A. Safety switches shall be as manufactured by Square 'D', G.E., Siemens or Cutler Hammer.
- B. Fuses shall be as manufactured by Bussman Mfg. Co. or equal.

PART 3 EXECUTION

3.1 SAFETY SWITCHES

- A. Safety switches shall be installed as shown on the plans and in accordance with N.E.C.
- B. Locations shown for safety switches on plans are diagrammatical only. Exact locations shall be field coordinated by contractor as required to provide code-required clearances.
- C. Switch enclosures shall be rated NEMA I indoors in dry locations and NEMA3R outdoors and in wet areas.
- D. Adequate support shall be provided for mounting safety switches. Safety switches shall not be mounted to the associated equipment (unless the safety switch is furnished with the equipment).

3.2 FUSES

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SAFETY SWITCHES AND FUSES**

SECTION 26 2816 – PAGE 2 OF 2

- A. Fuses shall be sized as shown on drawings, unless a smaller size is required by the associated equipment supplier, in which case the contractor shall provide fuses sized as directed by the associated equipment supplier at no additional cost.
- B. Provide not less than one spare set of fuses for each size used. Provide an additional spare set for each five sets of same size fuses used.

END OF SECTION 262816

PART 1 GENERAL

1.1 SCOPE

- A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.
- B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.
- C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.2 CODES AND STANDARDS

- A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of the latest editions of the following standards/codes where applicable:
 - 1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 - 2. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 3. International Building Codes.
 - 4. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - 5. NFPA99 – Essential Electrical Systems for Health Care Facilities.
 - 6. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- B. The generator set and supplied accessories shall meet the requirements of the latest editions of the following standards where applicable:
 - 1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
 - 2. UL142 – Sub-base Tanks
 - 3. UL1236 – Battery Chargers
 - 4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.
- C. The generator set and supplied accessories shall meet all applicable Environmental Protection Agency (EPA) TIER Emission Level or Emission Certification requirements and any local requirements in effect at the time the generator set is ordered (for the proposed location of the generator).
- D. The control system for the generator set shall comply with the following requirements.
 - 1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - 2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - 3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 4. FCC Part 15, Subpart B.
 - 5. IEC8528 part 4. Control Systems for Generator Sets

6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
 8. UL1236 –Battery Chargers.
- E. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

- A. Caterpillar
- B. Cummins/Onan
- C. Taylor

PART 2 PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set assembly (including both the motor/engine assembly and the generator assembly) shall operate at 1800 rpm, and the generator shall produce a 60 Hz waveform.
2. Voltage and phase ratings shall be as shown on plans.
3. Minimum kW rating (and associated alternator sizing) shall be the greater of the following:
 - a. Minimum kW rating listed on plans.
 - b. Ratings required to provide skVA as follows (shall be documented with reports in submittals using generator sizing software described in Part 3 below):
 - 1) If so listed on plans, the step loads fed by the generator at voltage/frequency dip criteria specified.
 - 2) If so listed on plans, the skVA rating specified.
 - 3) If neither of the above are listed on plans, generator shall be sized to accommodate a block load of 100% of the Total Demand Load listed on plans, with a maximum voltage dip of 20% and a maximum frequency dip of 10%.
4. kVA rating shall be 1.25 times the kW rating (based on .8 PF).
5. Unless shown otherwise on plans, the generator set shall be rated based on the following site conditions:
 - a. Altitude of project site.
 - b. Ambient temperatures up to 120 degrees F.
6. The generator set rating shall be based on emergency/standby service unless noted otherwise.
7. The generator set shall be IBC Seismic Rated.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.
3. The engine-generator set shall be capable of accepting a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Minimum motor starting capability shall be as shown on plans. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified skVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 20% unless shown otherwise on plans.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. The engine-generator set shall be rated for the seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.
3. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept compression terminations of the number and size as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required overcurrent protection located at panelboard(s) external to the generator set unless shown otherwise on plans. Where a load center or panelboard is shown within the generator enclosure on the plans, this load center/panelboard shall be furnished with the generator and shall comply with the applicable panelboard and identification sections of this specification.
3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.2 ENGINE AND ENGINE EQUIPMENT

- A.** The engine shall be diesel, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:
1. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating

- to start disconnect speed, accelerating to rated speed and operating in various isochronous or parallel states. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.
2. Skid-mounted radiator and cooling system rated for full load operation in 120 degrees F (49 degrees C) ambient as measured at the generator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H₂O restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.
 3. Electric starter(s) capable of three complete cranking cycles without overheating.
 4. Positive displacement, mechanical, full pressure, lubrication oil pump.
 5. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
 6. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
 7. Replaceable dry element air cleaner with restriction indicator.
 8. Flexible supply and return fuel lines.
 9. Engine mounted battery charging alternator and solid-state voltage regulator.
 10. Block heater
 - a. Engine mounted, thermostatically controlled, block heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
 - b. The block heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The block heater installation shall be specifically designed to provide proper venting of the system. The block heaters shall be installed using quick disconnect couplers to isolate the heaters for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
 - c. The block heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the block heater system.
 - d. The block heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification. If the heater quantities or wattage ratings are different than shown on plans, contractor shall be responsible for providing the properly-rated circuits (with circuit breakers) as required to the heater(s).
 11. Provide vibration isolators, spring & pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
 12. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.
 13. Provide critical-grade exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. Exhaust system

shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

14. A UL listed/CSA certified voltage regulated battery charger shall be provided for each engine-generator set. The charger shall be located at the generator unless shown otherwise on plans. Output amperage, Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

- a. Loss of AC power - red light
- b. Low battery voltage - red light
- c. High battery voltage - red light
- d. Power ON - green light and N.O. relay contact

2.3 FUEL TANK

- A. Refer to "Sub-Base Fuel Tank" Paragraph below for fuel tank requirements.

2.4 AC GENERATOR

- A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.
- B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
- D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.5 GENERATOR SET CONTROL

- A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.
- B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
- C. The generator set mounted control shall include the following features and functions:
 - 1. Control Switches

- a. **Mode Select Switch.** The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - b. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
 - c. **EMERGENCY STOP switch.** Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
 - d. **RESET switch.** The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 - e. **PANEL LAMP switch.** Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
2. **Generator Set AC Output Metering.** The generator set shall be provided with a metering set including the following features and functions:
- a. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
 - b. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
 - c. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.
3. **Generator Set Alarm and Status Display.**
- a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright exterior day lighting conditions.
 - b. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
 - 1) low oil pressure (warning)
 - 2) low oil pressure (shutdown)
 - 3) oil pressure sender failure (warning)
 - 4) low coolant temperature (warning)
 - 5) high coolant temperature (warning)
 - 6) high coolant temperature (shutdown)
 - 7) high oil temperature (warning)
 - 8) engine temperature sender failure (warning)
 - 9) low coolant level (warning or shutdown - selectable)
 - 10) fail to crank (shutdown)
 - 11) fail to start/overcrank (shutdown)
 - 12) overspeed (shutdown)
 - 13) low DC voltage (warning)
 - 14) high DC voltage (warning)
 - 15) weak battery (warning)

- 16) low fuel (warning)
 - 17) high AC voltage (shutdown)
 - 18) low AC voltage (shutdown)
 - 19) under frequency (shutdown)
 - 20) over current (warning)
 - 21) over current (shutdown)
 - 22) short circuit (shutdown)
 - 23) ground fault (warning) (if genset breaker is rated 1000A or greater)
 - 24) over load (warning)
 - 25) Genset circuit breaker tripped (warning)
 - 26) emergency stop (shutdown)
 - 27) Provisions shall be made for indication of four (4) customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions.
4. Engine Status Monitoring.
- a. The following information shall be available from a digital status panel on the generator set control :
 - 1) engine oil pressure (psi or kPA)
 - 2) engine coolant temperature (degrees F or C)
 - 3) battery voltage (DC volts)
 - 4) engine oil temperature (degrees F or C)
 - 5) engine speed (rpm)
 - 6) number of hours of operation (hours)
 - 7) number of start attempts
 - b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
5. Engine Control Functions.
- a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
 - b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
 - c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
 - d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
 - e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.
6. Alternator Control Functions:
- a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The

voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, with local indication of setting level.

- b. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
- c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. This protection may be provided using a microprocessor-based programmable relay system designed to protect the alternator system from damage, or using programmable electronic-trip LSI breaker(s), programmed/set by the generator supplier to ensure full protection of the alternator system.
- d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
- e. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
- f. When required by National Electrical Code or indicated on project drawings, the control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

7. Other Control Functions

- a. The generator set shall communicate with the Automatic Transfer Switch via hardwired control connections as required.
- b. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
- c. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is out of acceptable limits. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

2.6 GENERATOR REMOTE ANNUNCIATOR

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERATOR SETS**

SECTION 26 3213– PAGE 9 OF 15

- A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 requirements.
- B. Provide engraved nameplate at annunciator panel indicating associated generator name.
- C. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel. Transient Voltage Surge Suppression shall be provided on both ends of any interconnecting wiring (between the annunciator and other system components) that extends outside of a building.
- D. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

<u>Condition</u>	<u>Lamp Color</u>	<u>Audible Alarm</u>
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red	Yes
	(Flashing)	
Emergency Stop	Red	Yes
	(Flashing)	
Genset CB tripped/off	Red	Yes
	(Flashing)	
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
Other conditions as required by NFPA 110	As Required	As Required
(2) Spares	Configurable	Configurable

2.7 GENERATOR REMOTE MANUAL STOP STATION

- A. Each generator set shall be furnished with a remote manual stop station of a type to prevent inadvertent or unintentional operation per NFPA 110 requirements.

- B. Stop station pushbutton shall be red, non-illuminated, push-pull, mushroom-type, maintained-contact, 1 5/8" diameter, 30mm base, heavy-duty, oil-tight, water-tight unit) mounted within guarded enclosure to prevent inadvertent operation and labeled with engraved nameplate (white letters on red background) to read: "GENERATOR EMERGENCY STOP" (or similar with specific generator name where so identified on drawings).
- C. Exact stop station type shall be coordinated with generator controls supplier to ensure a fully-functional system per NFPA 110 requirements.

2.8 GENERATOR MAIN LINE CIRCUIT BREAKER(S)

- A. The generator set shall be provided with a mounted main line circuit breaker(s), sized as shown on plans. The circuit breaker(s) shall incorporate an electronic trip LSI-type unit that operates to protect the alternator under all overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.
- B. The main line circuit breaker(s) shall be provided with auxiliary contacts to indicate trip/off alarm conditions to the generator set control system.

2.9 OUTDOOR WEATHER-PROTECTIVE ENCLOSURE

- A. The generator set shall be provided with a weatherproof, sound-attenuated, outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (if applicable) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.
- B. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 76 dBA (including exhaust noise) at any location 7 meters from the generator set in a free field environment:
- C. The enclosure shall include vertical air discharge hoods as required to redirect discharge air upwards and reduce noise accordingly.
- D. The enclosure shall be insulated with non-hygroscopic materials.
- E. The enclosure shall be rated for the wind and seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.
- F. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
 - 1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
 - 2. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
 - 3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
 5. Salt Spray, per ASTM B117-90, 1000+ hours.
 6. Humidity, per ASTM D2247-92, 1000+ hours.
 7. Water Soak, per ASTM D2247-92, 1000+ hours.
- G. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
- H. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.
- I. A factory-mounted critical exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
- J. The enclosure shall include the following maintenance provisions:
1. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
 2. External radiator fill provision.
- K. If so shown on the plans, provide a factory-mounted and wired electrical distribution panel to serve the generator set and enclosure. The provisions required include:
1. 100-amp distribution panelboard installed inside enclosure and fed by a 120/208VAC power feeder installed by the contractor (unless shown otherwise on plans).
 2. Two duplex GFI receptacles, one inside the enclosure, and a weatherproof receptacle on the outside of the enclosure (all factory-wired).
 3. Two three-way switches controlling three AC lamps mounted in vapor tight and gasketed fixtures (all factory-wired).
 4. Factory-wired normal AC service from the panelboard to the engine coolant and alternator heaters, and battery charger.

2.10 SUB-BASE FUEL TANK

- A. Provide a sub-base fuel tank for the generator set, sized to allow for full load operation of the generator set for 30 hours. The sub-base fuel tank shall be UL142 listed and labeled. Installation shall be in compliance to NFPA37. The fuel tank shall be a double-walled, steel construction and include the following features:
1. Emergency tank and basin vents.
 2. Mechanical level gauge.
 3. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
 4. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
 5. High and low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level
 6. Basin drain.
 7. Integral lifting provisions.
- B. The equipment, as installed, shall meet all local and regional requirements for above ground tanks.

- C. Where the generator design/layout, sub-base fuel tank height, and/or concrete housekeeping pad for the generator set causes any circuit breaker handle, control device, metering display or other similar item to be located higher than 6'-7" above finished floor, the supplier shall provide an aluminum grating platform complete with stairs and handrails meeting all applicable code requirements for proper access to these items. The platform and stairs shall be permanently mounted to a concrete base as recommended by the system supplier. Alternatively, the supplier may relocate (at the factory) these items to be below 6'-7" above finished floor.

2.11 SEQUENCE OF OPERATION

- A. The maximum elapsed time allowed from loss of normal power to restoration of power to emergency circuits from generator through transfer switch shall be 10 seconds.
- B. Generator set shall start upon receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control.
 - 1. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
- C. The generator set shall complete a time delay start period as programmed into the control.
- D. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
 - 1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
 - 2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
 - 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
 - 4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand or load govern state.
- E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
- F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
- G. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

PART 3 EXECUTION

3.1 SUBMITTALS.

- A. Within 10 days after award of contract, provide six sets of the following information for review:

1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
2. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
3. Manufacturer's certification of prototype testing.
4. Manufacturer's published warranty documents.
5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
7. Generator sizing software report(s) showing compliance with all specification requirements and any additional motor starting requirements indicated in contract documents.
8. Time-current-curves demonstrating that the generator alternator relaying or breaker protective device(s) provide proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator.
9. Manufacturer's installation instructions.

3.2 FACTORY TESTING.

- A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.
- C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.3 INSTALLATION

- A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- B. Installation of equipment shall include furnishing and installing all interconnecting wiring, fuel lines, etc. between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Generator equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- D. Remote stop station type, labeling and location shall be submitted by contractor to engineer and local fire marshal for approval prior to rough-in. Location shall be outside the room housing the prime mover (where so installed within a room) or elsewhere on the premises where the prime mover is located outside the building. Contractor shall provide all interconnections from remote stop station to generator set as required by generator set supplier for a fully-functional system.

- E. Equipment shall be initially started and operated by representatives of the manufacturer.
- F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.4 ON-SITE ACCEPTANCE TEST:

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.
- B. Installation acceptance tests to be conducted on-site shall include the following (performed in accordance with NFPA 110):
 - 1. "Cold start" test.
 - 2. Four (4) hour full load test. Provide resistive load banks and make temporary connections as required.
 - 3. One step rated load pickup test.
 - 4. Power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.
- C. Upon completion of the manufacturer's site start-up and checkout, the contractor shall leave the diesel tank half full of fuel for use by the owner.

3.5 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to not less than 5 persons. Training date shall be coordinated with the facility owner.

3.6 SERVICE AND SUPPORT

- A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set shall be distributed and serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The manufacturer of the generator set shall own, maintain and make available (to engineer, free of charge) generator set sizing software that calculates voltage dip, frequency dip, THDI and THDV of proposed generator/alternator set using the following inputs:
 - 1. Summary of step loads including load type (across-the-line motor, VFD, Fire Pump, Fluorescent Lighting, UPS, etc.).
 - 2. Generator Set Duty (Standby, Prime, Continuous).
 - 3. Maximum Ambient Temperature.
 - 4. Project site altitude.
 - 5. Generator Fuel type.

6. Voltage/Phase/Frequency.

D. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.7 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 263213

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install a three-phase continuous duty, on-line, double conversion, solid-state uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the building electrical system to provide power conditioning, back-up and distribution for critical electrical loads. The UPS shall consist of, as required by the project, the UPS module, battery cabinet(s), and accessory or “option” cabinet(s) for transformers, maintenance bypass, parallel tie, and distribution applications, and other features as described in this specification.
- B. UPS Supplier shall provide external wall mounted, 3 breaker maintenance bypass switch.

1.2 SYSTEM DESCRIPTION

- A. Standard UPS system will include a minimum of (1) rectifier, (1) inverter, (1) static bypass, (1) maintenance bypass, and (1) battery system.
- B. Components:
 - 1. Rectifier
 - 2. Inverter
 - 3. Sealed Lead Acid Batteries
 - 4. Battery Charger
 - 5. Automatic Bypass
 - 6. User Interface Panel
 - 7. Serial (RS-232) Communication Interface
 - 8. Communication Card Slots (2)
 - 9. Remote Emergency Power Off Contacts
 - 10. Relay Output Contact (1)
 - 11. Environmental Inputs (2)
 - 12. Hardwired Input, Output
 - 13. Maintenance Bypass Module
 - 14. MBP internal to UPS module (standard)
 - 15. External MBP
- C. Definitions
 - 1. UPS Module: The portion of the UPS system which contains the rectifier, battery charger, inverter, static bypass switch, maintenance bypass switch, controls, monitoring, and indicators.
 - 2. Rectifier and Charger: The portion of the UPS module which converts the normal source AC input power to DC power for the inverter input and for charging the battery.
 - 3. Inverter: The portion of the UPS module that converts DC power, from either the rectifier/charger or the battery, to regulated and filtered AC power that is supplied to the critical load.
 - 4. Automatic Bypass Switch: The portion of the UPS module which automatically transfers the critical loads, without interruption, from the inverter output to the bypass AC power source in the event of an overload or degradation of the inverter's performance.
 - 5. Maintenance Bypass Switch: The portion of the UPS module which is used to connect the bypass AC power source to the critical loads while electrically isolating the static bypass switch, rectifier/charger and inverter for maintenance purposes.
 - 6. Battery: The battery system that provides DC power to the inverter input when the normal AC input power to the UPS module fails or in the event that the rectifier/charger should fail.

7. Critical Loads: Those loads that require regulated continuous AC power and which are connected to the output of the UPS module.

D. SYSTEM OPERATION

1. Normal During the Normal or Double-conversion Mode the rectifier shall derive power as needed from the commercial AC utility or generator source and supply filtered and regulated DC power to the online inverter. The inverter shall convert the DC power to highly regulated and filtered AC power for the critical loads.
2. Battery Upon failure of the AC input source, the critical load must continue to be supplied by the inverter without switching. The inverter must obtain its power from the battery. There must be no interruption in power to the critical load upon failure or restoration of the AC input source.
3. Recharge Upon restoration of the AC input source, the rectifier/battery charger must recharge the battery. The inverter shall, without interruption of power, regulate the power to the critical load.
4. Bypass: The static bypass switch must be used for transferring the critical load to the AC utility supply without interruption and shall be rated for continuous operation. Automatic re-transfer to normal operation must also be accomplished without interruption of power to the critical load. The static bypass switch must be capable of manual operation.
5. Maintenance bypass: A wall-mountable maintenance bypass switch is available; however, in the absence of this feature, the integral maintenance bypass switch should be used. The maintenance bypass is used for supplying the load directly from the AC utility supply, while the UPS is isolated for maintenance or repair.

1.3 QUALIFICATIONS

- A. The manufacturer of the unit shall have a minimum of forty years experience in the design, manufacture and testing of Uninterruptible Power Supplies.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001.
- C. Provide Seismic tested equipment as follows: With bracing kit, the equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application.
- D. UPS shall be manufactured by Eaton or approved equal.

1.4 STANDARDS

- A. The UPS shall be designed, manufactured and tested in accordance with the applicable portions of the following standards:
 1. UL 1778 - UPS Standard.
 2. NFPA 70 - National Electrical Code.
 3. IEEE 446 - Recommended Practice for Standby Power Systems.
 4. IEEE C62.41 - Recommended Practice for Surge Withstandability.
 5. NEMA PE 1 - Uninterruptible Power Systems.
 6. OSHA - Occupational Safety and Health Association.
 7. FCC Class A

1.5 SUBMITTALS

- A. With Proposals: Catalog cuts describing the proposed equipment shall be submitted with the proposal. All deviations to this specification shall be listed and included with the proposal.

B. After Construction of Equipment:

1. An Operations and Maintenance Manual shall be furnished with the UPS, and shall include as a minimum the following:
 - a. General information.
 - b. Safety precautions.
 - c. Installation instructions.
 - d. Operating instructions.
2. One certified copy of the factory test report shall be furnished upon request.

C. After Installation of Equipment: A signed service report describing start-up and on-site testing shall be furnished after start-up of the equipment.

1.6 DELIVERY, STORAGE AND HANDLING

- A. The UPS module shall be palletized and shipped via air ride or common carrier, as specified by the customer.
- B. Shipping splits shall be provided such that no section is more than 48" long.

