TECHNICAL SPECIFICATIONS & DRAWINGS

FOR

RESEARCH PARK COMPLEX (RPC)
PARKING LOT PHASE III

TO SERVE

UNIVERSITY OF TEXAS HEALTH
SCIENCE CENTER AT HOUSTON

WALTER P MOORE PROJECT NUMBER C03.17032.00

JANUARY 2018
SECTION 00 01 05

TITLE/CERTIFICATION PAGE

PROJECT: UTHealth Research Park Complex Parking Lot Phase III

PROJECT NUMBER: Walter P Moore Project No. C03.17032.00

Attn: Doug Coenen
1301 McKinney, Suite 1100
Houston, Texas 77010
713-630-7300

MEP ENGINEER: Shah Smith and Associates, Inc.
Attn: Doug Belisle
2825 Wilcrest Drive, Suite 350
Houston, Texas 77042
713-780-7563

END OF SECTION
I HEREBY CERTIFY THAT THESE PLANS AND TECHNICAL SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF TEXAS.

WALTER P MOORE & ASSOCIATES
1301 McKinney St, Ste 1100
Houston, TX 77010
713-630-7300

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Shah Smith & Associates
2825 Wilcrest Dr, Ste 350
Houston, TX 77042
713-780-7563

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SECTION 26 00 00-ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment required for complete and functioning electrical systems as required by the contract documents.

B. New Work. The work includes, but is not limited to, the following principal systems and equipment:

1. Medium Voltage distribution (>1000V).
2. 480/277 volt distribution.
3. 208/120 volt distribution.
4. Switchgear.
5. Panelboards-Distribution, Branch Circuit and Electronic Grade.
7. Bus duct.
8. Automatic transfer switches.
9. Luminaires, poles, lamps and ballasts.
10. Packaged electric generating system.
11. Lightning protection system.
12. Fire alarm system.
15. Power factor correction.
16. Lighting controls.
17. Digital addressable lighting control system.
18. Central dimming system.
19. Grounding and bonding system.
20. Isolated power systems.

22. Variable frequency drives for AC electric motors. Furnished by Division 23, installed by Division 26.


24. Synchronous clock system.

C. Empty Raceway. Refer to Division 27 telephone/data and Division 28 security specifications for cabling requirements. Provide empty raceway for the following systems:

1. Communications: Computer system cables and outlets. Refer to telecommunications Drawings for additional work.

2. Communications: Telephone system cables and outlets. Refer to telecommunications Drawings from additional work.


D. Demolition. Refer to demolition Drawings and Section 26 01 00 for scope of work.

1.2 APPLICABLE PROVISIONS

A. Provisions Specified Elsewhere. Unless modified in this Section, General and Supplementary General Conditions, applicable provisions of Division 01 - General and other provisions of contract documents apply to work of Division 26 - Electrical.

B. Application. Provisions of this Section apply to every section of Division 26 - Electrical, except where specifically modified.

C. Work covered by this Section shall be accomplished in accordance with applicable provisions of the Contract Documents and addenda or directives which may be issued herewith, or otherwise.

1.3 RELATED WORK

A. Existing Conditions - Division 02.

B. Site Work – Division 02.

C. Concrete - Division 03.

D. Sealing and Firestopping – Division 07.

E. Openings - Division 08.

F. Finishes - Division 09.
G. Equipment - Division 11.
H. Furnishings – Division 12.
I. Special Construction – Division 13.
L. Plumbing – Division 22.
M. Heating, Ventilation and Air Conditioning – Division 23.
N. Communications – Division 27.
P. Utilities – Division 33.

1.4 REFERENCE CODES AND STANDARDS
A. Standards of the following organizations may be referenced in the specification. Unless noted otherwise, references are to standards or codes current at the time of bidding.
B. Association of Edison Illuminating Companies (AEIC).
C. American National Standards Institute (ANSI).
D. Institute of Electrical and Electronics Engineers (IEEE).
E. Insulated Cable Engineers Association (ICEA).
F. National Electrical Code (NEC).
G. National Electrical Manufacturers Association (NEMA).
I. National Fire Protection Association (NFPA).
J. Underwriters' Laboratories (UL).