1.7 SITE CONDITIONS

- A. The UPS shall be designed for indoor installation with ambient temperatures from 32° - 104°F (0 - 40°C), 77°F ±5°F (25°C) for the battery and relative humidity from 0 - 95% non-condensing.

1.8 WARRANTY

- A. The manufacturer shall state his warranty of the equipment. In no case shall it be less than twelve (12) months after start-up or fifteen (15) months after shipment, whichever occurs first.
- B. The battery cell manufacturer's standard warranty shall be passed through to the end user.

PART 2 ELECTRICAL

2.1 ELECTRICAL CHARACTERISTICS

A. System Input

1. Input Voltage Operation Range
 - a. Nominal 208/120 or 220/127 VAC, 4-wire plus ground
 - b. Nominal 480 or 600 VAC available with optional input transformer in matching enclosure, 3-wire plus ground
 - c. +10% to -15% from nominal
2. Input Frequency
 - a. 45 to 65 Hz
 - b. auto-sensing
 - c. capable of 50 to 60 Hz or 60 to 50 Hz frequency conversion

3. Input Power Factor: 0.99 typical
4. Input Current Distortion: 5% THD maximum at full rated linear load
5. Inrush Current:
 - a. <2x branch rating without input transformer
 - b. <5x branch rating with input transformer
6. Surge Protection:
 - a. Line to Line 180J
 - b. Line to Ground 450J

B. System Output, Normal Mode -Nominal Output Voltage

1. 208/120, or 220/127 VAC, Selectable through front panel or through serial port connection with power management software, (or 480 VAC with optional output isolation transformer in matching cabinet)
2. Voltage regulation: +/-2% of selected output voltage in steady state
3. Transient Voltage Response: Meets Class 1 performance of IEC62040-3; +/-5% for 100% step load change; recovery in <1ms
4. Voltage THD:
 - a. 2% Total Harmonic Distortion (THD) maximum phase to neutral into a maximum rated linear load (5% phase to phase)
 - b. 5% THD maximum phase to neutral into a maximum rated non-linear load (7% phase to phase)
5. Nominal Frequency: 50 or 60 Hz selectable
6. Frequency Regulation:
 - a. 50/60 Hz +/- 0.5 to +/- 3.0 Hz selectable, synchronized to mains, +/- 0.005 Hz free running single units
 - b. +/- 0.15 Hz parallel units
7. Slew rate:
 - a. selectable to 1.0, 2.0, 3.0 Hz/s for single units,
 - b. < 0.5 Hz/s for parallel units;
 - c. Generator Mode (6 / 7.5 Hz/s) for single units selectable through software parameters that can be configured via LCD and service PC interface
8. Output Current: Maximum output current (at nominal output voltage) for the UPS shall be:
 - a. 20 kVA system: 55 A @ 208 V, 52 A @ 220 V
 - b. 30 kVA system: 83 A @ 208 V, 79 A @ 220 V
9. Current Overload Capability without Bypass:
 - a. 125% for 1 min
 - b. 150% for 5 seconds
 - c. >150% for 300 ms
10. Current Overload Capability with Bypass enabled"

- a. 1500A for ½ cycle
- b. 1000A for 0.1 sec
- c. 600A for 1 sec

11. Bypass:

- a. Automatic bypass shall provide an alternate path to power in the case of overload, inverter failure or other UPS failure
- b. External Maintenance Bypass can be utilized with the UPS to allow servicing of the UPS
- c. Transfer time to and from any internal bypass shall be no-break

12. Efficiency: Typical >91% while in normal mode, with nominal line conditions

C. System Output, Battery Mode

- 1. Nominal Output Voltage: This shall be the user-selected output voltage
- 2. Voltage Regulation: +/-1% phase to neutral of selected nominal voltage (+/-2% phase to phase)
- 3. Transient Voltage Response
 - a. Meets Class 1 performance of IEC62040-3
 - b. +/-5% for 100% step load change; recovery in <1ms
- 4. Voltage THD:
 - a. 2% Total Harmonic Distortion (THD) maximum into a maximum rated linear load
 - b. 5% THD maximum phase to neutral into a maximum rated non-linear load (7% phase to phase)
- 5. Frequency Regulation: +/-0.005 Hz of selected nominal frequency
- 6. Overload Capacity:
 - a. 125% for 1 min
 - b. 150% for 5 seconds
 - c. >150% for 300 ms

2.2 CONSTRUCTION

- A. The UPS system is initially provided as a single-module, non-redundant system. The UPS shall be field-upgradeable for additional parallel capacity or for redundant operation. The system can be configured with numerous options, including:
 - 1. External Matching Battery Cabinets
 - 2. Several Connectivity Options
 - 3. Wall-mounted Maintenance Bypass Cabinet
 - 4. Wall-mounted Hot-tie Cabinet with Bypass
 - 5. Matching Options Cabinet with:
 - a. Maintenance Bypass Switch
 - b. Input Transformer
 - c. Bypass Transformer
 - d. Output Transformer
- B. Converter (rectifier): Incoming power shall be filtered and converted to DC by a sine-wave rectifier. The rectifier corrects the input power factor to 0.99 and draws sinusoidal current (with less than 5%

THD) from the utility. In the event of utility failure, the DC-DC converter shall be supplied power without interruption from the internal or external batteries.

1. Overload Capacity: The converter shall be capable of supplying up to 150% of rated load for at least five (5) seconds if no bypass is available.
- C. Inverter: The inverter utilizes IGBT technology and Digital Signal Processing to convert the DC power from the rectifier or converter to regulated AC power for output to critical loads.
1. Output Voltage: The inverter output voltage is specified in section 1.12.B.
 2. Voltage Regulation: The inverter steady state voltage regulation is +/- 1% phase to neutral, 2% phase to phase. Dynamic regulation meets Class 1 performance of IEC62040-3.
 3. Frequency Control: The inverter steady state frequency regulation is +/-0.005 Hz, free running in steady state. UPS is synchronized to Utility in normal operation.
- D. Mechanical Construction
1. All materials and components of the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid-state.
 2. The UPS unit is comprised of an input rectifier, battery charger, inverter, bypass, and battery consisting of the appropriate number of sealed battery modules and shall be housed in a single freestanding enclosure. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Casters and leveling feet shall be provided as standard.
 3. Option Cabinets match the UPS cabinet, and may contain, input, bypass, or output transformers, and may include a rotary Maintenance Bypass Switch

2.3 SYSTEM INPUT & OUTPUT CONNECTIONS

- A. AC Input:
1. All UPS units shall be capable of utilizing hardwired input. Input, Bypass, and/or output terminals may be placed in Option cabinets as determined by system configuration. Option cabinets will contain sufficient power cabling to connect to the UPS power terminals when the Option cabinets are placed adjacent to the UPS.
 2. Input neutral is required for proper UPS operation unless input transformer option is used.
- B. AC Output:
1. All UPS units shall be capable of utilizing hardwired output
- C. Extended Battery Connector: External battery cabinets include cable to connect each battery cabinet to the UPS or daisy chain external battery cabinets.
- D. Remote Emergency Power Off (REPO) Connection: The UPS shall provide a built-in landing for field connection of a Remote Emergency Power Off circuit. Upon initiation of the REPO circuit, the UPS shall open its input relays, and disengage the battery converter, preventing power from being delivered to the attached loads.
- E. Serial (RS-232) Communication Interface: A 9-pin sub-D connector shall provide capability for communicating with manufacture-supplied software package. The UPS shall also provide signals for indication of UPS alarm status.

- F. (2) Communication Card Slots: The UPS shall provide (2) communication X-slots in the back of the UPS allowing for additional connectivity options, including SNMP/Web, AS/400 relays, Modbus/Jbus capabilities, etc.
- G. (2) Programmable Input Connections: The UPS shall provide built-in inputs for field connection (environmental input). The inputs shall be parameter programmable to suit the needs of the application.

2.4 USER INTERFACE

- A. Front Panel Display: The UPS shall include a front panel display consisting of a graphical LCD display with backlight, four status LED's, and a four-key keypad.
 - 1. Graphical LCD display: Includes basic language (English and local selectable language), display of unit function and operating parameters. It shall be used to signify the operating state of the UPS, for indicating alarms, for changing operations control parameters and set points.
 - 2. Four status LED's, which indicate:
 - a. Alarms, with a red LED
 - b. On Battery, with a yellow LED
 - c. On Bypass, with a yellow LED
 - d. Power On, with a green LED
 - 3. Four-Key Multifunction Keypad: UPS shall have keypad to allow user to adjust UPS parameters, view alarm and inverter logs, change UPS operational modes, and turn the UPS on and off.
- B. Power Management Software Package: The UPS shall include serial communications interface that provides the following communication capabilities:
 - 1. Monitor and graphically display input and output voltage and other operating characteristics
 - 2. Notify end-users in the event of a power anomaly via network, E-mail or page.
 - 3. Communication Ports:
 - a. Communication Card Slots: The UPS shall provide (2) communication X-slots in the back of the UPS allowing for additional connectivity options, including SNMP/Web, AS/400 relays, Modbus/Jbus capabilities, etc
 - b. Serial communications (via RS-232) with manufacturer-supplied power management software package

2.5 COMMUNICATIONS

- A. Provide UPS with Network Card and Industrial Relay Card for Building Management System or remote notification

2.6 BATTERIES

- A. Battery Type: Valve Regulated Lead Acid (VRLA), minimum two-year warranted float service life at 25 degrees C
- B. UPS Holdover Time (Runtime): Each UPS system, consisting of a minimum of six battery strings (108 battery blocks) for each power module shall have a minimum holdover time of 11 minutes.
- C. Extended Holdover Time (Runtime): Each UPS system shall have capability for addition of extra matching battery cabinets (in two cabinet configurations) to increase the total holdover time. P

D. Battery Recharge Time:

1. Base UPS system consisting of six (6) battery strings will have a recharge time of max. 1.75 hours to 95% usable capacity @ nominal line after a full load discharge (30 kVA).

E. Bus Voltage: Nominal bus voltage is 216 VDC. Each string consists of 18 battery blocks in series with 9 Ah capacities.

F. Battery Protection:

1. Short Circuit Protection: Over-current protection shall protect the batteries from all short circuit fault conditions
2. Battery Module Protection: Internal battery circuit breaker shall be provided
3. Under-voltage Protection:
 - a. Inverter cutoff voltage: Battery operation shall be terminated when the battery voltage drops to the 1.67 VPC set point
 - b. Protective shutdown voltage: Inverter shall shutdown after 1 minute when the battery voltage drops below 1.7 VPC volts-per-cell typical
4. Over-voltage Protection: If the UPS system's battery bus voltage exceeds the predetermined set point then the UPS will disable the charger and alarm a high battery condition

G. Advanced Battery Management:

1. Battery recharge: After recharging batteries to full capacity, the charger will enter the rest mode to increase the battery lifetime according the ABM cycle. Hence, continuous float charging of the battery shall not be allowed. The active battery charger states are constant-current (charge mode), constant-voltage (float mode) and no-charge (rest mode).
2. Battery Runtime Monitoring: UPS shall monitor batteries and provide status to end user of battery runtime via front panel, serial communications, or both. Runtime calculations to be based on load demand and analysis of battery health.
3. Battery Health Monitoring: UPS shall periodically test and monitor battery health and provide warnings visually, audibly and/or serially when battery capacity falls below 80% of original capacity. Battery testing may also be user initiated via front panel or serial communications.

2.7 EXTERNAL WALL MOUNTED MAINTENANCE BYPASS SWITCH

- A. UPS supplier shall provide 3 breaker external maintenance bypass switch as specified on drawings to allow complete UPS replacement without loss of utility power to UPS load.

PART 3 EXECUTION

3.1 MANUFACTURING

- A. The manufacturer shall design, build, test and arrange for shipment of the UPS.
- B. The manufacturer shall prepare and deliver the required installation drawings and operation and maintenance manuals with the equipment.

3.2 SITE PREPARATION

- A. The owner shall prepare the site for installation of the equipment.

- B. The owner shall arrange for installation of the equipment.
- C. The equipment shall be installed in accordance with the manufacturer's recommendations as well as in accordance with local and national electrical codes.

3.3 FIELD QUALITY CONTROL

- A. The equipment shall be commissioned and energized by an authorized representative of the equipment manufacturer. A signed service report shall then be submitted after equipment is operational to initiate the warranty.

END OF SECTION 263353

PART 1 GENERAL

1.1 SCOPE

- A. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: voltage sensors on all phases of both sources, power switch mechanism, permanently attached manual operation provisions, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.
- B. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product shall service the transfer switches.

1.2 CODES AND STANDARDS

- A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
 - 1. CSA 282, Emergency Electrical Power Supply for Buildings
 - 2. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - 3. NFPA99 – Essential Electrical Systems for Health Care Facilities
 - 4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
 - 5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 6. NEMA ICS10-1993 – AC Automatic Transfer Switches.
- B. The transfer switch assembly shall comply with the following standards:
 - 1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - 2. EN55011, Class B Radiated Emissions
 - 3. EN55011, Class B Conducted Emissions
 - 4. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
 - 5. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
 - 6. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
 - 7. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
 - 8. IEC 1000-4-6 Conducted Field Immunity
 - 9. IEC 1000-4-11 Voltage Dip Immunity.
 - 10. IEEE 62.41, AC Voltage Surge Immunity.
 - 11. IEEE 62.45, AC Voltage Surge.
 - 12. UL1008 – Transfer Switches. Transfer switches shall be UL1008 (latest edition) listed. UL1008 transfer switches may be supplied in UL891 enclosures if necessary to meet the physical requirements of the project.
- C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

- A. Cummins/Onan
- B. Caterpillar

- C. Zenith
- D. Russelectric
- E. ASCO
- F. Eaton

PART 2 PRODUCTS

2.1 POWER TRANSFER SWITCH

A. Ratings

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes equal to or greater than the required ratings shown on the drawings (at the specified voltage). The transfer switch shall be third party listed and labeled for use with the specific protective device(s) (both normal and emergency) installed in the application. All rating information including associated overcurrent devices shall be submitted with shop drawings. Where WCR is dependent on setting of upstream overcurrent device, transfer switch shall be field marked with the required settings of the associated device. When a power distribution system electrical study (including short circuit stud, etc.) is a part of the project, contractor shall further verify that all proposed equipment is properly rated (per the results of the study) prior to submitting shop drawings. The transfer switch and its upstream protection shall be coordinated.
5. Transfer switch ATS-CR shall be IBC seismic rated.

B. Construction

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches shall be of the Programmed (Delayed) Transition type. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.
3. The switch shall completely disconnect the load from both sources for an adjustable period of time to allow regenerative voltage to decay to a safe level prior to connecting to the new source.
4. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
5. All wiring shall be UL listed 105 degree C, 600 volt rated, and sized as required. Each wire, device or function shall be identified with a source and destination by silk-screen or similar permanent identification. Circuit boards shall be connected wiring harnesses by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

6. Bus structures shall be constructed from silver plated copper or tin plated aluminum with bolted joints for all three phases, with a full neutral, and a 1/4 x 2 inch ground bus extending through all sections.
7. The framework and all other sheet metal components of the system shall be primed with a rust-inhibiting primer, and finished with two coats of satin finish ANSI 61 gray enamel, or manufacturer's standard color.
8. All door mounted control components shall be industrial type oil-tight devices with contact ratings a minimum of twice the maximum circuit ampacity they are controlling. Toggle switches and other light duty and durability control devices are not acceptable. Indicator lamps shall be high intensity LED type devices. Indicator lamp condition (on or off) shall be easily visible in bright room lighting conditions.
9. Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation or shall be indicated by mechanical flags. Barriers shall be provided to prevent inadvertent contact with any voltage of greater than 50VDC.
10. Transfer switches shall be 3-pole with a solid neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

C. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

2.2 TRANSFER SWITCH CONTROL

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
2. High intensity LED lamps to indicate that the transfer switch is "not in auto" (due to control being disabled or due to bypass switch (when used) enabled or in operation) and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.
3. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
4. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
5. "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via an operator display panel.
7. Digital display meter panel, to display 3-phase AC Amps, 3-phase AC Volts, Hz, KW load level, and load power factor.
8. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
 - a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be

**SHELBY COUNTY EMA & IT BUILDING PROJECT
AUTOMATED TRANSFER SWITCHES**

SECTION 26 3623– PAGE 4 OF 9

- displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
- b. Display source status, to indicate source is connected or not connected.
 - c. Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.
 - d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
 - 1) Set nominal voltage and frequency for the transfer switch.
 - 2) Adjust voltage and frequency sensor operation set points.
 - 3) Set up time clock functions.
 - 4) Set up load sequence functions.
 - 5) Enable or disable control functions in the transfer switch, including program transition.
 - 6) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
 - e. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall be incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
 - f. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
 - g. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls

- 1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
- 2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
 - a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
 - b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
 - c. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.
 - d. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
 - e. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.
 - f. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

**SHELBY COUNTY EMA & IT BUILDING PROJECT
AUTOMATED TRANSFER SWITCHES**

SECTION 26 3623– PAGE 5 OF 9

- g. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.
 - 3. The transfer control shall incorporate a series of diagnostic LED lamps.
 - 4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature. The program/delayed transition time setting (time in which load is not connected to either source during transfer) shall be initially set at 10 seconds to allow motors to properly decay per MG-1 standard
 - 5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).
 - 6. The transfer switch shall be configurable to accept a relay contact signal from an external device (while in emergency state) for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to source 2. If source 1 is available when the load-shed signal is received, the transfer switch shall connect to source 1.
 - 7. The transfer switch shall be configurable to accept a relay contact signal from an external device to prevent transfer to the generator service.
 - 8. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage surge and RFI/EMI standards.
 - 9. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
- C. Control Interface
- 1. The transfer switch shall provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
 - 2. The integrity of the generator remote start circuit shall be monitored for broken, disconnected or shorted wires. Loss of integrity shall start the generator.
 - 3. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
 - 4. The transfer switch shall provide additional relay contacts to indicate the following conditions: Utility Source Available, Load Connected to Utility, Generator Source Available, Load Connected to Generator, Pre-Transfer Warning (adjustable 0-59 second time delay).

2.3 ENCLOSURE

- A. Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.
- B. If not specifically indicated otherwise on plans, transfer switch equipment enclosures shall meet the following minimum requirements:
 - 1. For dry interior locations: NEMA 1 or better (unless shown otherwise on plans).
 - 2. For wet interior (pump stations, etc.) or exterior locations: NEMA 3R or better (unless shown otherwise on plans).
- C. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches

with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

- D. Note size and access requirements for the transfer switch (and associated equipment) and provide equipment that will fit into the space allowed and comply with code-specified access requirements.

2.4 MANUAL BYPASS-ISOLATION SWITCH

- A. ATS-CR: Transfer switch ATS-CR shall include (integral to the transfer switch assembly) transfer switch bypass and isolation equipment as described in this section. The bypass-isolation switch shall provide a means for manually bypassing the transfer switch from either source (Normal or Emergency) to the load, while under load if necessary, and to isolate the transfer switch from both sources for maintenance or repair. Designs that bypass to only one source are not acceptable under this specification.
- B. Bypass-isolation switch equipment shall be UL Listed per Standard 1008, CSA Approved; with continuous current rating, voltage and frequency ratings, and withstand and closing ratings equal to the transfer switch ratings at the specified conditions of ambient temperature, humidity, and altitude.
- C. The bypass-isolation and transfer switches shall be mechanically held in each position. Switching mechanisms shall be break before make on all poles, including the neutral pole on four pole switches. The switch mechanism shall be an over center toggle device which provides stored energy contact operation during both opening and closing. The speed of contact operation shall be independent of the force applied to the operating handles, which permit manual operation under load.
- D. Bypass switch shall be a fully rated manually operated switch, rated for the same loads as the automatic transfer switch. Bypass switch shall provide bypass to either normal or emergency source by use of a door-mounted keyed source selector switch and a permanently mounted external-operating handle. Equipment shall provide manual bypass without disturbance of the power supply to the load. Equipment requiring load isolation before bypass is not acceptable for use on this project.
- E. Equipment shall provide for manual bypass operation to the source opposite that to which the transfer switch is connected. This shall cause the transfer switch to go automatically to a position disconnected from both sources. Equipment that does not provide a rapid means of opposite source bypass is not acceptable under this specification.
- F. Positive mechanical interlocks shall prevent all possible source to source interconnections. Designs which depend on electrical interlocks to prevent source to source interconnections, or which intentionally interconnect the sources, are not acceptable. The interlock system shall assure a properly sequenced, mechanically guided bypass and isolation action.
- G. The equipment shall utilize automatic, solenoid-activated mechanical stops to prevent manually bypassing to a dead source. Equipment that does not prevent dead source bypass is not acceptable.
- H. A drawout isolation mechanism shall provide closed-door isolation of the transfer switch, using a permanently mounted, external handle. The isolation mechanism shall be interlocked so that either the transfer switch must be bypassed or the transfer switch must be open, before the mechanism will permit isolation of the transfer switch.
- I. The isolation mechanism shall provide for three-position operation; Connected, Test, and Isolated. In the Connected position, isolation contacts shall be fully engaged and closed, with the transfer switch control cable connected. In the Test position, isolation contacts shall be open and the transfer switch control cable connected. The Test position shall allow operational testing of transfer switch and controls without power disruption to the load. In the Isolated position, the transfer switch and control

shall be completely isolated from all power sources. In the isolated position, safety shutters shall close to cover bypass switch power terminals minimizing the possibility of accidental contact with energized parts. In the isolated position, the transfer switch shall be capable of being withdrawn from the cabinet, and removed using overhead lifting equipment. Mechanisms that do not allow for drawout and removal for servicing using overhead lifting equipment are not acceptable under this specification. When re-installing the transfer switch, from isolated to connected position, the isolation mechanism shall not permit connection of the transfer switch unless it is in the open position, and shall automatically open the transfer switch if necessary regardless of the availability of electrical power. When the transfer switch is fully connected and locked in place, the mechanism shall move the transfer switch from the open position to the closed position on the same source as the bypass switch.

- J. The bypass and isolation process for the automatic transfer switch shall be capable of being fully accomplished without opening the cabinet door.

2.5 BATTERY CHARGING

- A. The transfer switch/generator set combination shall be provided with a battery charger for the generator set starting batteries. Refer to Generator Sets Specification Section 263213 for specific requirements. Supply power failed indication shall be displayed on the ATS control panel.

2.6 SEQUENCE OF OPERATION

- A. Programmed (Delayed) Transition Sequence of Operation

- 1. Normal State:

- a. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is connected to source 1 (connected to the utility), and no start signal is supplied to the genset.

- 2. Normal Power Failure and Restoration:

- a. When the transfer switch senses a power failure on source 1, it shall complete a pre-programmed time delay start sequence, and then send a start signal to the generator set.
- b. The generator set shall immediately start and accelerate to rated voltage and frequency.
- c. The transfer system shall complete a programmable time delay sequence, and then transfer to source 2 by delayed (programmed) transition. The transfer switch shall accomplish this by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard).
- d. On return of source 1 to acceptable voltage and frequency levels, the control system shall initiate a time delay retransfer sequence. On completion of the time delay sequence, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller. The control system shall transfer loads back to source 1 in the reverse sequence to that which was used to connect loads to source 2.
- e. If the generator set fails during this period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.
- f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
AUTOMATED TRANSFER SWITCHES**

SECTION 26 3623– PAGE 8 OF 9

3. Generator Set Exercise (Test) With Load Mode (Delayed (programmed)Transition). The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:
 - a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
 - b. The transfer switch shall issue a compatible start command to the generator set as follows:
 - 1) On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
 - 2) On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.
 - c. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller.
 - d. The generator set shall operate connected to the load for the duration of the exercise period.
 - e. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later (to allow motor loads to decay per NEMA MG-1 standard). The timing sequence for the contact operation shall be programmable in the controller.
 - f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.
 - g. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.
 - h. If the generator set fails during the exercise period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.
4. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:
 - a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
 - b. The transfer switch shall issue a compatible start command to the generator set as follows:
 - 1) On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
 - 2) On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.
 - c. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
 - d. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is

running, the transfer switch shall immediately connect the system loads to the generator set.

PART 3 EXECUTION

3.1 POWER COMPANY APPROVAL

- A. The transfer switch shall be designed to meet all applicable power company requirements for connection to the power company's system, and if applicable, shall be on the power company's approved list of automatic transfer switches. Contractor shall ensure that transfer switch is specifically approved by power company for connection to their system prior to purchasing the transfer switch.

3.2 FACTORY TESTING

- A. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be submitted. Test process shall include calibration of voltage sensors.

3.3 SERVICE AND SUPPORT

- A. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
- B. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.
- D. After generator set installation, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 5 persons employed by the facility owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be at least 4 hours in length, and include practical operation with the installed equipment.

3.4 WARRANTY

- A. The automatic transfer equipment shall be warranted (by the generator supplier when a generator is supplied within the project) for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 263623

PART 1 GENERAL

1.1 SCOPE

- A. Provide complete factory assembled Dual purpose, dual-breaker docking station with connectors for portable generator source and load bank testing.

1.2 CODES AND STANDARDS

- A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
 - 1. NEC 700.3 (F)
 - 2. IBC Seismic certification as applicable for the installed location

1.3 ACCEPTABLE MANUFACTURERS

- A. Trystar
- B. ESL Power Systems
- C. PSI Control Solutions

1.4 SUBMITTALS

- A. Contractor shall submit manufacturer's drawings and data of the proposed equipment for Engineer's approval prior to start of fabrication. Drawings and data shall include, as a minimum, dimensioned general arrangement drawings and wiring diagrams, UL listing information including UL file or control number, short circuit rating or withstand rating, component data, mounting provisions, conduit entry locations and installation instructions.
- B. Upon installation of equipment, Contractor shall submit manufacturer's Operating & Maintenance Manual which shall include as a minimum:
 - 1. Certified as-built General Arrangement drawings and Wiring Diagram.
 - 2. Materials / Component List including part numbers.
 - 3. Maintenance and service requirements.

1.5 COORDINATION

- A. Contractor shall coordinate layout and installation of equipment and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels. Verify available space with generator supplier prior to ordering.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Generator Load Bank Docking Station shall be Trystar #DBDS-5 or equivalent, rated as indicated on plans.
- B. Equipment shall consist of (2) kirk-key-interlocked molded case circuit breakers, male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a padlockable enclosure. Switch shall allow source selection of permanent generator source or temporary portable source connected through camlok connectors to provide

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERATOR LOAD BANK DOCKING STATION**

SECTION 26 3633– PAGE 2 OF 4

backup/emergency power to associated building. Switch shall allow connection of portable load bank connected through camlok connectors.

- C. Switch shall include two circuit breakers. One molded case circuit breaker shall control the connection between the permanent generator and the automatic transfer switch. The second circuit breaker shall control the connection between the portable generator (via male cam-style connectors) and the building automatic transfer switch. All molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless all breakers are in the "OFF" position. All molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The molded case circuit breakers shall be kirk-key-interlocked to ensure that only one of these breakers can be closed at any given time
- D. Enclosure
 - 1. NEMA 3R Rain-Tight Aluminum Enclosure unless indicated otherwise on drawings
 - 2. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
 - 3. NEMA 3R Integrity shall be maintained while temporary cabling is connected during use
 - 4. Front and Side shall be accessible for maintenance
 - 5. Top, Side, and Bottom shall be accessible for permanent cabling
 - 6. Powder coat
 - 7. Paint after fabrication shall be Hammer tone Gray
- E. Phase, Neutral, and Ground Busbar
 - 1. Material: Silver-plated Copper
 - 2. Equipment Ground Bus: bonded to box.
 - 3. Isolated Ground Bus: insulated from box.
 - 4. Ground Bus.
 - 5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
- F. Temporary generator and Load Bank connectors shall be Camlok style mounted on gland plate.
 - 1. Camlok connectors shall be provided for the full ampacity for all phases, neutral and ground.
 - 2. Camlok shall be 16 Series model and color coded according to system voltage requirements.
 - 3. Camlok connections shall be Bus Bar Style. Cabling or Double Set Screw is not acceptable
 - 4. Camlok connection shall be protected against accidental contact while not in use
- G. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier
- H. Short Circuit & Withstand Rating
 - 1. Shall be the greater of 65 KAIC or the available fault current of the associated generator unless otherwise indicated on drawings
- I. Voltage & Amperage
 - 1. Shall be as indicated on drawings. If not indicated, voltage shall match generator output voltage and amperage shall match or exceed generator main line circuit breaker amperage.
- J. Factory Installed Phase Rotation Monitor Device:

1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed
- K. The following additional accessories shall be included and indicated in submittal drawing as follows:
 1. Three Wire Auto Start
 2. Kirk Key Door Interlock
 3. An auxiliary contact shall be provided in the circuit breaker controlling the connection from the Permanent Generator to the building ATS and shall be factory wired to terminal blocks within the enclosure.
 4. Enclosure anti-condensation strip heater & thermostat (1.5 kW, 120 volt max)
 5. Integral duplex 20 amp, 125 volt GFCI receptacle for portable generator battery charger
 6. Surge protection device

PART 3 EXECUTION

3.1 INSTALLATION

- A. Prior to installation of equipment, Contractor shall examine the areas and conditions under which the equipment is to be installed and notify the Engineer in writing if unsatisfactory conditions exist.
- B. Equipment shall be installed as shown on the drawings and per the manufacturer's written instructions. In addition, the installation shall meet the requirements of local codes, the National Electrical Code and National Electrical Contractors Association's "Standard of Installation".
- C. Free standing, base mounted equipment shall be mounted on 6" concrete housekeeping pad.
- D. Conduit entry into the equipment shall be by Contractor; Contractor shall furnish and install listed watertight conduit hubs, as manufactured by MYERS or T&B, for each conduit entry on the equipment. The incoming hub size shall match the conduit size for feeders and ground as shown on the drawings. The outgoing hub size shall match the conduit size for loads and ground as shown on the drawings. Hubs shall be properly installed and tightened to maintain Type 3R integrity of the enclosure.
- E. Contractor shall terminate feeder conductors, load conductors and ground per the manufacturer's instructions. All field wiring terminations shall be torqued as required per the instructions on the equipment's power distribution blocks, circuit breakers & ground lugs.

3.2 TESTING

- A. Contractor shall test equipment in accordance with manufacturer's instructions as follows:
 1. With the equipment deadfront in place and the main access door closed and properly latched, actuate all Breakers/Operator Mechanisms; verify:
 2. With the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "ON" position, the breaker controlling the connection between the portable generator and the automatic transfer switch cannot be turned "ON"
 3. With the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "OFF" position, the breaker controlling the connection between the portable generator and the automatic transfer switch can be turned "ON" and "OFF"
 4. With the breaker controlling the connection between the portable generator and the automatic transfer switch (ATS) in the "ON" position, the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) cannot be turned "ON".
 5. Confirm operation of the Docking Station's ground receptacle by attaching a plug to the equipment's ground receptacle and then verify that the plug is grounded to the facility ground.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
GENERATOR LOAD BANK DOCKING STATION**

SECTION 26 3633– PAGE 4 OF 4

6. Once normal power has been applied, confirm operation of the equipment's integral transfer switch by following directions on main access door.

3.3 WARRANTY

- A. The equipment shall be warranted by the manufacturer for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 263633

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTNING PROTECTION SYSTEM**

SECTION 26 4100– PAGE 1 OF 2

PART 1 GENERAL

1.1 SCOPE

- A. Furnish and install all materials and labor required to provide a complete and functional Lightning Protection and Common Grounding System as indicated, in strict accordance with this section of the Specifications and the applicable Contract Drawings.

1.2 STANDARDS & QUALITY ASSURANCE

- A. The lightning protection system shall comply with all requirements of the latest edition of each of the following codes and standards. The latest edition of these codes and standards form a part of this specification:
 - 1. U.L. Standard 96A.
 - 2. Lightning Protection Institute - Installation Code LPI-175.
 - 3. N.F.P.A. 780.
- B. Equipment manufacturer shall be certified by the Lightning Protection Institute, and products approved for UL listing. All materials shall be manufactured by one of the following manufacturers:
 - 1. Bonded Lightning Protection Systems
 - 2. East Coast Lightning Protection
 - 3. Erico/Eritech Lightning Protection
 - 4. Harger Lightning Protection
 - 5. Preferred Lightning Protection
 - 6. Robbins Lightning
 - 7. Thompson Lightning Protection
- C. For approval of LPI manufacturer other than specified, complete proposed material data and installation drawings shall be submitted to Engineer for review not less than 10 days prior to bid date.
- D. In order to insure integrity of installation, the system shall be installed under the direct jobsite supervision of a Certified Master Installer/Designer, who has qualified under the LPI's Certification Program as a Master Installer/Designer.

1.3 SUBMITTALS

- A. Complete shop drawings of the entire lightning protection system showing the type, size, mounting details, and location of all equipment, grounds, cable routings, roof materials (for coordination of lightning protection system materials), etc., shall be submitted to the Architect-Engineer for approval prior to start of work.
- B. Submittals shall document the local manufacturer's representative's Certified Master Installer/Designer qualifications from LPI.

PART 2 PRODUCTS

2.1 SYSTEM

- A. System materials in general shall be copper, copper alloy or aluminum with high-copper content bronze castings or aluminum castings (all compatible with associated surface materials and installed per UL, NFPA & LPI standards), and shall comply in weight, size and composition for the class of structure to be protected. The system shall consist of all necessary cables, air terminals, mounting

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTNING PROTECTION SYSTEM**

SECTION 26 4100– PAGE 2 OF 2

bases, fittings, couplings, connectors, fasteners, surge protection devices, etc., as required to give a complete and coordinated system.

- B. Copper conductors shall be utilized for all downleads and below-grade conductors.
- C. Aluminum components shall be utilized in cases where copper is not compatible with mounting surfaces.
- D. All ground rods shall be copper-clad steel.
- E. All cable and all air terminals shall bear proper UL labels.
- F. Air terminals shall have blunt tips.
- G. System design shall be concealed wherever practical, with roof perimeter cables concealed in parapet walls, and mid-roof cables installed under roof slabs. Exposed cable on parapet walls will only be accepted if structural details preclude cable concealment. Cable drops for roof penetrations at downlead locations shall be made with solid-bar thru-roof connectors, with copper rod flashings. Bond rebars top and bottom at each downlead position and risers. Primary and secondary bonding of roof metals and equipment shall also be under roof slabs. Ground level, intermediate and roof level potential equalization shall be provided per current building Code classifications.
- H. All system fittings except cable holders, regardless of Structure classification, shall be heavy-duty type made from bronze or aluminum castings and secured with bolted-pressure clamps. Pressure plates made from stamped or pressed metal parts, or fittings utilizing crimp-type pressure devices will not be allowed. All bolts, screws, and related type hardware shall be stainless steel.
- I. Contractor shall coordinate with the roofing contractor to insure compatibility of any adhesive with the roofing system in use.
- J. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface, and shall be spaced according to LPI, UL, and NFPA code requirements.
- K. Where applicable, an approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead cable.
- L. Surge protection devices shall be provided on the power, telecommunications and other conductive electrical services at the points of entrance into the building(s) as required by UL96A in order to obtain the UL Master Label Certificate of Inspection. It shall be the responsibility of the electrical contractor to install or verify that a proper surge protection device has been installed on each of the building electrical services to meet this requirement. This may require surge protection devices in addition to those specifically shown on plans or called out within other specifications.

PART 3 EXECUTION

3.1 SUPERVISION AND CERTIFICATION

- A. The manufacturer's local representative shall be a Certified Master Installer/Designer under the LPI program, and shall provide direct jobsite technical supervision to Contractor's personnel during installation to insure compliance with all Code requirements. Upon job completion, Contractors shall furnish Owners with written certification on UL Master Label "C", that system is installed in compliance with above Standards.

END OF SECTION 264100

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (<1000 V) power distribution and control equipment.
- B. The specified unit(s) shall provide effective high energy transient voltage surge suppression, surge current diversion and high frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main overcurrent device. The unit(s) shall be connected in parallel with the facility's wiring system.
- C. The unit(s) shall be designed and manufactured in North America by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacture of such products for minimum of ten (10) years.
- D. All products that are submitted according to these specification will be required to meet this specification in its entirety for both service and distribution TVSS systems. Any product that is submitted and does not comply with all parts of this specification will be subject to rejection.

1.3 DEFINITIONS

- A. VPR: Voltage Protection Rating.
- B. SPD: Surge Protective Device(s)
- C. $I_{(n)}$: Nominal Discharge Current

1.4 SUBMITTALS

- A. See specification section 260500.
- B. Product Data: For each type of product indicated. Include:
 - 1. Maximum Single Impulse Surge Current Rating.
 - 2. Surge Life (Repetitive Surge) Rating.
 - 3. UL1449 (Latest Edition) Voltage Protection Ratings (VPR).
 - 4. UL1449 (Latest Edition) Nominal Discharge Current (In).
 - 5. Product dimensions and weights.
 - 6. Furnished specialties and accessories.
- C. Qualification Data:
- D. Safety Agency File Number.
- E. ISO 9001-2008 Certification.
- F. ISO 1401-2001 Certification.

G. Operation and Maintenance Data: For SPDs to include all submittal data and any applicable operation and maintenance manuals.

H. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Device and UL 1283 Listed as an Electromagnetic Interference Filter

C. Provide 2nd party certified data demonstrating SPD response to ANSI/IEEE C62.41.2-2002 standard waveforms when tested according to IEEE C62.45.

D. Comply with NFPA 70.

E. All SPDs provided within this project at the service entrance, distribution panels, and sub-panels shall be from the same manufacturer.

1.6 PROJECT CONDITIONS

A. Service Conditions: Rate SPDs 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 150 deg F.
3. Humidity: 0 to 95 percent, non-condensing.
4. Altitude: Less than 13,000 feet above sea level.

1.7 COORDINATION

A. Where field-mounted SPD's are specifically shown on plans, coordinate locations of field-mounted SPDs to allow adequate clearances for maintenance.

1.8 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: 10 years from date of Substantial Completion.

1.9 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: 1 of each size and type installed, where field-replaceable modular SPDs are provided.
2. Fuses: 1 of each size and type installed, where field-replaceable fuses are provided.

PART 2 PRODUCTS

2.1 SURGE PROTECTIVE DEVICES

A. Manufacturer:

1. Integral Devices: Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.), or by Surge Suppression Inc. if all of the performance of this specification are met and all UL listing of the equipment manufacturer are met.
2. External Devices (where specifically specified on plans): Surge Protective Devices shall be as manufactured by the distribution equipment manufacturer (Square D, etc.) or Surge Suppression Inc.

B. Each Surge Protective Device shall:

1. Be internal to the associated distribution equipment (without violating any applicable UL listings) unless specifically shown otherwise on plans.
2. Be UL 1449 (Latest Edition) listed.
3. Have short-circuit current rating complying with UL 1449 (Latest Edition), that matches or exceeds the short-circuit rating of the associated distribution equipment.
4. Be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
5. Have fuses, rated at 200-kA interrupting capacity.
6. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
7. Be fabricated using bolted compression lugs.
8. Provide suppression for seven (7) modes of protection.
9. Have LED indicator lights for power and protection status of each phase.
10. Have audible alarm, with silencing switch, to indicate when protection has failed.
11. Have form-C contacts rated at 2 A and 24-V ac minimum, 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 facility monitoring and control system if monitoring by that system is required by plans or other specifications.
12. Have six-digit transient-event counter, mounted to front of equipment door, set to totalize transient surges (externally mounted SPD's may have the transient –event counter monted on the visible face of the SPD).
13. Meet all UL 96A requirements (for Lightning Protection Systems) where the device is installed at a service entrance of the facility. At a minimum, these devices shall:
 - a. Be marked as Type 1 or Type 2 SPDs with product Identity consisting of “Surge Protective Device” or “SPD”, and identifying all ratings so required by UL96A and the 4 digit alpha numeric Control Number.
 - b. Have a minimum UL 1449 Nominal Discharge Current (I_n) Rating of 20kA.
 - c. Be UL listed and labeled with holographic label.

C. Peak Single-Impulse Surge Current Rating shall be meet the following minimums unless specifically shown otherwise on plans:

Application	Per Phase	Per Mode
Service Entrance Devices	240 kA	120 kA

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SURGE PROTECTIVE DEVICES**

SECTION 26 4300– PAGE 4 OF 5

Downstream Devices	160 kA	80 kA
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- D. The ANSI/UL 1449 voltage protection rating (VPR) in grounded wye circuits, the SPDs shall not exceed the following:

Modes	208Y/120V	480Y/277V	600Y/347V
L-N,L-G, N-G	800	1200	1500
L-L	1200	2000	2500

- E. The ANSI /UL 1449 VPR for 240/120 V, 3-wire or 4-wire circuits with high leg shall not exceed the following:

Modes	240/120V
L-N,L-G, N-G	1200/800

2.2 ENCLOSURES

- A. Where external units are specifically specified on plans, units not mounted within electrical distribution equipment (such as switchboards, MCC's, etc.) shall be provided in enclosures with NEMA enclosure ratings that match or exceed the NEMA enclosure ratings of the equipment from which the units are fed. For example, a unit fed from a NEMA 4X stainless steel panelboard shall also be mounted within a NEMA 4X stainless steel enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All SPD's shall be integrally-mounted within the associated distribution equipment unless specifically shown otherwise on plans.
- B. Install SPDs at service entrance on load side, with ground lead bonded to service entrance ground.
- C. Install SPDs downstream of the service entrance with conductors or buses between suppressor and points of attachment as short and straight as possible. The lead lengths between the TVSS unit and the equipment being protected shall not exceed fourteen (14) inches without approval from the engineer. Do not bond neutral and ground. Leads shall be as straight as possible with no sharp bends.
- D. Where externally-mounted SPD's are specifically shown on plans, provide circuit breaker as directed by the SPD supplier as a dedicated disconnecting means for SPD unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

- A. Ensure that interiors are free of foreign materials and dirt.
- B. Check and test switches, pushbuttons, meters for proper operation.
- C. Check and test indicating lights for proper operation and color.
- D. Perform manufacturer's on site field test procedures.