1.5 REGULATIONS AND PERMITS
A. Regulations. Work, materials and equipment must comply with the latest rules and regulations of the following:
3. Occupational Safety and Health Act (OSHA).
4. Americans with Disabilities Act (ADA).
5. Texas Department of Licensing and Regulation (TDLR).
8. State and federal codes, ordinances and regulations.

B. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner's representative in writing, including a proposed resolution, and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified or shown.

C. Permits: Obtain certificates of inspection and other permits required as a part of the work. Submit written evidence to the Owner’s Representative and Architect/Engineer that the required permits and inspections have been secured.

1.6 DRAWINGS AND CONTRACT DOCUMENTS

A. Intent: The intent of the construction Drawings or contract documents, hereinafter referred to as the “Drawings”, is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system. The Drawings, specifications, and related contract documents are cooperative, and work or materials called for in one and not mentioned in the other shall be provided. Electrical Drawings, are generally diagrammatic and show approximate location and extent of the work. Review pertinent Drawings and adjust the work to conditions shown. Install the work complete, including minor details necessary to perform the function indicated.

B. The Contractor shall carefully investigate structural and finish conditions, and shall coordinate the work in order to avoid interference between the various phases of work. The Contractor shall be responsible for the proper routing of raceways, subject to prior review by the Owner’s Representative. Work shall be organized and laid out in finished portions of the building so that it will be concealed in furred chases, suspended ceilings, and similar elements of the building, unless specifically noted to be exposed. Work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. Discrepancies: In case of doubt as to work intended, or if amplification or clarification is needed, or where discrepancies occur between Drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer and the Owner’s Representative in writing, requesting an interpretation, and include a proposed solution.
D. Dimensions: Dimensional information related to new structures shall be taken from the appropriate Drawings. Dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

E. Outlet and Equipment Locations: Coordinate the actual locations of electrical outlets and equipment with building features and equipment as indicated on architectural, structural, mechanical, telecommunications, audio-visual (AV), security, plumbing, and laboratory Drawings. Review with the Owner’s Representative proposed changes in outlet and equipment location. Relocation of outlets before installation of up to 5 feet from the position indicated may be directed without additional cost to the Owner. Remove and replace outlets placed in unsuitable locations, when so requested by the Owner’s Representative, and at no additional cost to Owner.

1.7 SUBMITTALS

A. Submit the following in addition to and in accordance with the requirements of the Uniform General Conditions and in Division 01, Submittals.
   1. Include inspection and permit certificates and certificates of final inspection and acceptance from the authority having jurisdiction.
   2. Manufacturer’s standardized schematic diagrams and catalog cuts shall not be acceptable unless applicable portions are clearly indicated and non-applicable portions clearly deleted or crossed out.
   3. Schematic, connection and/or interconnection diagrams.
   4. Provide submittals as required by individual specification section.

B. Provide the following with each submittal:
   1. Catalog cutsheets with manufacturer’s name clearly indicated. Applicable portions shall be clearly indicated by arrows, circles, or similar markings and non-applicable portions shall be clearly deleted or crossed out.
   2. Line-by-line specification review by equipment manufacturer and contractor with exceptions explicitly defined.
   3. Itemize and organize equipment and material submittals by specification Section number; include manufacturer and identifying model or catalog numbers.
      a. Submittal packages for product data, shop drawings, and other required submittals shall be numbered sequentially according to the applicable specification Section number. For example, the first submittal package for Energy-Efficient Dry-Type Transformers shall be identified as Submittal number 262213-01. The second submittal package for Energy-Efficient Dry-Type Transformers would be identified as Submittal number 262213-02. Re-submittal packages shall be identified by an “R” in the sequential numerical suffix.
      b. Where directed by the Owner or the Architect to combine submittals into a common package, the submittal data may be organized in one or more 3-ring binders or similar container. Product data, shop drawings, and other submittal data shall be organized in separate tabs according to paragraph 1.07B.3a, above. That is, submittal data in
individual tabs of a common submittal package shall be numbered sequentially, according to the applicable specification Section number.