3.3 STARTUP SERVICE

- A. Do not perform insulation resistance (MEGGER) tests of the distribution wiring equipment with the SPDs installed. Disconnect all wires, including neutral, before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 SYSTEM WARRANTY

- A. The SPD system manufacturer shall warranty the entire SPD system against defective materials and workmanship for a period of ten (10) years from the date of substantial completion. This warranty is in effect as long as the unit is installed in compliance with the manufacturer's installation, operation, and maintenance manual, UL Listing requirements, and any applicable national or local electrical codes.
- B. Any SPD device which shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period which starts at the date of substantial completion of the system to which the surge suppressor is installed.
- C. The manufacturer is required to have a nationwide network of factory-authorized local service representatives for repair and service of this product. The manufacturer shall have a dedicated 1-800 telephone number for service problems and questions. This number shall be manned by a knowledgeable factory employee to ensure prompt response to any emergency situation that may arise.

END OF SECTION 264300

PART 1 GENERAL

1.1 DESCRIPTION

- A. Lighting Fixtures
- B. Drivers

1.2 SUBMITTALS

- A. Complete submittals shall be provided identifying all lighting fixture types and options, all lamp types (where applicable) and compliance with all contract requirements. The absence of clear submittal information specifically listing exceptions/deviations from detailed contract requirements will be understood to indicate that the contractor/supplier intends to meet all contract requirements. Refer to specification section 260500 for additional requirements.

PART 2 PRODUCTS

2.1 GENERAL

- A. Lighting fixtures shall be furnished as shown on plans and specified herein. It shall specifically be the responsibility of Contractor to verify exact types ceilings, walls, etc. and recessing depth of all recessed fixtures and furnish the specific mounting trims and accessories of the specified and/or accepted fixture specifically for the ceiling, wall etc. in which each fixture is to be installed.
- B. Base bid manufacturers are listed on the lighting fixture schedule. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards, efficiency, maximum wattages and photometric distributions set by the specified product.
- C. All lighting fixtures shall be so designed and shall have drivers and other similar items so installed as to function without interruptions or failures when operating in the environment in which they are proposed to be installed. Special attention shall be given to environments with potentially high ambient temperatures such as attic spaces, exterior soffits, confined interior soffits, coves, unconditioned spaces, etc. and shall be addressed by providing fixtures with suitable high ambient temperature ratings, remote mounting of drivers/ballasts, providing approved ventilation, etc. as directed by fixture manufacturer and approved by engineer, at contractor's expense.
- D. All fixtures installed such as to create penetrations through fire rated ceiling or wall assemblies shall be labeled as suitable for that purpose or installed with covers, tenting or other means as required to maintain the fire rating of the assembly.

2.2 LED LUMINAIRES

- A. For the purpose of these specifications, LED Luminaires shall be defined as the entire LED fixture assembly including LED array, drivers, housing, electronics, etc. that compose the lighting fixture.
- B. Furnish and install LED Luminaire of proper size, type, efficacy, delivered lumen output, color temperature, distribution pattern, operational life, and CRI as shown on drawings.
- C. LED Luminaires shall be tested in accordance with LM-79 and LM-80 standards.
- D. LED drivers shall comply with NEMA 410 standards for inrush current, etc.
- E. Exterior, pole mounted LED Luminaires shall be provided with an easily-serviceable, UL recognized surge protection device that meets a minimum 10kA Category C Low operation (IECC C62.41.2-

2002). Device shall be wired in front of light engine(s) and driver(s) and shall fail “open” such as to prevent fixture operation after a surge protection failure.

- F. LED Luminaires shall have a guarantee-warranty of at least five years unless specifically noted otherwise on contract documents.
- G. LED Luminaire assembly shall comply with ambient temperature requirements specified in General section above.

2.3 STEMS/PENDANTS

- A. Hangers shall be approved ball aligner type swivel, 30 degrees from vertical with swivel below canopy.
- B. Stems/Pendants shall be rigid or IMC conduit unless specified otherwise on plans. Proposed stem/pendant types shall be submitted for review prior to shipment of light fixtures from factory.
- C. Stems/Pendants shall be provided as required to prevent swaying of fixtures due to HVAC system airflow or other similar occurrences.
- D. Shall be painted the same color as the fixture trim unless noted otherwise.

2.4 MANUFACTURER

- A. Fixtures and stems shall be manufactured as shown in fixture schedule or approved equals.
- B. Drivers shall be as manufactured by Philips/Advance, GE, Lutron, Magnatec, Motorola, EldoLED or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

- A. Support:
 - 1. Support of all lighting fixtures shall be responsibility of electrical contractor. All lighting fixture supports shall be installed in accordance with lighting fixture supplier's recommendations.
 - 2. Contractor shall coordinate installation requirements for all wall-mounted fixtures (especially for wall-mounted fixtures on uneven wall surfaces, etc.) as required to assure a level/flat mounting surface and level/plumb/secure finished installation. Contractor shall provide flat mounting plates or other mounting provisions where necessary. Any proposed mounting plates, etc. shall be submitted to and approved by project architect prior to ordering materials.
 - 3. Fixtures shall be supported independent of ceiling from structural members of building.
 - 4. Lay-in fixtures shall be supported by four (4) taut 12 gauge hanger wires connected from each corner of the fixture to the structure above so that fixture is supported independent of the ceiling.
 - 5. Other recessed light fixtures (including recessed downlights) shall be supported with two (2) taut 12 gauge hanger wires connected from opposing corners of the light fixture to the structure above so that fixture is supported independent of the ceiling.
 - 6. Pendant mounted fixtures shall be directly supported from the structure above using a 9 gauge hanger wire or an approved alternate support without using the ceiling suspension system for direct support.
 - 7. Tandem fixtures may utilize common hanger wires.
 - 8. All lay-in fixtures shall be attached to ceiling grid by means of approved clips and in accordance with the N.E.C.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
LIGHTING MATERIALS AND METHODS**

SECTION 26 5000– PAGE 3 OF 3

9. Contractor shall submit typical hanging detail to Engineer before installing any fixtures.
- B. Connections:
1. All grid fixtures shall be wired by flex individually to junction and not wired fixture to fixture.
 2. All flex shall contain 3 conductors (3rd wire ground). Ground wire shall be securely grounded at each end. Other conductors shall be connected by approved connectors.
- C. Row-Mounted fixtures:
1. All stems on row-mounted fluorescent fixtures shall be installed as follows (except fixtures with slide grip hangers):
 - a. One stem shall be installed in the first fixture knockout from end of row (on the first and last fixture of the row).
 - b. One stem shall be installed between each two fixtures. Stem shall center joint where fixtures join and shall attach by use of "joining plates".
 2. All fixtures in continuous rows other than recessed grid type shall be connected by nipples with locknuts bushings.
- D. Coordination:
1. Contractor shall coordinate all dimensions & locations of light fixtures prior to rough-in to ensure proper fit and coordination with other trades.
 2. Contractor shall verify exact location of light fixture with Reflected Ceiling Plan. If there are any discrepancies, verify exact location with architect.
 3. Contractor shall verify exact ceiling types being installed and shall adjust fixture trim types accordingly (prior to submitting light fixture shop drawings).

END OF SECTION 265000

PART 1 GENERAL

1.1 DESCRIPTION

- A. Cables rated for 0V-50V application

PART 2 PRODUCTS

2.1 GENERAL

- A. Unless specified otherwise, all cables within the scope of this specification section shall:
1. Be rated for exposed cable tray installation.
 2. Be plenum rated.
 3. Be UL-rated for the proposed application.
 4. Be multi-conductor with overall outer sheath as required by the application. The insulation of each conductor within the overall multi-conductor cable shall be uniquely color-coded. Ground conductors (when provided) within the multi-conductor cable shall have green insulation. Conductors with green insulation shall not be used for conductors other than ground.
 5. Utilize copper conductors.
 6. Have wire gauge as required to limit voltage drop to acceptable limits determined by the system supplier and to meet all applicable code requirements.
 7. Where installed underground, within slab-on-grade or in exterior locations, be rated for wet locations.
 8. Where required for specific systems, meet the specific requirements (conductor quantity, wire gauge, insulation type, shielding, etc.) of the system supplier.

2.2 CLASS 1 CONTROL CABLING (120VAC CONTROL CIRCUITS, ETC.)

- A. In addition to above requirements, and unless specified otherwise, Class 1 control cabling shall:
1. Be rated for 600V.
 2. Be industrial grade.
 3. Have stranded conductors.
 4. Have sunlight/oil-resistant PVC/Nylon insulation and jacket with ripcord.
 5. Be manufactured by Belden, AlphaWire or General Cable.

2.3 CLASS 2 & 3 CONTROL CABLING (FED FROM CLASS 2 OR 3 POWER SUPPLIES)

- A. In addition to above requirements, and unless specified otherwise, Class 2 & 3 control cabling shall:
1. Be rated for 300V.
 2. Be shielded if so recommended by the system supplier/integrator.
 3. Have twisted conductors.
 4. Have plenum-rated insulation/jacket with ripcord.
 5. Be manufactured by AlphaWire, Belden, General Cable, Superior Essex or West Penn.

2.4 NETWORK CABLING

- A. Furnish and install all Ethernet, Fiber Optic and Backbone Copper Telephone cabling in accordance with all BICSI requirements and in accordance with other applicable specification sections.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
AUXILIARY SYSTEM CABLES, 0-50V**

SECTION 27 0500 PAGE 2 OF 3

A. Routing:

1. All wires and cables shall be installed in conduit unless specifically noted otherwise. Where conduit is not otherwise required by contract documents, 0-50V Cabling located within concealed, accessible ceiling spaces (such as above lay-in ceilings) may be run without conduit if the following requirements are met:
 - a. Cabling is plenum-rated, multi-conductor.
 - b. Cabling is supported by cable tray or with J-hook supports on intervals not to exceed 5'-0" on center. Cabling shall be supported solely from the cable tray or j-hooks supported from the building structure, without using piping, ductwork, conduit or other items as supports.
 - c. Cabling is neatly formed, bundled and tied with plenum-rated Velcro straps on intervals not to exceed 30" on center.
 - d. Properly-sized conduit(s) are provided wherever cabling enters an inaccessible or exposed area (such as above gyp board ceilings, within walls or through walls).
 - e. Cabling is not a part of a Fire Alarm System, Smoke Control System, Emergency Generator Control System or other life-safety related system.
2. End bushings shall be provided on both ends of all raceway terminations.
3. No splices shall be pulled into conduit.
4. No cabling shall be pulled until conduit is cleaned of all foreign matter.

B. Penetrations:

1. All fire/smoke barrier penetrations shall be made in accordance with a U.L. listed assembly.
2. For cabling not installed in conduit:
 - a. Fire/smoke barrier penetrations shall be sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.
3. For cabling installed within conduit from endpoint to endpoint:
 - a. Fire/smoke barrier penetrations shall be sealed utilizing fire caulk or other equivalent firestop systems around perimeters of conduits per UL requirements.
4. For cabling installed within cable trays:
 - a. Fire/smoke barrier penetrations shall be sealed with one of the following methods:
 - 1) Continuous cable tray through the penetration, with a combination of large firestop pillows and small firestop pillows contained, supported and secured (to prevent unauthorized removal) on both sides by aluminum wire mesh and firestop putty. Firestop pillows shall be STI Series SSB or equal and Firestop putty shall be STI Spec Seal or equal.
 - 2) Cable tray broken at the penetration, with fire/smoke barrier penetrations sealed utilizing an enclosed fire-rated pathway device (STI EZ Path or equal) containing a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed or

retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and tested to the requirements of applicable ASTM/UL1479 standards.

C. Excess Cabling:

1. Excess cabling shall be neatly coiled within all junction boxes, pullboxes, wireways, etc. and at all terminations as required to allow future re-termination of cabling.

D. Terminations:

1. All conductors/cabling (including spare conductors) shall be properly terminated unless specifically directed otherwise. See below for general termination hardware requirements.
2. Cabling shall be neatly formed, bundled and tied at all terminations.

3.2 SPLICES/CONNECTIONS/TERMINATIONS:

A. Network Cabling:

1. Network and fiber optic cabling shall be continuous from endpoint to endpoint and shall not be spliced unless specifically noted otherwise.

B. Control Cabling:

1. Connections shall be made with T & B Sta-Kon wire joints EPT66M, complete with insulating caps. To be installed with WT161 Tool or C nest of WT11M Tool, Ideal Super - Nuts (not wire nuts), Ideal Wing Nuts, or Buchanan Elec. Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators to be installed with C24 pressure tool.

C. Shielded cabling:

1. Unless directed otherwise by the system supplier, 0-50V cable shielding shall be grounded at the PLC/control panel end only (not at the field device end) with a termination kit as directed by the PLC/control panel supplier.
2. Shielded cabling shall be continuous from endpoint to endpoint and shall not be spliced without prior written approval from the Engineer.

3.3 LABELING

- A. Refer to Specification Section 260553 for all labeling requirements.**

END OF SECTION 270500

PART 1 GENERAL

1.1 SCOPE:

- A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling. Backbone and Horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
- B. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the structured cabling contractor as detailed in this document.
- C. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types are indicated on the plans. If the bid documents are in conflict, this specification shall take precedence.
- D. Refer to Specification Section 260553 (Electrical Identification) for additional identification requirements.
- E. Refer to Specification Section 270500 (Auxiliary System Cables, 0-50V) for additional material and installation requirements.

1.2 REGULATORY REFERENCES:

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the National Electrical Code, local ordinances and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All modular jacks, patch cords, consolidation point, and patch cords shall be ETL Verified (not just tested) to be category 6A component and channel compliant.
- D. The cabling system described in this specification is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
 - 1. ANSI/TIA/EIA - 568-B.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, April, 2001
 - 2. ANSI/TIA/EIA - 568-B.2, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components, April, 2001
 - 3. ANSI/TIA/EIA - 568-B.2-1, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components, Addendum 1 – Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling
 - 4. ANSI/TIA/EIA - 568-B.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, March, 2000
 - 5. ANSI/TIA/EIA – 569-E, Commercial Building Standard for Telecommunications Pathways and Spaces, 2019
 - 6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 2 OF 17

7. ANSI/TIA/EIA – 607-AJ, Commercial Building Grounding and Bonding Requirements for Telecommunications, August 1994
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) 10TH edition.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2002
11. ANSI/TIA/EIA – 45-B, Test Procedures for Fiber Optic Connections.
12. ANSI/TIA/EIA – 526-14, Power Test for Fiber Runs.
13. FCC 47 CFR 68
14. NEMA 250
15. NEC Articles 770 and 800
16. ADA, Americans with Disabilities Act

- E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release.
- F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project. All local State and federal codes are to be followed.

1.3 APPROVED CONTRACTOR:

- A. The Structured Cabling Contractor must meet the following requirements:
1. Contractor must have a certified RCDD on staff. The project manager for this project shall have an RCDD certification, and RCDD shall be responsible for reviewing all aspects of the design, submittals and installation of all products.
 2. All required submittal information shall be stamped by the RCDD.
 3. Contractor must have a minimum of 3 years experience with projects of similar size and scope to this project.
 4. The company performing the work must have been in business for a minimum of 3 years.
 5. The company must have an office within 75 miles of the job site.
- B. The Structured cabling contractor is responsible for workmanship and installation practices in accordance with the requirements of the standards described in these specifications and manufacturer's requirements.

1.4 WORK INCLUDED:

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The structured cabling contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.
- B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure.
 2. Furnish, install, and terminate all UTP and Optical Fiber cable
 3. Furnish and install all wall plates, jacks, patch panels, and patch cords at equipment racks and at work outlets (unless shown otherwise on plans).
 4. Furnish and install all required cabinets and/or racks as required and as indicated.
 5. Furnish any other material required to form a complete system.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 3 OF 17

6. Perform channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Provide owner test results and documentation. (Testing documentation and As-built drawings)

1.5 SUBMITTALS:

- A. Within thirty (30) days of notice to proceed the structured cabling contractor shall submit the following items:
 1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 2. Submit proof from manufacturer of contractor's good standing in manufacturer's certification program.
 3. Submit copy of contractor's RCDD certification.
 4. Submit listing of five (5) projects of similar size and scope to this project that have been completed within the last five years. Include in this submittal owner's contact information for each project.
 5. Submit letter from the manufacturer stating that the manufacturer will provide a twenty-five year (25) warranty in accordance with the requirements paragraph 1.03 (B) of these specifications.
 6. Submit appropriate cut sheets and samples for all products, hardware and cabling.
 7. Submit 1/8" = 1'-0" drawings of floor plans indicating all work outlets and the labeling designation for each jack.
 8. Submit 1/2" = 1'-0" drawings of each MDF and each IDF showing all racks, patch panels, 110 blocks, etc.
- B. Work shall not proceed without the engineer's approval of the submitted items.
- C. The structured cabling contractor shall receive approval from the engineer on all substitutions of material. No substituted materials shall be installed except by written approval from the engineer.

1.6 DRAWINGS:

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the structured cabling contractor in bidding the job. The structured cabling contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The structured cabling contractor shall verify all dimensions at the site and be responsible for their accuracy.

PART 2 PRODUCTS

2.1 EQUIVALENT PRODUCTS:

- A. Due to the nature and type of communications all products, including but not limited to faceplates, jacks, patch panels, racks, 110 blocks, and patch cords, for the purpose of this document, shall be manufactured by Hubbell, Ortronix, Panduit, Amp or Systimax. See below for acceptable cable manufacturers.

2.2 WORK AREA OUTLETS:

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 4 OF 17

- A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate:
1. A minimum of two (2) modular jacks
 2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
 3. A blank filler will be installed when extra ports are not used.
 4. A dust cap shall be provided on all modular jacks with the circuit number on the identifier strip.
 5. Multiple jacks will be placed as documented on the plans.
 6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the structured cabling contractor shall submit the proposed configuration for each outlet assembly for review by the architect.
 7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.
- C. Faceplates: The faceplates shall:
1. be UL listed and CSA certified.
 2. be constructed of stainless steel (except where noted otherwise). All faceplate colors/materials in public areas shall be approved by the architect. In all cases the material and color of the faceplate shall match the adjacent electrical faceplate.
 3. (where plastic faceplates are specifically allowed by the architect/engineer) shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
 4. be compliant with the above requirements along with the following when incorporating optical fiber:
 - a. be a low profile assembly,
 - b. incorporate a mechanism for storage of cable and fiber slack needed for termination,
 - c. position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
 - d. incorporate a shroud that protects the optical couplings from impact damage.
 5. be available as single-gang or dual-gang.
 6. possess recessed designation windows to facilitate labeling and identification.
 7. shall include a clear plastic cover to protect labels in the designation window.
 8. have mounting screws located under recessed designation windows.
 9. comply with ANSI/TIA/EIA-606-A work area labeling standard.
 10. allow for the UTP modules to be inverted in place for termination purposes.
 11. be manufactured by an ISO 9001 registered company.
- D. Voice / Data Jacks
1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6A performance as defined by the references in this document including ANSI/TIA/EIA-568-B.2-1. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory including, but not limited to, ETL.
 2. The wiring scheme shall be T568A or T568B as directed by the owner.
 3. The modular jack shall use dual reactance modular contact array.
 4. The modular jack shall have low emission IDC contacts.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 5 OF 17

5. The modular jack shall use standard termination practice using 110 impact tool
6. The modular jack shall be backwards compatible to Category 3 and 5.
7. The modular jack shall be center tuned to category 6A test specifications.
8. Dust cover shall be used on each termination.

2.3 110 COPPER TERMINATION BLOCK:

- A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.
- B. 110 Block Kits shall
 1. include both the wiring block and connecting block in a 50, 100 and 300 pair footprint as required
 2. be manufactured using fire retardant molded plastic.
 3. include 4-pair 110C connecting blocks for field termination.
 4. support termination of 22-24 AWG solid conductor
 5. wiring blocks shall contain back openings for the feed through of cable
 6. meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory
 7. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
 8. shall use standard termination practice requiring a single conductor 110 impact tool
 9. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 10. be backwards compatible to category 3 and 5.
 11. be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and label printer.
 12. be manufactured by an ISO 9001 registered company.

2.4 MODULAR PATCH PANELS:

- A. The Modular Patch Panels shall
 1. be modular design.
 2. meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory
 3. use low emission IDC contacts
 4. use dual reactance technology to enhance the signal-to-noise ratio
 5. require standard termination practices using a 110 impact tool
 6. use a single piece IDC housing designed to accept larger Category 6 conductors
 7. support both T568B and T568A wiring
 8. include easy to follow wiring labels
 9. include label fields
 10. allow for the use of icons
 11. include full length metal rear cable management
 12. be available in standard or high density
 13. be backward compatible to category 3 and 5.
 14. be center tuned to category 6A test specifications

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 6 OF 17

15. be sized to accommodate number of data or data and phone cables (where phone cables are terminated on patch panels in lieu of 110 blocks) served by each equipment room plus 30% spare capacity.
16. be separated by horizontal cable management sections.

2.5 RACKS:

- A. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack.
- B. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Double-sided wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.
- C. Free-Standing Racks shall:
 1. have a minimum capacity of 45U
 2. have the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
 3. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
 4. have horizontal front and rear cable management above, below and between each 48-port patch panel.
 5. have a rack-mounted power strip.
 6. have EIA hole pattern on front and rear.
 7. be available with a 6.0" channel depth.
 8. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
 9. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
 10. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
 11. provide floor and ceiling access for cable management and distribution.
 12. provide pre-drilled base for floor attachment of rack.
 13. be available in standard color of black.
 14. be manufactured by an ISO 9001 registered company.
- D. Wall-Mounted Racks shall:
 1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
 2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
 3. have horizontal front and rear cable management above, below and between each 48-port patch panel.
 4. have a rack-mounted power strip.
 5. have EIA hole pattern on front and rear.
 6. be available with a 6.0" channel depth.
 7. be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
 8. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
 9. provide usable depth as required for standard network ethernet switch and other equipment
 10. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
 11. provide floor and ceiling access for cable management and distribution.
 12. provide pre-drilled base for wall attachment of rack.
 13. be available in standard color of black.

14. be manufactured by an ISO 9001 registered company.
15. be constructed to swing-out from wall (for rear access) via heavy-duty hinged corner and configurable for either left or right opening.

2.6 HORIZONTAL DISTRIBUTION CABLE:

A. Horizontal Distribution Cabling shall meet the following requirements:

1. Shall be 100 Ohm Enhanced Category 6A Unshielded Twisted Pair (UTP) Cable.
2. Physical Characteristics:
 - a. Unless directed otherwise by owner (contractor shall verify with owner), Cat 6A cable coloring shall be based on system type as follows, unless specifically approved otherwise:
 - 1) Data (or IP Voice): Blue
 - 2) Analog Voice: Grey
 - 3) Lighting Control System: White
 - 4) Fire Alarm or other Life-Safety System: Red
 - 5) CCTV Surveillance Cameras: Yellow
 - 6) Other: As directed by owner
 - b. Shall be plenum-rated.
 - c. Shall meet applicable requirements of ANSI/ICEA S-80-576.
 - d. The diameter of the insulated conductor shall be .023 in. maximum.
 - e. Shall consist of (4) 22-26 AWG twisted pairs.
 - f. The overall diameter of the cable shall be no larger than 0.240 inches.
 - g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
 - h. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.
 - i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-B.2-1.
 - j. Where installed underground, within slab-on-grade or in exterior locations, be gel-filled and rated for wet locations.
3. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20° C. Measured in accordance with ASTM D 4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 nF nominal.
 - c. DC resistance unbalance any two conductors of any pair shall not exceed 5% when measured at or corrected to 20° C in accordance with ASTM D 4566.
 - d. Structural return loss swept measurement for 100m or longer shall meet or exceed Category 6A requirements.
4. Shall be manufactured by Amp NetConnect, Berk-Tek, Leviton, General Cable, Mohawk or Superior Essex.

2.7 BACKBONE - FIBER:

A. Backbone Fiber Optic Cabling shall meet the following requirements:

1. All optical fiber shall be Indoor/Outdoor, Tight-Buffered, All-Dielectric, Plenum rated (unless specified otherwise on plans) with Enhanced Multimode OM4-rated 50/125 Optical Fibers.
2. Each Multimode Fiber shall:
 - a. Be graded-index optical fiber wave-guide with nominal 50/125µm-core/cladding diameter.

- b. Comply with ANSI/EIA/TIA-492AAAC-A
 - c. Have attenuation measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
 - d. Have information transmission capacity measured in accordance with ANSI/EIA/TIA-455-51 or 30.
 - e. Have measurements performed at 23 degrees C +/- 5 degrees.
 - f. Have Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.0
 - g. Have bandwidth \geq 4700 MHz-km @ 850nm. (EMB)
 - h. Have bandwidth \geq 500 MHz-km @ 1300nm.
 - i. Be laser optimized and guarantee a 1 Gb/s distance of 1000 meters @ 850nm and 10 Gb/s at 600 meters @ 850nm.
 - j. Terminate on fiber patch panel using SC Type fiber connectors.
3. Each indoor/outdoor fiber optic cable shall:
- a. Be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b. Be suitable for use in risers, plenums and horizontal applications.
 - c. Have a dry water blocking system for cable.
 - d. Have a fiber strand count of 12 (unless shown otherwise on plans).
 - e. Have a nominal 2.21 mm sub-unit diameter.
 - f. Have and be marked with an UL-OFNP Flame Rating (unless engineer specified otherwise on plans).
 - g. Comply with Bellcore GR-409 and GR20
 - h. Be independently verified to comply with ICEA S-104-696
 - i. Have strength members of FGE/Aramid yarn.
 - j. Be suitable for underground or above ground conduits.
 - k. (Where applicable) Have Tight Buffered fibers color coded in accordance with EIA / TIA 598 with an overall black jacket.
 - l. Be suitable for operation between -40° to +70° C
 - m. Be UV resistant
 - n. Be of an all dielectric design
4. Shall be manufactured by Berk-Tek, Corning, General Cable or Superior Essex.

2.8 BACKBONE - COPPER:

A. Backbone Copper Cabling shall meet the following requirements:

- 1. Shall be Cat 3 rated.
- 2. Shall be RDUP PE-39 rated.
- 3. Where installed underground or in wet locations, shall include fully-flooded waterblocking compound to provide wet-location rating of cable.
- 4. Size of the backbone cables shall be determined by multiplying the number of horizontal voice cables to be terminated in each IDF by 200% and rounding up to the nearest 50 pair group. For Example if 94 horizontal voice cables are to be terminated in IDF1, install $94 \times 1 \text{ pr} \times 200\% = 188 \text{ pr}$ rounded up to nearest 50 pr = 200 pr cable to IDF1.
- 5. Shall be manufactured by Berk-Tek, Corning, General Cable, Mohawk or Superior Essex.

2.9 COPPER CABLE SURGE PROTECTION DEVICES:

- ### A.
- All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of the latest edition of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

- B. The surge protection device shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

2.10 PATCH CORDS:

- A. The structured cabling contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. Patch cords shall be provided by the structured cabling contractor to connect patch panels to owner furnished electronics. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 for patch cord testing. Provide one set of optical fiber patch cables per fiber run that terminates on fiber patch panel and provide one category 6A patch cord for each category 6A work outlet that terminates on patch panel.
- B. Copper (UTP) patch cords shall:
 - 1. Be furnished to connect each patch panel jack to owner supplied electronics.
 - 2. Be furnished for each work outlet jack.
 - 3. Be a Category 6A patch cord manufactured by Panduit, Amp or Systimax.
 - 4. Use 8 position connector with impedance matched contacts and designed using dual reactance.
 - 5. Be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
 - 6. Meet TIA category 6A component specifications in ANSI/TIA/EIA-568-B.2-1 100% factory tested to meet category 6A performance and ETL or any other nationally recognized 3rd party verification
 - 7. Be capable of universal T568A or T568B wiring schemes.
 - 8. Have modular connector that shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 - 9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 - 10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
 - 11. Have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
 - 12. Be available in three standard colors
 - 13. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths
 - 14. Be backwards compatible to Category 3, 5 and 5e
- C. Fiber Optic patch cords shall:
 - 1. Be furnished in the quantity of two (2) per IDF in each IDF and two (2) per IDF in each MDF.
 - 2. Be manufactured by Panduit, Amp or Systimax.
 - 3. Be multimode OM4 type.
 - 4. Have connector type as directed by owner.
 - 5. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 - 6. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
 - 7. Be available in three standard colors
 - 8. Be available in 3 foot, 5 foot, 7 foot, 10 foot, and 14 foot standard lengths

2.11 GROUNDING AND BONDING:

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in

accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). Each grounding bus shall be 12"W x 4"H x 1/4"THK and be mounted to the backboard with porcelain isolators.
- C. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.12 FIRESTOP:

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an UL listed firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

2.13 INNERDUCT:

- A. Innerduct, shall be:
 - 1. Non-metallic, corrugated with pre-installed pull tape.
 - 2. Plenum-rated, where installed within buildings.
 - 3. UL listed for the application.
 - 4. Size as required by the application.
 - 5. Orange in color in concealed areas or within telecommunications or electrical rooms. Color shall be custom as selected by owner in exposed areas (such as within cable trays overhead in areas without ceilings outside telecommunications/electrical rooms).

PART 3 EXECUTION

3.1 PRE-INSTALLATION SITE SURVEY:

- A. Prior to start of work, meet at the project site with the owner's representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial schedule completions of the equipment rooms and telecommunication closets.
- B. Examine areas and conditions under which the system is to be installed. Do not proceed with work until satisfactory conditions have been achieved.

3.2 WORK AREA OUTLETS:

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack

shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B.1 document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable.
- E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).
- G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.3 HORIZONTAL DISTRIBUTION CABLE INSTALLATION:

- A. All horizontal voice and data cabling shall be terminated on modular patch panels except for horizontal voice cables serving life safety related functions (fire alarm systems, security systems, elevator communications, etc.). All horizontal voice cabling serving life safety related functions shall be terminated on 110 blocks.
- B. The voice and data cables shall be installed in separate patch panels.
- C. All wiring above ceilings shall be installed in cable tray or open top cable hangers or in provided conduit.
- D. Cable above accessible ceilings shall be supported 60" on center from cable support attached to building structure.
- E. Do not untwist cable pairs more than 0.5 in. when terminating.
- F. The Contractor shall be responsible for replacing all cables that do not pass Category 6A requirements for data and 5e for the voice applications.
- G. Maximum horizontal cable length shall be 90 meters.
- H. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket. Cables with defects shall be replaced.
- I. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90° sweeps at all vertical drops.
- J. Do not install Category 6A cable with more than 110N (25 lbs) pull force, as specified in ANSI/TIA/EIA and BICSI TDDM practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use of tensile rated cords (i.e. fishing line) should be used for difficult or questionable pulls - to judge to go/no-go condition of the conduit and pulling setup.

- K. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.
- L. Test, label and document as called for in contract documents.
- M. Firestop all openings where cable is installed through a fire barrier.

3.4 HORIZONTAL CROSS CONNECT INSTALLATION:

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.
- B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained as close as possible to the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.5 OPTICAL FIBER TERMINATION HARDWARE:

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.
- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. A maximum of 12 strands of fiber shall be spliced in each tray
- F. All spare strands shall be installed into spare splice trays.

3.6 BACKBONE CABLE INSTALLATION:

- A. Raceways:
 - 1. All backbone cables shall be installed inside innerducts (see specification above) within conduits meeting specification requirements unless specifically noted otherwise.
 - 2. Backbone cables shall be installed separately (in separate innerducts/conduits) from horizontal distribution cables.
 - 3. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 13 OF 17

4. Where backbone cables and distribution cables are specifically specified to be installed in a cable tray or wireway, backbone cables shall be installed first, within innerducts meeting specifications above, bundled separately from the horizontal distribution cables.

B. Support:

1. Within Telecommunications Rooms or at Telecommunications Backboards, all backbone cables shall be securely fastened to the backboards on the walls.
2. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
3. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
4. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.7 COPPER TERMINATION HARDWARE:

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A/B standard, manufacturer's recommendations and best industry practice.
- B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.8 RACKS:

- A. Floor-mount racks shall be used unless specifically shown otherwise.
- B. Floor-mount racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.
- C. Racks shall be placed with a minimum of 36 inches clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
- D. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.11 of this document.
- E. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- F. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of grey fire retardant paint.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 14 OF 17

- G. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.
- H. Rack-mounted patch panels (and the associated horizontal cable management sections) furnished within the contract shall occupy no more than 40% of the available space within the associated racks (also furnished within the contract) unless specifically shown or specified otherwise. A minimum of 60% of available rack space shall be reserved for owner-furnished equipment. Where the number of patch panels and horizontal cable management sections would exceed 40% of the available rack space, an additional rack shall be installed.

3.9 EQUIPMENT TRAY FOR TELECOMMUNICATION ROOMS:

- A. All equipment trays shall be 18" in width.
- B. Furnish and install 18" equipment tray from each floor mount rack/server cabinet to wall. Furnish 18" equipment tray around wall as required to support cables. A minimum of two (2) walls shall be completely covered by equipment tray.
- C. Furnish and install cable retaining posts on each side of tray every 4 feet as required to supports cables.

3.10 FIRESTOP SYSTEM:

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.11 GROUNDING SYSTEM:

- A. The TMGB in the MDF shall be connected to the building electrical entrance grounding facility with a #6 AWG ground. Each TBB in each IDF shall be connected to a ground bus in the MDF with #4/0 AWG minimum ground. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- B. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
- C. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.
- D. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by the electrical contractor.

3.12 IDENTIFICATION AND LABELING:

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful structured cabling contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
STRUCTURED CABLING SYSTEM**

SECTION 27 1000 PAGE 15 OF 17

- B. All label printing will be machine generated by Panduit software (or other) using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.13 TESTING AND ACCEPTANCE:

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Panduit Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for category 6A performance compliance, respectively.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B.1 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Category 6A Performance:
 - a. Follow the Standards requirements established in:
 - 1) ANSI/TIA/EIA-568-B .1, B.2 and B.2-1
 - b. A Level III test unit is required to verify category 6A performance. The basic tests required are:
 - 1) Wire Map
 - 2) Length
 - 3) Attenuation
 - 4) NEXT (Near end crosstalk)
 - 5) Return Loss
 - 6) ELFEXT Loss
 - 7) Propagation Delay
 - 8) Delay skew
 - 9) PSNEXT (Power sum near-end crosstalk loss)
 - 10) PSELFEXT (Power sum equal level far-end crosstalk loss)

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end to end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the structured cabling contractor shall test each link from end to end to ensure the performance of the system. **ONLY LINK TEST IS REQUIRED.** The structured cabling contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.14 SYSTEM DOCUMENTATION:

- A. Upon completion of the installation, the structured cabling contractor shall provide three (3) full documentation sets to the owners for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the structured cabling contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the structured cabling contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS:

- A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-A/B including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6A cabling systems.

- C. Test results generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The structured cabling contractor must furnish this information in electronic form (CD-ROM).
- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.16 AS-BUILT DRAWINGS:

- A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 2002) formats on which as-built construction information can be added. These documents will be modified accordingly by the structured cabling contractor to denote as-built information as defined above and returned to the Owner.
- B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD DWG) form.

3.17 WARRANTY:

- A. The manufacturer shall provide a 25 year extended product warranty with a 25 year applications assurance warranty. Manufacturer shall provide the warranty directly to the end user.
- B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal copper and the backbone optical fiber portions of the cabling system.
- C. The Application Assurance Warranty shall cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-B.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.
- D. The contractor shall provide a warranty on the physical installation.

3.18 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the manufacturer, registering the installation.

END OF SECTION 271000

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TELEVISION DISTRIBUTION SYSTEM**

SECTION 27 4100 PAGE 1 OF 2

PART 1 GENERAL

- A. The contractor shall provide and install a complete television distribution system as specified herein and as shown on the plans together with all accessories required to provide a complete operating system.
- B. Equipment manufacturer name and model numbers specified are provided to establish quality of equipment and system operational features. Any proposed substitution of equipment from that specified must be approved by the Architect within ten (10) days prior to bid date.
- C. The entire system shall be guaranteed for a period of one (1) year from the date of final acceptance of the installation and the Contractor shall repair or replace defective equipment, during this period, at no cost to the owner.
- D. The system shall be designed to receive and distribute channels to all TV locations.

PART 2 PRODUCTS

- A. The line splitters shall be 2-way and 4-way as required and shall be Blonder Tongue SCVS series.
- B. The directional couplers shall be Blonder Tongue SRT series as required.
- C. The television distribution amplifier shall be Blonder Tongue BIDA550-50 and shall receive its input from Cable TV Company and other locations shown on the plans.
- D. The receiver outlet shall consist of suitable connector mounted to wall plate. The receiver outlet shall be installed at all locations shown on the drawings.
- E. All distribution cable shall be low-loss coaxial type, plenum-rated RG-6U (as manufactured by West Penn or Belden). See Specification Section 270500 for additional requirements.
- F. All head-end equipment shall be rack-mounted.
- G. Provide filters, amplifiers, and any miscellaneous items required to rebroadcast the signal at the proper level for each channel.
- H. All copper circuits routed between or outside of buildings shall be provided with a surge protection device at each end. The surge protection device shall be labeled as meeting the requirements of UL 96A (exact requirements shall be coordinated with the lightning protection system supplier, where applicable).

PART 3 EXECUTION

- A. Wiring shall be in strict accordance with the National Electrical Code and all state and local regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall test free from ground, opens and short circuits.
- B. All connections shall be made under the direct supervision of a qualified technician.
- C. All cables shall be terminated.
- D. Wiring for the Television Distribution System is based on one manufacturer's recommendation. This contract requires that the installed wire be in accordance with the accepted manufacturer's recommendations.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TELEVISION DISTRIBUTION SYSTEM**

SECTION 27 4100 PAGE 2 OF 2

- E. Refer to Specification Section 270500 for additional installation requirements.
- F. Upon completion of job, the entire system shall be tested and a certificate shall be forwarded to the Architect by technician stating that he has personally verified the the following:
 - 1. System is in accordance with specifications.
 - 2. System is in correct operating condition.

END OF SECTION 274100

PART 1 GENERAL

1.1 WORK INCLUDED

- A. The work included under this section includes the connection of the Access Control System card reader and sensors to the corresponding reader processor and the installation of the Access Control and Alarm Monitoring System to which it connects.

1.2 REFERENCES

- A. The system provided shall conform to the following standards, as applicable.
 - 1. FCC part 15, subpart J for emitted radiation
 - 2. UL 294 Standard for Access Control Systems
 - 3. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the above listings.

1.3 GENERAL

- A. Access Control readers, associated equipment and system controller shall be manufactured and guaranteed by Avigilon or pre-approved equal.
- B. The system shall be fully compatible with the owner's existing system at other facilities.
- C. The contractor shall provide a complete access control system consisting of all hardware, devices, cabling, software and licenses.

1.4 ACCESS CONTROL SYSTEM OPERATION

- A. The system shall control access by comparing the unique ID number stored within each valid system card with the list of acceptable ID numbers stored in the reader processor. The list will be modified, as required, by the system controller depending on date, time and reader location.
- B. When a card is used at a reader location, the decision to allow access is made without need of communication to the system controller. If the conditions are met, the electric door strike is activated or magnetic lock de-activated to allow access for a programmable time from 1 to 99 seconds. The ID number of the badge is transmitted to the system controller for audit trail logging.
- C. If a card is rejected, an appropriate message identifying the reason shall be transmitted to the System Controller.
- D. The card readers shall operate for a minimum of 8 hours on standby batteries in the event of commercial power failure. When the system switches to battery power or back to A.C. power, an appropriate message will be issued to the system controller

1.5 SOFTWARE / COMPUTER

- A. The contractor shall provide a computer as recommended by the access control system manufacturer with all software and licenses required for full operation of the system. Include training the owner as required regarding programming system.

1.6 PROXCARDS

- A. Provide forty (40) HID Proxcards for use with the system.