4. Replace rejected items and resubmit with acceptable items in accordance with the requirements of Division One for Submittals, and with the Uniform General Conditions.

C. Within the specified time window after award of contract, submit list of equipment and materials to be furnished.

1. Itemize equipment and material by specification section number; include manufacturer and identifying model or catalog numbers.

2. Replace rejected items with an acceptable item within 2 weeks after notification of rejection.

3. If a satisfactory replacement is not submitted within a two-week period, Owner will notify contractor as to equipment manufacturer or type and make or material to be furnished. Provide designated items at no additional cost to Owner.

D. Equipment Layout Drawing: 1/8-inch scale minimum drawings indicating electrical equipment locations. Dimensions for housekeeping pads shall be indicated on these drawings. Indicate routing of conduit 2 inches and over on these drawings.

E. Coordination Drawings: The Contractor shall prepare one complete set of composite drawings. The shop drawings for sheet metal ductwork shall be used as the basis for this coordination. When the sheet metal drawings have been prepared, the raceway, luminaires, mechanical piping, plumbing piping, and fire protection piping shall be overlaid and drafted onto the composite drawing. The intent of this process is to define areas of potential conflict and resolve those conflicts prior to fabrication or installation of work. In areas of congestion (where simply overlaying and drafting will create an unreadable product), the plan view scale shall be increased and multiple layered views shall be developed. Elevations of the individual elements shall be established, and elevations shall be drawn to illustrate that the ductwork, piping, raceway, and other systems and components will co-exist within the available space, and that the proper access to equipment, luminaires, valves, filters, etc. has been established for operation, service, removal and replacement. In addition to the above, the Contractor shall also submit the following for review:

1. Electrical and Telecommunications Rooms. Submit 1/4-inch scale coordination drawings of electrical and telecommunications rooms indicating location of equipment. Indicate the exact location of each component in relation to other mechanical, electrical, and plumbing (MEP) components within each room. Include location(s) and quantity of raceway(s) and sleeve(s) stubbed up through floor slab for power, lighting, control, grounding, communications, and low-voltage system(s). These coordination drawings shall take into account the configuration of the mechanical, electrical, and telecommunications equipment which has been proposed and approved for use in the project, particularly where it differs in configuration from the equipment shown on the Drawings.

2. Mechanical and Pump Rooms. Submit 1/4-inch scale coordination drawings of mechanical and pump rooms indicating location of electrical equipment. Indicate the exact location of each component in relation to other MEP components within each mechanical and pump room. These coordination drawings shall take into account the configuration of the mechanical and electrical equipment which has been proposed and approved for use in the
3. Auditorium, Lecture, Conference and Audio-Visual (A/V) Rooms. Submit 1/8-inch scale coordination drawings showing receptacles, snap switches, occupancy sensors, lighting controls, dimmers, communication outlets, and Audio-Visual (AV) outlets and devices (including projector mounts). Indicate locations and mounting heights of outlets and devices. Electrical, communication and AV devices shown in proximity to each other shall be grouped.

4. Corridors. Submit 1/4-inch scale coordination drawings, including sections, of corridors indicating equipment and material.

5. Building Information Modeling (BIM). Where a BIM-model of the project has been developed by the Architect/Engineer or Contractor, the BIM model may be used to develop and produce the coordination drawings. The Contractor and the individual trades shall confirm in writing that the BIM-model and related coordination drawings accurately match the components and systems to be fabricated and installed.

6. Review: The completed “Composite Drawings” shall be submitted to the Architect/Engineer for review prior to installation. Work that proceeds without appropriate coordination and review will be subject to removal and relocation at no additional cost to the Owner.

F. Installation: Where product data or shop drawings are required, do not install equipment or materials until submittals are accepted by the Architect/Engineer and by Owner’s Representative. Use only equipment and materials accepted by the Architect/Engineer and by Owner’s Representative. Equipment and materials installed prior to acceptance by the Owner/Engineer and Owner’s Representative shall be removed at no additional cost to Owner and replaced at the Contractor’s expense.