PART 2 PRODUCTS

2.1 ACCESS CONTROL

A. CARD READERS

1. Card reader systems shall be of the proximity, and be flush mounted in an environmental back box.
2. Each card reader shall be connected to an intelligent processor via cabling recommended by the manufacturer.
3. The processor shall contain a backup power supply for continuous operation in the event of a power failure for at least 8 hours. The batteries to be automatically recharged on the resumption of power.
4. The reader/processor shall be capable of stand alone operation in the event of a communication failure with the Central Controller.
5. The processor shall provide a memory buffer so that the Central Controller is automatically updated when communications is restored.
6. The processor shall be capable of being programmed locally at the reader or remotely via the Central Controller.
7. Authorized access shall be allowed only if the card is valid for the system, the card is valid for the site, the card is valid for the particular reader, the card is valid for the current time and date and if anti-passback, the current entry/exit request has logically followed a previous exit/entry .
8. The system shall permit door release contacts to close for an adjustable period, pre-programmed for each door, from 200 milliseconds to 99 seconds. Adjustment of door release/alarm shunt delay times shall be operator adjustable at any time. (ie. software controlled).
9. The system shall display messages at the Central Controller in the event of any card transaction or alarm condition being detected. The message shall consist of the time and, for a valid access, the employee name and department. For an invalid attempt, the controller shall display card number or name and reason such as whether void, non-facility code, incorrect site, passback violation, incorrect time zone, not valid for door, or incorrect code entry (when fitted with keypad).
10. The Processor/reader shall supervise itself and indicate malfunctions, tampers of the reader or communication and power problems.
11. The reader shall have Light Emitting Diodes (LEDS) to indicate GREEN for a valid card and RED for an invalid card.

B. CARD READERS

1. Card readers shall be HID Signo Model 40K.

C. ACCESS CARDS

1. Access cards shall be provided by owner.

D. READER HOST CONTROLLER BOARD:

1. Reader host controller board shall be Avigilon MP 1502.

E. READER CONTROLLER BOARD

1. Reader controller board shall be Avigilon MR52-2

F. MOTION DETECTORS

1. Wall mounted motion detectors shall be compatible with system.

G. REQUEST TO EXIT BUTTONS

1. Request to exit buttons shall be compatible with the system.

H. DOOR CONTACT SWITCHES

1. Door contact switches for door monitoring shall be EDWARDS No. 45 or equal.

I. WIRING

1. See Specification Section 270500 for additional requirements.

PART 3 EXECUTION

3.1 WIRING

- A. Wiring shall be in strict accordance with the National Electrical Code and all state and local regulations. Wiring shall be installed in accordance with manufacturer's wiring diagrams and shall be test free from grounds, opens and short circuits.
- B. All connections shall be made by or under the direct supervision of a qualified program system technician.
- C. Wiring for the system is based on one manufacturer's recommendation. This contract requires that the installed wire be in accordance with the accepted manufacturer's recommendations.
- D. See Specification Section 270500 for additional installation requirements.

3.2 PRE-CONSTRUCTION COORDINATION

- A. Supplier shall meet with owner prior to beginning work for a detailed coordination meeting and review of the proposed system.

3.3 CERTIFICATION AND ACCEPTANCE

- A. Upon completion of job, the entire system shall be tested and a certificate shall be forwarded to the Architect by Technician stating that he has personally verified the following:
 1. System is in accordance with specifications
 2. System is in correct operating condition
- B. Complete system shall be operated and explained to the Owner's designated representative by the Contractor. Owner shall be provided with complete operating/instruction manual and as-built hookup and connection drawing.

3.4 WARRANTY

- A. All equipment shall be guaranteed for one year from acceptance date.
- B. Contractor shall provide free one-year service contract on program system materials and equipment.

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install a complete low voltage, automatic and manual fire alarm system as specified herein and indicated on the drawings.
- B. The system shall include a central control panel, power supply, signal initiating devices, audible and visual alarm devices, a conduit and wiring system and all necessary accessories required to provide a complete operating system.
- C. The system shall be completely addressable.
- D. The system shall be seismic rated.
- E. The system shall comply with the applicable provisions of the National Fire Protection Association Standard Number 72 (National Fire Alarm Code) for fire alarm systems; N.E.C. Article 760; and meet all requirements of the local authorities having jurisdiction.
- F. The system shall be provided by a local service organization located within 50 miles of the job site.

1.2 DESCRIPTION OF SYSTEM

- A. Conduit, outlet boxes, cabinets, devices and wiring installation for complete fire detection and alarm system.
- B. Each and every item of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOBZ as a single control unit. Partial listing shall not be acceptable. System controls shall be UL listed for Power Limited Applications per N.E.C. Article 760. All circuits shall be marked in accordance with N.E.C. 760-23.
- C. Wiring shown is diagrammatic to define system and is not intended to show every wire. Review drawings prior to bidding and inform Contractor of any additional wiring necessary for installation of systems. Wiring shall comply with pathway survivability requirements defined in NFPA 72. Include cost of all wiring in bid.
- D. After completion of work, submit one set of record mylar sepias with items for Owner described above. Typical type drawings will not be accepted.
- E. Manufacturer's trained technical representative shall supervise installation, connections and tests. The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. Before acceptance, manufacturer's representative will test and certify in writing that system is installed and functioning properly as intended by drawings and specifications. Test includes operation of all devices in entire system.
- F. Guarantee entire system in writing for one year from date of acceptance by Owner. Guarantee will cover completely all components, equipment, wiring, etc. Repair any defects found in the system within the guarantee period without cost to owner.
- G. Submit with bid a guaranteed price for complete maintenance and service of system for one year beginning at expiration of guarantee period. Price shall be guaranteed for acceptance by Owner until date of substantial completion of system.

1.3 SUBMITTALS

- A. Submit complete shop drawings of system for review per minimum requirements of NFPA 72 and local AHJ including the following:
- B. Product data cutsheets for all propose equipment with complete descriptive information on each item of equipment including UL listing for all system components
- C. Fire alarm NICET designer information and fire alarm contractor permit information
- D. Legend, notes, sheet index, wiring schedule
- E. To-scale floor plans showing all devices and room names
- F. Terminal-to-terminal connection diagrams for system components and associated equipment interfaces. Identify color code and terminal numbers on shop drawings.
- G. System input/output matrix
- H. Unique device identification numbers
- I. Conduit diagrams
- J. Battery calculations and voltage drop calculations
- K. Typical device installation details
- L. Any other information required by Architect to describe system.

1.4 SYSTEM OPERATION

- A. Actuation of any alarm initiating device shall cause all audible alarm signals to sound, all visual indicating appliances to flash, activate an alarm LED and local tone-alert at control panel/annunciator, cause an LCD read-out of point in alarm including type of alarm (smoke detector, manual station, etc.), provide a signal to the mechanical controls to shut down or re-route air handling systems according to established plans. This shall include a suitable addressable relay at each air handling unit to shut down all air handlers in a given zone when system goes into alarm.
- B. The general alarm devices may be silenced by authorized personnel only, by entering a locked cabinet and operating the proper silencing switch. A subsequent zone alarm shall reactivate the signals. Operation of the silencing switch shall be indicated by a trouble light and audible signal.
- C. Operation of any sprinkler monitoring switch, power failure, opens, grounds, or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced; however, the trouble LED shall remain lit until the system has been returned to normal operating condition.
- D. Analog Smoke Sensor Operation
 - 1. The smoke sensor shall be a smoke density measuring device having no self contained alarm set-point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values.
 - 2. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors and are deemed unacceptable.

3. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value, a "Dirty Sensor" trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location.
4. If a "Dirty Sensor" is left unattended, and its average value increases to a second predetermined value, an "Excessively Dirty Sensor" trouble condition shall be indicated at the control panel for the individual sensor.
5. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor which fails the self-test will cause a "Self Test Abnormal" trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable.

1.5 SYSTEM FEATURES

- A. The fire alarm system shall include the following features as a minimum:
1. Supervision of all field wiring.
 2. Microprocessor based solid state modular construction.
 3. Ground fault detection and ground fault isolating & supervising circuitry.
 4. 80 character LCD display to indicate alarms, supervisory service conditions and troubles.
 5. Simultaneous test of all LED's and LCD's from a central point.
 6. "Dead Front" design control panel/annunciator with field programmable LED alarm, status and trouble indicators, and all control switches located behind a locked tempered glass door.
 7. Fully automatic battery charger and lead alkaline batteries. Batteries shall have capacity to maintain system operation for 24 hours in normal supervisory mode and shall have sufficient capacity remaining to operate in alarm mode for 15 minutes at conclusion of supervisory period. Batteries shall be supervised for connection to the system and for low voltage threshold. Ammeter and voltmeter shall be provided to indicate battery voltage and charging current.
 8. Two (2) sets of 2 amp form C auxiliary alarm contacts fused with feedback.
 9. One (1) set of 2 amp form C auxiliary trouble contacts.
 10. Standard with 99 addressable points (expandable to 250 points) and four input/output (I/O) circuits (expandable to 20 circuits).
 11. Basic four (4) amp power supply (expandable as required).
 12. 600 event historical logging.
 13. System shall be field programmable for offsite monitoring by remote station reverse polarity, local energy master box or shunt master box types.
 14. System shall be field programmable for signal circuit type of operation; march time code, temporal code, selective code, zone code, general alarm, time limit cutout and alarm silence inhibit.
 15. System shall be field programmable for waterflow/sprinkler supervisory operation on distinct zones as required.
 16. Transient suppression protection shall be provided on the system power supply and on the municipal protection circuit to comply with UL 864 requirements. Additionally, surge suppression shall be provided within the control panel on all circuits that extend outside the building (including to roof-mounted HVAC units).
 17. Supervised remote annunciator connection circuit.
 18. System shall incorporate an alarm/trouble walk test.
 19. Resident non-volatile programmable operating system memory for all operating requirements.

PART 2 PRODUCTS

2.1 FIRE ALARM CONTROL PANELS/ANNUNCIATORS

- A. Furnish and install Notifier fire alarm control panel(s) with options and accessories as required.

2.2 MANUAL ALARM STATIONS

- A. Manual alarm stations shall be addressable break glass (double-action). The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "Pull Lever" shall remain at right angle to the station body until reset.
- B. Boxes:
 - 1. Recessed, two-gang outlet boxes with Simplex type 2099-9813 red, semi-flush trim plates shall be used where possible.
 - 2. Where surface-mount outlet boxes are required, boxes shall be red, cast aluminum Simplex type 2975-9022.

2.3 PHOTOELECTRIC SMOKE SENSOR

- A. The smoke sensors shall be of the photoelectric addressable and shall communicate actual smoke chamber values to the system control panel. The smoke sensors shall operate on the light scatter principle. For maximum maintenance free service and low power requirement, light source for detection chamber and visual alarm indication shall be solid state photodiode.
- B. Each sensor base shall be visually and electrically supervised.
- C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.
- D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.
- E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.
- F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.
- G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
- H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
- I. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness, if field conditions so require.

- J. Provide a U.L. listed sensor guard for sensors in areas subject to tampering. The guard shall be suitable for ceiling or sidewall mounting and hinged for easy access. The guard shall be securely mounted with tamper-proof screws.

2.4 PHOTOELECTRIC DUCT DETECTOR

- A. The detector shall be an addressable, non-polarized 24VDC, which is compatible with the Fire Alarm Control Panel and obtains its operating power from the supervisory current in the fire alarm detection loop. It shall be of the same analog type as the ceiling smoke detectors. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
- B. The detector head shall be directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the control panel reset switch.
- C. Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Contact between the base and head shall be of the bifurcated type utilizing spring type, self-wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
- D. Sampling tubes sized to match duct size as recommended by equipment manufacturer shall be provided with duct detectors as required.
- E. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.). It shall be possible to alarm the duct housing by using a test switch. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.
- F. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
- G. Separate auxiliary SPDT relays for fan shutdown shall be provided with each duct detector for fan shutdown, smoke evacuation or other purposes as indicated on plans.
- H. Remote key operated test stations with LED alarm indicators shall be installed in an accessible, inconspicuous location for each duct detector.
- I. Duct detectors shall be installed for the equipment as indicated on plans as follows (locations shown on plans are diagrammatical only):
 - 1. A minimum of six duct widths downstream from bends or inlets to avoid air turbulence.
 - 2. On the downstream side of filters to detect fires in the filters.
 - 3. In return ducts, ahead of mixing areas.
 - 4. Upstream of air humidifier and cooling coil.
 - 5. With accessibility for test and service.
- J. The following duct detector locations shall be avoided:
 - 1. Where dampers closed for comfort control would interfere with airflow.
 - 2. Next to outside air inlets (unless the intent is to monitor smoke entry from that area).
 - 3. In return air damper branch ducts and mixing areas where airflow may be restricted.

- K. Where duct detectors are installed in exterior or wet locations, weatherproof duct housing enclosures shall be provided to protect the detectors. Enclosures shall be located to be in shaded areas rather than direct sunlight. Entire installation shall be as directed by the equipment manufacturer.

2.5 HEAT SENSORS

- A. Heat sensors shall be U.L. listed and addressable. They shall provide rate-of-rise temperature sensing, fixed temperature sensing (135 degrees F) and utility temperature sensing (32 degrees F to 155 degrees F range).
- B. Each sensor base shall be visually and electrically supervised.
- C. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.
- D. Each sensor base shall contain integral addressable electronics and an LED that will flash each time it is scanned by the control panel (once every 4 seconds). The control panel shall be responsible for drift compensation. When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable. Sensor bases shall be compatible with detachable photoelectric, ionization and heat sensors so that these various sensor types can be easily interchanged to meet specific location requirements. Sensor base shall be addressable type as required.
- E. Where required, sensor bases shall be provided with a relay driver output and supervised relay, which are to be controlled either automatically or manually from the control panel.
- F. Each sensor base shall be scanned by the control panel for its type identification to prevent inadvertent substitution of the wrong sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.
- G. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
- H. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
- I. Heat sensor shall be automatically restorable.

2.6 MAGNETIC DOOR HOLDERS

- A. Provide magnetic door holders as required where shown on plans. Coordinate exact type with mounting location and door type.

2.7 ALARM SIGNALS (AUDIBLE)

- A. Horns:
 - 1. Alarm horns shall be polarized and shall be operated by 24 VDC. Each horn assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted. Where horns are shown as a combination audio-visual assembly, they shall be mounted as a

combination unit in a single back box (4903 series) . Horns shall be capable of producing 95 dB.

- B. Devices required to be surface mounted shall be furnished with surface mounting box and adaptor plate.
- C. Devices installed in areas subject to mechanical damage (ie. gymnasiums) shall be furnished with suitable wire guards as indicated on plans.

2.8 ALARM SIGNALS (VISUALS)

A. Visual Flashing Lamps (Xenon Strobe):

1. Furnish and install per plans and specs Simplex type 4904 series visible appliance for fire alarm system notification. The appliance shall be 1HZ synchronized (15cd, 30cd, 110cd) with polar distribution or 75 cd illumination as required by the Americans with Disabilities Act (ADA). The appliance shall be U.L. listed to Standard 1971 and have a circumpolar light output allowing mounting in either vertical or horizontal positions or on the ceiling.
2. The light unit shall be of ABS polycarbonate and the lens of high grade, optical quality LEXAN. For optimized light distribution, the xenon flash tube shall be installed perpendicular to the appliance's back plane. A special compound reflector shall be utilized to maximize and best distribute the light pattern in key axis directions.
3. The effect of the illuminated visible appliance shall be observable in a circumpolar pattern. The visible appliance shall be labeled with the word "FIRE" in a contrasting color and the height of each character shall be a minimum of 5/8 inches. In its quiescent state, the word "FIRE" shall be visible.
4. Mounting heights of visual appliances shall in all respects comply with the Americans with Disabilities Act.
5. Visual indicating appliances shall be comprised of a Xenon flashtube and be entirely solid state. These devices shall be U.L. listed and be capable of either ceiling or wall mounting. The LEXAN lens shall be pyramidal in shape to allow better visibility. Visual units shall be of the stand alone type.

2.9 REMOTE ANNUNCIATOR

- A. Where shown on the plans, provide and install an LCD annunciator. The annunciator(s) shall have a stainless steel finish and shall provide the same functionality as the main control panel front panel display. The annunciator shall communicate to the control panel over one twisted shielded pair of wire and operating power shall be 24VDC and be fused at the control panel. Point-wired annunciators will not be considered as equal.
- B. The serial annunciator shall provide a common alarm and trouble circuit consisting of:
 1. Control push-button switches – for alarm silence, trouble silence, system reset and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches.
 2. Tone Alert – Duplicates the control panel tone alert during alarm and trouble conditions.
 3. System trouble LED.
 4. Power on LED.
- C. To accommodate and facilitate job site changes the control switches shall have the capability to be programmed on site to provide for manual switch input operation other than their standard purpose.

2.10 SPRINKLER FLOW SWITCHES

- A. Sprinkler flow switches and supervisory switches are provided under another section of these specifications. This contractor shall be responsible for electrical connection of these devices to the fire alarm system.

2.11 SMOKE DAMPERS

- A. Smoke dampers are provided under another section. This contractor shall be responsible for supplying a source of power and connecting them to the fire alarm system to close on alarm.

2.12 SYSTEM RECORD DOCUMENT CABINET

- A. Furnish and install a documentation cabinet at the system control unit or other approved location. All final record documentation shall be stored in the cabinet. Cabinet shall be labeled as "SYSTEM RECORD DOCUMENTS". Cabinet shall include a 4 gigabyte digital flash drive interface with USB connector loaded with a digital copy of all system documentation including shop drawings and product data.

2.13 OFF SITE MONITORING

- A. Furnish all material and labor to accomplish and coordinate with local company or fire department as necessary for off site monitoring of the Fire Alarm System. Transmission method(s) shall be as required by applicable codes and Authority Having Jurisdiction (AHJ). Off site monitoring shall be in operation prior to final acceptance. Exact type of off site monitoring (basic reporting or advanced reporting as described below) shall be provided by the contractor per the owner's direction.
- B. Furnish and install serial digital alarm communicating transmitter (DACT), capable of reporting specific alarm points to the central station. DACT shall be universal in that it can be utilized to either provide basic reporting (alarm, trouble, supervisory conditions) or more advanced reporting (point-to-point reporting of specific alarm conditions) DACT shall be mounted integral to or beside fire alarm control panel.

2.14 FIRE ALARM CABLING

- 1. All fire alarm cabling shall:
 - a. Have red outer insulation/jacket with ripcord.
 - b. Be listed and labeled for the intended use in Fire Alarm systems.
 - c. Where Level 2 or Level 3 pathway survivability is required by NFPA 72, cabling shall be 2-hour fire rated circuit integrity (CI) type.
 - d. Be manufactured by West Penn, Allied, Belden or Superior Essex.

2.15 FIRE ALARM SYSTEM MANUFACTURER

- A. All equipment shall be listed by UL. All panels and peripheral devices shall be the standard equipment of a single manufacturer and shall display the manufacturer's name on each component..
- B. Equipment shall be as manufactured by Notifier or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
FIRE ALARM SYSTEM**

SECTION 28 3100 PAGE 9 OF 10

- B. The contractor shall provide 120VAC power to all remote booster power supplies, control panels, transponder cabinets or other similar items as required. Where the project is provided with emergency power from an emergency generator, all power supplies shall be connected to an emergency source. Dedicated branch circuit(s) shall be provided to supply primary power to the fire alarm system. The associated branch circuit breakers shall be furnished with lock-on hardware and shall be identified with red marking as a fire alarm circuit. The location of the circuit disconnecting means shall be permanently identified at the fire alarm control unit.
- C. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 Parts I and III, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 Parts I and II.
- D. All wiring shall be installed in strict compliance with pathway survivability requirements of applicable codes including NFPA 72.
- E. Upon completion, the contractor shall so certify in writing to the owner and general contractor.
- F. Front surface of all junction box covers in concealed areas (such as above lay-in ceilings) or within mechanical/electrical rooms (and other similar areas where appearance of boxes is not an issue) shall be sprayed red and labeled "Fire Alarm" or "F/A". Covers in exposed areas shall be labeled "F/A" on interior of front cover. Wiring color code shall be maintained throughout the installation.
- G. All fire alarm wiring shall be installed in conduit. Conduit shall be sized per manufacturer's recommendations, but in no case shall conduit be smaller than 3/4".
- H. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- I. All raceways shall be concealed unless specifically shown or approved otherwise.
- J. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- K. Install System Record Document cabinet adjacent to control panel unless alternate location is approved.
- L. The manufacturer's authorized representative shall provide on-site supervision of installation and shall provide all system setup and programming services.
- M. The manufacturer's authorized representative shall have as a minimum, a NICET LEVEL III certification. The fire alarm contractor shall have a technician with a minimum Nicet Level III certification working in a position of responsibility. All technicians working for the certified contractor shall have a minimum Nicet Level II certification. Any fire alarm contractor wishing to bid on the fire alarm work shall show evidence of certifications at the pre-bid conference.
- N. The fire alarm contractor shall be licensed as a certified fire alarm contractor by the state in which the work is to be performed in compliance with all requirements of state fire marshall or other AHJ's as applicable.
- O. The drawing/specifications included herein are to indicate contract intent only. The Fire Alarm contractor shall provide final design documents to include plans specifying exact device types/locations, circuitry, battery calculations, circuit/voltage drop calculations, etc. in accordance with all applicable code requirements. These final design documents shall be prepared under the supervision of an engineer licensed in the state where the work is to be performed,

engaged/employed by the Fire Alarm contractor, and must bear the engineer's licensure seal with signature and date.

3.2 TESTING

- A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor, and shall submit final testing results with O&M documentation..
- B. The contractor shall test and demonstrate proper operation of all smoke detection equipment and associated HVAC controls to the satisfaction of the authority-having-jurisdiction and fire marshal.

3.3 WARRANTY

- A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.
- B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

3.4 CERTIFICATION & ACCEPTANCE

- A. A factory trained representative of the manufacturer shall supervise final testing of the system in accordance with N.F.P.A. Standard 72H-1984 in the presence of a representative of the authority having jurisdiction. Manufacturer's representative shall be NICET trained and shall have a level III NICET certificate. It shall be subject to the approval and acceptance of the responsible engineer. On completion of the acceptance tests, the Owner or his representative shall be instructed in the operation and testing of the system.
- B. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy whichever is earlier. Any equipment shown to be defective in workmanship or material shall be repaired, replaced, or adjusted free of charge.
- C. The equipment manufacturer shall be represented by a local service organization, and the name of this organization shall be furnished to the Architect and Owner. The service organization shall be located within 50 miles of the job site. The service organization shall furnish, gratis to the Owner, a one year maintenance warranty contract, effective from the date of final acceptance.

END OF SECTION 283100

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing of vegetation, trees, landscaping and other vegetation
- B. Clearing of stumps, roots, shrubs, brush, grass , and organic material
- C. Removal of existing debris, junk, and trash from site.
- D. Stripping Topsoil

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion and Sediment Control.
- B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- D. Section 02 4100 - Demolition: Removal of built elements and utilities.
- E. Section 31 2200 - Grading: Topsoil removal.
- F. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations. Topsoil removal.
- G. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- H. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 2323 - Fill and Backfill
- B. Topsoil: See Section 31 2323.

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- B. Provide traffic control and when working near or adjacent to open roads, streets, walks, etc.
- C. Provide temporary construction barricades to as needed to separate the work zone from open facilities and the public.
- D. Do not close streets or sidewalks without permission from authority having jurisdiction.
- E. Protect existing improvements to remain and adjacent properties from damage.
- F. Restore damaged improvements and adjoining properties as acceptable to party having jurisdiction and at no cost to the owner.
- G. Dewater low areas prior to clearing and stripping topsoil.
- H. Strip topsoil to whatever depth encountered on site. Prevent intermingling of topsoil to be reused with underlying subsoil or other objectionable material.
- I. Strip and stockpile topsoil as needed for reuse on site in landscaped, grassed, and seeded areas.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SITE CLEARING**

SECTION 31 1000 – Page 2 of 2

- J. Topsoil stockpiles shall be free draining, covered or seeded if the stockpile shall not be reused in 13 days. Provide silt fencing around the perimeter of all stockpiles.
- K. Fill holes, pits, and excavations generated as a result of clearing operations in accordance with Section 31 2200 - Grading and Sec31 2323 - Filling.
- L. Remove other items elsewhere on site as indicated on drawings
- M. Provide positive drainage as needed to keep the site in a dry condition.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

- A. Completely remove trees, stumps, roots, shrubs, brush, grass , and organic material in areas to be covered by buildings, structures, paving, lawns and landscaped areas.
- B. Do not remove or damage vegetation beyond the limits indicated on drawings.
- C. Do not burn, bury, landfill, or leave on site any trees, stumps, roots, shrubs, brush, grass, or organic material resulting from clearing operation.
- D. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on site; treat as specified for vegetation removed.
- E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS AND DISPOSAL

- A. Remove debris, junk, and trash from site.
- B. Remove cleared trees, stumps, roots, shrubs, brush, grass , and organic material from site.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.
- E. Burning on site shall not be permitted.
- F. Dispose of all excess topsoil, unsuitable material, and waste material off site in a legal manner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal and storage of topsoil.
- B. Rough grading and filling the site for site structures, building pads, and paving.
- C. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 31 1000 - Site Clearing.
- B. Section 31 2316 - Excavation.
- C. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.
- D. Section 31 2323 - Fill: Filling and compaction.
- E. Section 32 9219 - Seeding: Finish ground cover.
- F. Section 32 9223 - Sodding: Finish ground cover.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Alabama, Department of Transportation standards.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: See Section 31 2323.
- B. Fill Materials: See Section 31 2323.
- C. Unsuitable Materials: Material defined as highly plastic soils, organic or material that will not provide a stable foundation or material that will not compact to the requirements set forth in these specifications or material not meeting the requirements of Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Verify the absence of standing or ponding water.
- C. It shall be the obligation of the Contractor to satisfy himself as to the accuracy of the topographic survey furnished on the grading plan by personal examination of the site and the existing conditions. If contractor disagrees with topographic survey, he must notify owner in advance of bidding or it is taken that contractor accepts topography.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above and below grade utilities to remain.
- D. Notify utility company to remove and relocate utilities.
- E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.
- F. Do not perform grading operations during periods of wet weather when it would be impossible to control moisture of soils
- G. Complete demolition and clearing operations in areas to be graded. Remove debris, roots, branches, and large rock.

- H. Prior to grading lower areas perform the following:
 - 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump or any other measures necessary for drainage of site.
 - 2. After drainage of area is complete, remove muck, mud, debris, and other material of unsuitable nature by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
- I. When rain is predicted, contractor shall roll graded areas to seal against infiltration. Contractor shall at all times keep site graded to maximize runoff in case of rain.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. After grade has been established in cut areas and prior to placement of fill in any fill areas, the exposed subgrade shall be carefully inspected by probing, proof rolling and testing as needed. Remove any topsoil, organic material, unsuitable material, wet, soft or loose soil and other undesirable material.
- D. Contractor shall contact the testing representative to inspect proof rolling operations. All areas failing proof rolling shall be undercut to an unyielding subgrade.
- E. Where low density soils and or highly plastic soils are encountered, as detected by proofrolling the contractor shall undercut and replace with compacted structural fill.
- F. Building pads and foundations shall be support on a minimum of 12" of structural fill. Structural fill shall extend 5 feet beyond the periphery of the buildings. Structural fill shall extend 3 feet beyond the paving limits. This requirement applies to both cuts and fills.
- G. All cavities and irregularities shall be enlarged to permit use of compaction equipment for subsequent filling.
- H. Scarify and recompact the top 8" of all areas to receive fill.
- I. See Section 31 2323 for fill material, compaction and moisture content requirements..
- J. Horizontally bench existing slopes greater than 1:4 to key fill material into existing slope for firm bearing.
- K. Fill placement can proceed after the surface densification is accomplished and proof rolling is completed.
- L. In areas where fill is to be placed on exiting steep cuts slopes, the exiting surface shall be horizontally benched the width of a piece of equipment prior to fill placement.
- M. All fill shall be placed in lifts, moisture conditioned, and compacted
- N. After excavations have been cut to subgrade, the subgrade areas shall be scarified to a minimum depth of 8 inches and re-compacted.
- O. Grade areas to elevations or contours are indicated on Drawings. Refer to the drawings for thickness of pavements, concrete slabs, etc. to determine subgrade elevations. Refer to the architectural drawing for thickness floor slabs and granular support material.
- P. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner

- Q. Refer to Section 31 2323 Filling for all material, lift thickness, compaction, and moisture requirements to include re-compact of scarified cuts exposed at grade.
- R. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

- A. Stockpile topsoil to be re-used on site; remove all excess topsoil from site.
- B. All unsuitable material, and excess subsoil shall be removed from the site.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Where topsoil is to be placed, scarify surface to depth of 2 inches.
- C. Place topsoil to thickness 4 inches.
- D. Place topsoil during dry weather.
- E. Remove roots, weeds, rocks, and foreign material from topsoil while spreading.
- F. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- G. Roll placed topsoil.
- H. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.
- I. All fill shall be placed in lifts, moisture conditioned, and compacted
- J. All excavations cut to subgrade shall be scarified to a minimum depth of 8 inches and re-compactd
- K. Grade areas to elevations or contours are indicated on Drawings. Refer to the drawings for thickness of pavements, concrete slabs, etc. to determine subgrade elevations. Refer to the architectural drawing for thickness floor slabs and granular support material. Refer to site construction plans for pavement, sidewalks, and other slab on grade thickness.
- L. Ditches and swales shall be graded to allow for proper drainage with no ponding.
- M. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner
- N. Top Surface of Subgrade: Plus or minus 0.10 feet from required elevation.
- O. Top Surface of Finish Grade: Plus or minus 0.05 feet from required elevation.

3.06 OFF-SITE CONSTRUCTION

- A. It shall be understood that all work occurring off-site and on adjacent highways, roads, streets, or right-of-ways is to be constructed in accordance with latest edition of Standard Specifications of the Alabama Department of Transportation, and any local agency having jurisdiction. Also, this work shall be subject to their inspection, regulations, and acceptance.
- B. All construction of highways or streets is to have appropriate signage and or barricades in accordance with traffic control manual and/or the Alabama Department of Transportation. Peak hour traffic is to be inconvenienced at an absolute minimum.

3.07 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.08 FIELD QUALITY CONTROL

- A. Independent Testing Laboratory, paid for by the contractor, shall perform construction testing on site as follows
 - 1. Fill Placed in Areas to be Paved: At least one compaction test for every 5,000 square feet of each 8" loose lift or layer.
 - 2. Fill Placed Under Building and Extending 10' outside Exterior Building Line: At least one compaction test for every 2,500 square feet of each 8" loose lift or layer, a minimum of 3 test per lift.
 - 3. Inspect proof rolling operations of all cuts and fills.
- B. The Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Architect, Engineer and Contractor shall be provided with copies of reports within 24 hours of time test was performed.
- C. In event that any test performed fails to meet these Specifications, owner and Contractor shall be notified immediately by the Independent Testing Laboratory.
- D. Foundation excavations shall be inspected and tested for appropriateness of bearing capacity at the bottom of footing by the Independent Testing Laboratory.
- E. All proof rolling operations shall be performed in the presence of the independent testing laboratory. The independent testing laboratory shall determine if the subgrade passes the proof rolling operation.

3.09 CLEANING

- A. Remove unused stockpiled topsoil, subsoil, and excess material.
- B. Grade stockpile area to prevent standing water.
- C. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Trenching for utilities outside the building to utility main connections.
- C. Temporary excavation support and protection systems.

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.
- B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.
- C. Section 02 4100 - Demolition: Shoring and underpinning existing structures.
- D. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.
- E. Section 31 2200 - Grading: Soil removal from surface of site.
- F. Section 31 2200 - Grading: Grading.
- G. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- H. Section 31 2323 - Fill: Fill materials, filling, and compacting.
- I. Section 31 3700 - Riprap.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

1.04 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. A geotechnical report is available. Document: Geotechnical Engineering Report – Hoover Fire Station #1, Dated November 16th, 2023, Prepared by ECS Southeast, LLP Project No. 30:2556

PART 2 PRODUCTS

2.01 MATERIALS

- A. Refer to Section 31 2323 for fill material requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. 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 locations.
- B. See Section 31 1000 for clearing, grubbing, and removal of existing debris.
- C. See Section 31 2200 for topsoil removal.
- D. Locate, identify, and protect utilities that remain and protect from damage.
- E. Notify utility company to remove and relocate utilities.

- F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- G. Protect plants, lawns, rock outcroppings, and other features to remain.
- H. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Engineer.

3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION

- A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.

3.04 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or unless shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut utility trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.
- G. Provide temporary means and methods, as required, to remove all water from excavations until directed by Engineer. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.05 SUBGRADE PREPARATION

- A. See Section 31 2323 for subgrade preparation at general excavations.
- B. See Section 31 2316.13 for subgrade preparation at utility trenches.

3.06 FILLING AND BACKFILLING

- A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.
- B. See Section 31 2323 for fill, backfill, and compaction requirements at general excavations.
- C. See Section 31 2316.13 for fill, backfill, and compaction requirements at utility trenches.
- D. See Section 31 2200 for rough and final grading and topsoil replacement requirements.

3.07 REPAIR

- A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

3.08 FIELD QUALITY CONTROL

- A. Refer to Section 31 2200 Grading
- B. Refer to Section 31 2316.13 Trenching
- C. Probe and visually inspect load-bearing excavated surfaces before placement of foundations.
- D. The Independent Testing Laboratory, paid for by the contractor, shall prepare test reports that indicate test location, elevation data, and test results. Owner, Architect, Engineer and Contractor shall be provided with copies of reports within 24 hours of time test was performed.

3.09 PROTECTION

- A. Divert surface flow from rains or water discharges from the excavation.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
EXCAVATION**

SECTION 31 2316 – Page 3 of 3

- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from drainage, rain and freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Document: A geotechnical report is available. Document: Geotechnical Engineering Report – Hoover Fire Station #1, Dated November 16th, 2023, Prepared by ECS Southeast, LLP Project No. 30:2556
- B. Section 03 3001 - Cast-in-Place Concrete (Site).
- C. Section 31 2200 - Grading: Site grading.
- D. Section 31 2316 - Excavation: Building and foundation excavating.
- E. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.
- F. Section 31 2323 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Determined for Sections and details on site drawing and from architectural drawings for building and accessory structures.

1.04 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2012).
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- E. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.
- F. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2015.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. Structural Fill: Refer to Section 31 2323 Filling.
- B. Concrete for Fill: Lean concrete.
- C. Granular Fill - Fill Type Crushed stone ASTM #67: Coarse aggregate, conforming to State of Alabama Department of Transportation standard.
- D. Drainage Fill: Fill Type Crushed stone ASTM #67: Coarse aggregate, conforming to State of Alabama Department of Transportation standard.
- E. Bedding, Hunching and Initial Back Fill (Pipe): Fill Type Crushed stone ASTM #67: Coarse aggregate, conforming to State of Alabama, Department of Transportation standard.
- F. Final Backfill (Pipe): Structural Fill. Refer to Section 31 2323 Filling
- G. Topsoil: See Section 31 2323 Filling

2.02 ACCESSORIES

- A. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, whichever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:
 - 1. Natural Gas or Propane - Yellow.
 - 2. Electric - Red.
 - 3. Telephone - Orange.
 - 4. Water - Blue.
 - 5. Sanitary Sewer - Green.
- B. Geotextile Fabric: Non-biodegradable, non-woven, filter fabric; 160N manufactured by Marifii.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Engineer.

3.03 TRENCHING

- A. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- B. Remove excavated material that is unsuitable for re-use from site.
- C. Remove excess excavated material from site.
- D. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Geotechnical Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- E. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Geotechnical Engineer.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with in accordance with pipe bedding detail shown on drawings..
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Fill up to subgrade elevations unless otherwise indicated.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
TRENCHING**

SECTION 31 2316.13 – Page 3 of 3

- E. Backfill and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- F. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- G. Correct areas that are over-excavated.
 - 1. Use structural fill, flush to required elevation and compact.
 - 2. Refer to section 31 2323.
- H. Compaction Density and moisture content requirements:
 - 1. Refer to section 31 2323.
- I. Reshape and re-compact fills subjected to vehicular traffic.
 - 1. Refer to section 31 2323.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Utility Piping, Conduits, Duct Bank, and 4" diameter piping and less:
 - 1. Provide Bedding, hunching, initial backfill and final backfill.
 - 2. Compact in maximum 6 inch lifts
 - 3. Refer to section 31 2323 for density and compaction requirements.
- B. At Pipe Culverts:
 - 1. Provide Bedding, hunching, initial backfill and final backfill.
 - 2. Compact in maximum 6 inch lifts.
 - 3. Refer to section 31 2323 for density and compaction requirements.
- C. At French Drains and Subdrainage Piping:
 - 1. Use granular fill.
 - 2. Fill up to 6 inches below finish grade.
 - 3. Refer to section 31 2323 for density and compaction requirements.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.08 FIELD QUALITY CONTROL

- A. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- C. An independent testing laboratory, paid for by the contractor, shall perform tests at intervals not exceeding 200 feet of trench for each 6" of compacted trench backfill.
- D. The Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Architect, Engineer and Contractor shall be provided with copies of reports within 24 hours of time test was performed

3.09 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of identified and discovered rock during excavation.

1.02 RELATED REQUIREMENTS

- A. Section 31 2323 - Fill: Fill materials.

PART 2 PRODUCTS - NOT USED

2.01 MATERIALS

- A. Explosives: Type recommended by explosive firm following seismic survey and required by authorities having jurisdiction.
- B. Delay Device: Type recommended by explosives firm.
- C. Blast Mat Materials: Type recommended by explosives firm.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL

- A. Excavate and remove rock by either mechanical or explosive methods.
- B. Use of Explosives: Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.
 - 1. Comply with NFPA 495 and applicable state and local codes.
 - 2. Prior to blasting, obtain a seismographic survey to determine maximum charges that can be used at each location in area of excavation without damaging adjacent properties or other work.
 - 3. Prior to executing seismographic survey, advise owners of adjacent buildings and structures in writing; explain planned survey and blasting operations.
 - 4. Prior to blasting, document conditions of buildings near locations of intended blasting and photograph existing conditions identifying existing irregularities.
 - 5. Prepare pre- blast surveys.
 - 6. Schedule work to avoid working hours of occupied buildings nearby.
- C. Form level bearing at bottom of excavations.
- D. Remove shaled layers to provide sound and unshattered base to 12 inches below slab or footing.
- E. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- F. Excavated rock materials may be may be used as fill.. Refer to Section 31 2323 for rock fill requirements
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 2323.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
ROCK REMOVAL**

SECTION 31 2316.26 – Page 2 of 2

3.04 FIELD QUALITY CONTROL

- A. The Contractor shall have an independent testing laboratory visually inspect foundation bearing surfaces and cavities formed by removed rock.
- B. Determination of 'Rock' shall be by qualified testing agency or geotechnical engineer.
- C. All 'Rock' removed on a unit cost basis, or as part of a Change Order shall be quantified by the qualified testing agency.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and buildings.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.
- B. Section 31 2200 - Grading: Placement of on site and borrow material.
- C. Section 31 2200 - Grading: Site grading.
- D. Section 31 2316 - Excavation: Placement of on site and borrow material.
- E. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- F. Section 31 3700 - Riprap.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Unsuitable Materials: Material defined as highly plastic soils, organic or material that will not provide a stable foundation or material that will not compact to the requirements set forth in these specifications or material not meeting the requirements of this Section.

1.04 REFERENCE STANDARDS

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- B. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- C. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

- A. Soil Samples: 50 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. On site materials are generally considered acceptable as fill. On site materials failing to meet the requirements of structural fill are not acceptable as fill.
- B. Structural Fill: On Site and Borrow Material.
 - 1. Free of organic matter and debris
 - 2. Free of rocks larger than 6 inches.
 - 3. Refer to Site Preparation Notes on the site plans.

- 4. Material imported from off site shall meet the geotechnical requirements and specifications as defined in the construction documents and geotechnical report for the project.
- C. Concrete for Fill: Lean concrete.
- D. Topsoil: Topsoil excavated on-site and Friable loam; imported borrow.
 - 1. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - 2. Acidity range (pH) of 5.5 to 7.5.
 - 3. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 - 4. Complying with ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. All fill areas shall scarified and recompact prior to proof rolling.
- B. After recompaction is achieved, the area shall be proof rolled in the presence of the qualified testing agency.
- C. Proof rolling shall be performed in the presence of an independent testing laboratory representative.
- D. Prior to placing fill, any area failing proof roll shall be undercut and backfilled with Structural Fill meeting the project specifications.
- E. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- F. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. In areas where fill is to be placed on exiting steep cuts slopes, the exiting surface shall be horizontally benched the width of a piece of equipment prior to fill placement.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Place fill in 6" compacted lifts or as defined by the geotechnical recommendations and construction documents.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Structural Fill: Place and compact material in equal continuous layers not exceeding 8 inches loose depth.
- H. When insufficient material exist on site, provide borrow material meeting the requirements for structural fill.
- I. Excess material shall be disposed of off site, or as directed by the owner.
- J. Correct areas that are over-excavated.

- K. Compaction Density are as follows:
 - 1. Fills shall be compacted to a minimum of 98% of the maximum dry density as defined by ASTM D698 at all location and all depths
 - 2. Where stabilizing agents are used compact to 100% of the maximum dry density as defined by ASTM D698.
- L. Moisture requirements are as follows:
 - 1. Refer to Site Preparation Notes on the site plans.
- M. Reshape and re-compact fills subjected to vehicular traffic.
- N. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the geotechnical engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 TOLERANCES

- A. Top Surface: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL

- A. Refer to Section 2200 Grading for additional Field Quality Control requirements.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition.
- B. Stabilize and leave free draining any borrow area, if used.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Riprap.