G. Startup and Test Procedures:

1. Furnish documentation from equipment manufacturer for the startup and field testing procedures for equipment installed as a part of this project.

2. Startup and testing procedures shall include prerequisite conditions, system and equipment alignments and lineups, sequential steps for execution of the test, shutdown procedures, and criteria for satisfactory test completion and test failure.

3. Startup and testing procedures shall address and demonstrate modes of system or equipment operation, including startup, manual, unattended/automatic, and shutdown procedures, as well as procedures for testing and demonstration of abnormal or emergency operating conditions.

4. Include forms and logs to be used during field testing. Forms and logs shall include the range of permissible values for monitored parameters, as applicable.

H. As-Built and Record Drawings:

1. Maintain a master set of as-built drawings that show changes and other deviations from the Drawings. The markups shall be made as the changes are done. The markups shall show the actual changes and shall not reference RFI’s, ASI’s etc. The record drawing shall be a
2. At the conclusion of the project, these as-built drawings shall be transferred to AutoCAD electronic files, in a format acceptable to the Owner’s Representative, and shall be complete.

3. Prior to final acceptance, deliver to the Owner’s Representative the AutoCAD electronic files, the complete set of record drawings showing the as-built condition of the project, and the actual field set of as-built drawings. Also deliver one set of as-built drawings on CD-Rom or similar electronic media acceptable to the Owner. Drawing files shall be in AutoCAD (.dwg) and Adobe Acrobat (.pdf).

4. Quantity: In accordance with the requirements of Division One and the General Conditions. Where not specified elsewhere, provide 3 hard copies plus one reproducible set.

I. Operating and Maintenance Manuals: As specified in Part 3 of this Section and in Division One, as applicable.

J. Overcurrent Protective Device Coordination Study: Provide preliminary and final study as specified in Section 26 05 73. Make adjustments to materials and submittals under other Sections of Division 26 as required and as recommended by the Overcurrent Protective Device Coordination studies.

1.8 SUBSTITUTIONS

A. Refer to requirements of Division One for substitution of Material and Equipment.

B. Product manufacturers are listed to establish a level of quality for the products. Substitutions may be allowed if the product is equal to or better than what is listed in the design guidelines, as determined by the Architect/Engineer and owner’s Representative upon submittal of comparison products.

C. Samples: When requested by the Owner’s Representative or the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. When requested, provide samples of both the specified item and the proposed item for comparison purposes.

D. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. Time periods for Architect/Engineer processing and review of submittal data, shop drawings, samples, studies, and reports shall be in accordance with the applicable submittal and substitution requirements of Division One and the General Conditions. The Contractor shall allow sufficient time for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles for processing of submittal data and shop drawings, including time for resubmittal cycles on unacceptable and rejected materials, equipment, components, and systems covered by the data submitted. Construction delays and lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in requests for scheduled construction time extensions and additional costs to the Owner.

E. Acceptance: Acceptance of materials and equipment will be based on manufacturer’s published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the Drawings, specifications, and other applicable Contract Documents, and that adequate and
acceptable clearances will exist for entry, servicing, and maintenance. Acceptance of materials and equipment under this provision shall not be construed as authorizing deviations from the Specifications, unless the attention of the Owner’s Representative and the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless pertinent information is properly identified.

F. Replacement; Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment originally specified at no additional cost to the Owner.

1.9 CONTRACTOR QUALIFICATIONS

A. An acceptable Contractor for the work under this division must have personnel with experience, training and skill to provide a practical working system.

1. The Contractor may be required to furnish acceptable evidence of having installed not less than three systems of size and type comparable to this project. The systems must have served satisfactorily for not less than 3 years. The superintendent must have had experience in installing not less than three such systems.

2. The Contractor must have personnel with the proper licenses to perform electrical work under this Contract. In accordance with the Texas Electrical Safety and Licensing Act – Title 8, Occupation Code, Chapter 1305, Subchapter D, section 1305.151: “LICENSE REQUIRED. Except as provided by Section 1305.003, a person may not perform electrical work unless the person holds an appropriate license issued or recognized under this chapter.”

B. The Contractor shall follow the safety