1.02 RELATED REQUIREMENTS

- A. Section 31 2323 - Fill: Aggregate requirements.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with Alabama Department of Transportation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Riprap: Provide in accordance with Alabama Department of Transportation.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place geotextile fabric over substrate, lap edges and ends. Geotextile fabric shall be heavy weight (10oz minimum) non-woven fabric.
- B. Place riprap at culvert pipe ends, embankment slopes, swales, and ditches as indicated.
- C. Installed Thickness: 18 inch average.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Preparation of site for base course.
- B. Section 31 2316.13 - Trenching: Compacted fill over utility trenches under base course.
- C. Section 31 2323 - Fill: Topsoil fill at areas adjacent to aggregate base course.
- D. Section 31 2323 - Fill: Compacted fill under base course.
- E. Section 32 1216 - Asphalt Paving: Finish and binder asphalt courses.
- F. Section 32 1313 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2012).
- B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2015.
- C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.
- H. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2015.
- I. Alabama Department of Transportation Latest Details and Specifications

PART 2 PRODUCTS

2.01 MATERIALS

- A. Crushed Aggregate Base Type B per Section 825 per the Alabama Department of Transportation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.
- C. Proof roll immediately prior to placing aggregate base course. Repair any areas failing proof roll.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
AGGREGATE BASE COURSES**

SECTION 32 1123 – Page 2 of 2

3.03 INSTALLATION

- A. Under Bituminous Concrete Paving:
 - 1. Place Crushed Aggregate Base to a total compacted thickness of 6 inches.
 - 2. Compact to 100 percent of maximum dry density.
- B. Under Portland Cement Concrete Paving:
 - 1. Place coarse aggregate to a total compacted thickness of 4 inches.
 - 2. Compact to 100 percent of maximum dry density.
- C. Place aggregate in maximum 8 layers and roller compact to specified density.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. An independent testing laboratory, paid for by contractor, shall be retained to perform construction testing of in-place asphalt concrete courses for compliance with these requirements as follows:
- B. Results will be evaluated in relation to compaction curve determined by testing material in accordance with AASHTO T 180 or ASTM D1557 ("modified Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Frequency of Tests: 1 density test per 4000 sf.
- E. The contractor shall repair or remove and replace unacceptable base as determine by the above testing results.

3.06 CLEANING

- A. Leave area in a clean and neat condition.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Double course bituminous concrete paving.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Preparation of site for paving and base.
- B. Section 31 2323 - Fill: Compacted subgrade for paving.
- C. Section 32 1123 - Aggregate Base Courses: Aggregate base course.
- D. Section 32 1313 - Concrete Paving: Concrete substrate.
- E. Section 32 1313 - Concrete Paving: Concrete curbs.
- F. Section 32 1723.13 - Painted Pavement Markings: Concrete bumpers.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2012).
- B. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 2015.
- C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- D. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.
- E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.
- G. Alabama Department of Transportation Latest Details and Specifications

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with Alabama Department of Transportation standard.
- B. Mixing Plant: Conform to Alabama Department of Transportation standard.
- C. Obtain materials from same source throughout.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.

1.06 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Bituminous Concrete Wearing Surface shall comply with Alabama Department of Transportation standard section 424.
- B. Bituminous Concrete Upper Binder Layer shall comply with Alabama Department of Transportation standard section 424.

2.02 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

- A. See Section 32 1123.

3.03 PREPARATION - TACK COAT

- A. Apply tack coat on asphalt surface in accordance with Alabama Department of Transportation standard.

3.04 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Tack shall be used to adhere the Bituminous Concrete Wearing Surface to the Bituminous Concrete Upper Binder Layer
- B. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- C. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.05 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

3.06 FIELD QUALITY CONTROL

- A. An independent testing laboratory, paid for by contractor, shall be retained to perform construction testing of in-place asphalt concrete courses for compliance with these requirements as follows:
- B. Asphalt surface and base course shall be randomly cored at a rate of one core for every 5,000 square feet of paving. Asphalt pavement samples shall be tested for aggregate gradation and bitumen content for conformance with the mix design
- C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawing. Thickness of core shall be use to determine thickness of asphalt provided
- D. The contractor shall repair or remove and replace unacceptable paving as determine by the above testing results.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete parking areas, and roads.

1.02 RELATED REQUIREMENTS

- A. Section 03 3001 - Cast-in-Place Concrete (Site).
- B. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- C. Section 31 2323 - Fill: Compacted subbase for paving.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2016.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ACI 305R - Guide to Hot Weather Concreting; 2010.
- E. ACI 306R - Cold Weather Concreting; 2010.
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.
- I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2016b.
- J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.
- K. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- M. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

1.04 SUBMITTALS

- A. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

- A. Comply with applicable requirements of ACI 301.
- B. Slabs on grade, Concrete Sidewalks, Curb and Gutter: 4000 psi, 28 day compressive strength

2.02 FORM MATERIALS

- A. Refer to Section 3 3000 Cast in Place Concrete

2.03 REINFORCEMENT

- A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 3000 Cast in Place Concrete

2.04 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: Provide in accordance with Alabama Department of Transportation requirements and specifications.

2.05 ACCESSORIES

- A. Refer to Section 03 3001 Cast in Place Concrete

2.06 CONCRETE MIX DESIGN

- A. Concrete Properties:
 - 1. Heavy Duty Concrete Paving: Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4000 psi compressive strength with a minimum flexural strength of 500 psi
 - 2. All other Concrete: Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 3000 psi compressive strength with a minimum flexural strength of 500 psi

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 SUBBASE

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.

3.05 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.06 PLACING CONCRETE

- A. Place concrete in accordance with Alabama Department of Transportation Highways standards.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

3.07 JOINTS

- A. Place 3/8 inch wide expansion joints at not to exceed 12 foot intervals and to separate paving from vertical surfaces and other components.
- B. Provide scored joints.
 - 1. Between sidewalks and curbs.
 - 2. Between curbs and pavement.
- C. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.08 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
CONCRETE PAVING**

SECTION 32 1313 – Page 3 of 3

- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
- C. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

3.10 FIELD QUALITY CONTROL

- A. An independent testing laboratory, paid for by contractor, shall be retained to perform construction testing of in-place asphalt concrete courses for compliance with these requirements as follows:
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- D. The contractor shall remove and replace unacceptable concrete as determine by the above testing results

3.11 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION

SHELBY COUNTY EMA & IT BUILDING PROJECT PAINTED PAVEMENT MARKINGS

SECTION 32 1723.13 – Page 1 of 3

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, and curb markings.
- B. Roadway lane markings and crosswalk markings.
- C. "No Parking" curb painting.

1.02 RELATED REQUIREMENTS

- A. Section 32 1216 - Asphalt Paving.
- B. Section 32 1313 - Concrete Paving.

1.03 REFERENCE STANDARDS

- A. FS TT-B-1325 - Beads (Glass Spheres); Retro-Reflective; Rev. D, 2007.
- B. FS TT-P-1952 - Paint, Traffic Black, and Airfield Marking, Waterborne; Rev. E, 2007.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
- D. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; Current Edition.

1.04 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

1.01 MATERIALS

- A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Lots: White
 - 2. Handicapped Symbols: Blue.
 - 3. Crosswalks: White
 - 4. Double Stripe at Stop Bar: Yellow
 - 5. Stop Bar: White
 - 6. Cross Hatch and Chevrons: White
- B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Clean surfaces thoroughly prior to installation.

SHELBY COUNTY EMA & IT BUILDING PROJECT PAINTED PAVEMENT MARKINGS

SECTION 32 1723.13 – Page 2 of 3

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
- D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.
- E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.
- F. Temporary Pavement Markings: When required or directed by Engineer, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.
 1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
 2. At Contractor's option, temporary marking tape may be used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Owner.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.
- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Comply with FHWA MUTCD manual (<http://mutcd.fhwa.dot.gov>) for details not shown.
- E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.
- F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.
 1. Apply paint in (2) two coats in accordance with manufacturer recommendations. Newly laid asphalt may require a minimum amount of time between coats to assure removal of volatiles to assure paint life and quality installation.
 2. Wet Film Thickness: 0.015 inch, minimum.
 3. Width Tolerance: Plus or minus 1/8 inch.
- G. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.
 1. Conduct operations in such a manner that necessary traffic can move without hindrance.
 2. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
 3. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.
 4. Skip Markings: Synchronize one or more paint "guns" to automatically begin and cut off paint flow; make length of intervals as indicated.
 5. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used.
- H. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
 1. Mark the International Handicapped Symbol at indicated parking spaces.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
PAINTED PAVEMENT MARKINGS**

SECTION 32 1723.13 – Page 3 of 3

- 2. Hand application by pneumatic spray is acceptable.
- I. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.
- D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.
- F. Replace removed markings at no additional cost to Owner.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide traffic control signs complying with U. S. Department of Transportation, Federal Highway Administration's Manual "Uniform Traffic Control Devices" and as required by other local ordinances or regulations or other governing authorities and as specified herein. See Drawings for type and location of signs required

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM):
 - 1. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 2. ASTM C94 - Ready Mix Concrete
 - 3. ASTM D4956 - Retroreflectivity Sheeting for Traffic Control.
- B. US Department of Transportation, Federal Highway Administration:
 - 1. Manual on Uniform Traffic Control Devices (MUTCD)
- C. Alabama Department of Transportation standard.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Conform to US Department of Transportation MUTCD. Sign classification, type, size, and color shall be as shown on the drawings
- B. Retroreflectivity: Microprismatic type sheeting conforming to ASTM D 4956, Type VIII, IX, or XI

2.02 POSTS

- A. Square Post: Square tubular steel sign post, galvanized, 12 ga, perforated full-length with 7/16 inch holes on four sides. Post size shall be as shown on the Drawings.
- B. Steel Pipe: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 40, size as shown on the Drawings.

2.03 CONCRETE

- A. Mix concrete and deliver in accordance with ASTM C 94.
- B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - 1. Compressive Strength: 3,000 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
 - 2. Slump Range: 1 to 3-inches at time of placement
 - 3. Air Entrainment: 5 to 8 percent

2.04 MOUNTING HARDWARE

- A. Provide stainless steel nuts, bolts and washers.

2.05 SIGNS (SEE DRAWINGS FOR SIGNS REQUIRED)

- A. "STOP" Signs: 30"x30" octagon, reflectorized copy and border.
- B. "HANDICAPPED SYMBOL" Signs: 18"x24", blue legend on white reflective or baked enamel background
- C. "ONE WAY" Signs: 36"x12; ";Legend and Background: black, Arrow Boarder: white; Reflectorized: legend, background and arrow border.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SITE REGULATORY SIGNS**

SECTION 32 1723.20 – Page 2 of 2

PART 3 - EXECUTION

3.01 PREPARATION

- A. Field verify underground utilities prior to sign installation. Primary utilities of concern of shallow depths are lawn sprinkler systems, electric, telephone, fiber optic, cable and gas.

3.02 INSTALLATION

- A. Install signs as shown on the Drawings and in accordance with MUTCD and manufacturer's instructions.
- B. Install signs of the type and at locations shown on the Drawings.
- C. Install posts of the type as shown on the drawing. Set posts vertical and plumb with bottom of sign at 7'-0" above adjacent finish grade to bottom of lowest sign.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Hydroseeding, mulching and fertilizer.
- D. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Topsoil material.
- B. Section 31 2200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- C. Section 31 2323 - Fill: Topsoil material.

1.03 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

- A. Topsoil samples.
- B. Certificate: Certify seed mixture approval by authority having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

2.02 SEED MIXTURE

- A. Permanent Seed Mixture:
 - 1. Mowable mix as per Alabama Department of Transportation Department Standard Specification for applicable zone.
- B. Temporary Seed Mixture:
 - 1. Oats- 72 lb/ acre - Cool Season
 - 2. Foxtail Millet 34 lb/ac - Warm Season

2.03 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Fertilizer: recommended for grass, with fifty percent of the elements derived from organic sources of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SEEDING**

SECTION 32 9219 – Page 2 of 2

- C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare subgrade in accordance with Section 31 2200.
- B. Place topsoil in accordance with Section 31 2200.

3.02 HYDROSEEDING

- A. Apply seeded slurry with a hydraulic seeder at a rate as per Alabama Department of Transportation Department Standard Specification.
- B. Do not hydroseed area in excess of that which can be mulched on same day.
- C. Immediately following seeding, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.03 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will provide water.
- B. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.
- C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- D. Neatly trim edges and hand clip where necessary.
- E. Immediately remove clippings after mowing and trimming.
- F. Water to prevent grass and soil from drying out.
- G. Roll surface to remove minor depressions or irregularities.
- H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- I. Immediately reseed areas that show bare spots.
- J. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Fertilizing.
- D. Sod installation.
- E. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Topsoil material.
- B. Section 31 2200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- C. Section 31 2323 - Fill: Topsoil material.

1.03 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 REFERENCE STANDARDS

- A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding; 2006.

1.05 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sod: TPI (SPEC), Certified Turfgrass Sod quality; cultivated grass sod; type indicated below; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft. Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
 - 1. Bermuda Grass Type: 100 percent.
- B. Topsoil: Refer to Section 31 2323
- C. Fertilizer: as required by soil analyzation; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.
- D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.02 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 31 2200.
- B. Place topsoil in accordance with Section 31 2200.

3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately after delivery to site to prevent deterioration.
- C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- D. Where new sod adjoins existing grass areas, align top surfaces.
- E. Where sod is placed adjacent to hard surfaces, such as curbs, pavements, etc., place top elevation of sod 1/2 inch below top of hard surface.
- F. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
- G. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.05 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner until 30 days following project turnover; Owner will pay for water. The contractor shall water grass through completion of the 30 day period following turnover.
- B. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- C. Neatly trim edges and hand clip where necessary.
- D. Immediately remove clippings after mowing and trimming.
- E. Water to prevent grass and soil from drying out.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately replace sod to areas that show deterioration or bare spots.
- H. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISINFECTION OF WATER UTILITY PIPING SYSTEMS**

SECTION 33 0110.58 – Page 1 of 2

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 1416.
- B. Testing and reporting results.

1.02 RELATED REQUIREMENTS

- A. Section 33 1416 - Site Water Utility Distribution Piping.

1.03 REFERENCE STANDARDS

- A. AWWA B300 - Hypochlorites; 2010, Addendum 2011.
- B. AWWA B301 - Liquid Chlorine; 2010.
- C. AWWA B302 - Ammonium Sulfate; 2016.
- D. AWWA B303 - Sodium Chlorite; 2010.
- E. AWWA C651 - Disinfecting Water Mains; 2014.

1.04 SUBMITTALS

- A. Test Reports: Indicate results comparative to specified requirements.
- B. Disinfection report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.

1.05 QUALITY ASSURANCE

- A. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system and water well has been cleaned, inspected, and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

- A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
DISINFECTION OF WATER UTILITY PIPING SYSTEMS**

SECTION 33 0110.58 – Page 2 of 2

- B. Provide and attach equipment required to perform the work.
- C. Inject treatment disinfectant into piping system.
- D. Maintain disinfectant in system for 24 hours.
- E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- F. Replace permanent system devices removed for disinfection.
- G. Pressure test system to the required pressure, psi, as determined by the Local Utility have jurisdiction. Repair leaks and re-test.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Test samples in accordance with AWWA C651.
- C. Contractor shall provide written report confirming disinfection of water lines.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe for site conveyance lines.
- B. Pipe valves.
- C. Fire hydrants.
- D. Pipe and fittings for site water lines including domestic water lines and fire water lines.
- E. Valves, Fire hydrants, and Domestic water hydrants.

1.02 RELATED REQUIREMENTS

- A. Section 03 3001 - Cast-in-Place Concrete (Site): Concrete for thrust restraints.
- B. Section 31 2316 - Excavation: Excavating of trenches.
- C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- D. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- E. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2011).
- F. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2009.
- G. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010.
- H. AWWA C602 - Cement-Mortar Lining of Water Pipelines in Place, 4 In. (100 mm) and Larger; 2011.
- I. AWWA C800 - Underground Service Line Valves and Fittings; 2014.
- J. UL 246 - Hydrants for Fire-Protection Service; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Ductile Iron Pipe: AWWA C151/A21.51:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, Styrene butadiene rubber (SBR) or vulcanized SBR gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- B. Copper Tubing: ASTM B88, Type K, Annealed:
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

2.02 VALVES

- A. Gate Valves 3 Inches and Over:
 - 1. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, and extension box.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SITE WATER UTILITY DISTRIBUTION PIPING**

SECTION 33 1416 – Page 2 of 2

2.03 HYDRANTS

- A. Hydrants: Type as required by utility company and or fire department.
- B. Finish: Primer and two coats of enamel in color required by utility company.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.13.
- B. Cover: As specified in Section 31 2316.13.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3001.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See the sections on excavation and fill for additional requirements.

3.04 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in accordance with Section 21 1100.
- D. Set hydrants to grade, with nozzles at least 20 inches above ground in accordance with Section 21 1100.
- E. Locate control valve 4 inches away from hydrant.
- F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.
- G. Paint hydrants in accordance with Section 09 9113.

3.05 FIELD QUALITY CONTROL

- A. Perform bacteria and pressure test in accordance with state and local utility authority having jurisdiction. Provide copies of all test as required.
- B. Contractor shall provide copies of all testing to the engineer.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to public sewer systems.
- C. Cleanout access.

1.02 RELATED REQUIREMENTS

- A. Section 03 3001 - Cast-in-Place Concrete (Site): Concrete for cleanout base pad construction.
- B. Section 31 2316 - Excavation: Excavating of trenches.
- C. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 2323 - Fill: Bedding and backfilling.
- E. Section 33 0513 - Manholes and Structures.

1.03 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2016.
- B. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2018.
- C. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.
- D. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.
- E. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
- F. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and manholes.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. Ductile Iron Pipe: ASTM A746, Pressure Class 350, with asphaltic lining, inside nominal diameter (as specified on site plans), bell and spigot end.
- C. Joint Seals for Ductile Iron Pipe: AWWA C111/A21.11; styrene butadiene rubber (SBR) or vulcanized SBR gaskets.
- D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

- A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.

2.03 CLEANOUT MANHOLE

- A. Lid and Frame: Cast iron construction, hinged lid.

**SHELBY COUNTY EMA & IT BUILDING PROJECT
SITE SANITARY SEWERAGE GRAVITY PIPING**

SECTION 33 3113 – Page 2 of 2

2.04 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Section 31 2323.
- B. Pipe Cover Material: As specified in Section 31 2323 and as shown on sewer plan and profile.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform work in accordance with applicable code(s) and Local Utility having jurisdiction

3.02 TRENCHING

- A. See Section 31 2316.13 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.
- E. Install trace wire 6 inches above top of pipe; on all plastic pipe coordinate with Section 31 2316.13.

3.04 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Pressure Test: Test in accordance with Local Utility having jurisdiction.
- C. Infiltration Test: Test in accordance with Local Utility having jurisdiction.
- D. Deflection Test: Test in accordance with Local Utility having jurisdiction.
- F. Contractor shall provide grade as-built of the installed sewer system.
- E. Contractor shall provide copies of all testing and as-builts to the engineer.

3.06 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of drainage system to existing structures.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316 - Excavation: Excavating of trenches.
- B. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 2323 - Fill: Bedding and backfilling.

1.03 DEFINITIONS

- A. Bedding, Haunching, and Initial Backfill: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations. Refer to Section 31 2316.13 Trenching.
- B. Final Backfill: Structural fill. Refer to Section 31 2323 Fill.

1.04 REFERENCE STANDARDS

- A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Drainage Pipe; 2009 (Reapproved 2012).
- B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60-in.) Diameter; 2013.
- C. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2016.
- D. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2015.
- E. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.
- F. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.
- G. ASTM D1785 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- H. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.
- I. ASTM D3034 - Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings; 2016.
- J. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material; 2014.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class III with Wall type A; mesh reinforcement; inside nominal diameter as shown in construction documents, bell and spigot end joints.
- B. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

- C. Plastic Pipe: Polyvinyl Chloride storm sewer/drain pipe and fittings shall be manufactured and tested in accordance with ASTM F949. The structural design of thermoplastic pipe shall be in accordance with AASHTO LRFD titled "Buried Structures and Tunnel Liners." PVC pipes shall be manufactured from 12454 cell class material per ASTM D1784. Pipe and fitting shall have a minimum stiffness of 46 lbs./in./in. when tested in accordance with ASTM D2412. Joints shall be integral bell and gasketed joint. When joints are assembled, the joints shall prevent misalignment of adjacent pipes and form a watertight joint (10.8 psi test per ASTM D3212 titled: Standard Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals"). Contech A-2000 or equivalent.

2.02 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2323.
- B. Cover: As specified in Section 31 2316.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31 2316.13 - Trenching for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.03 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION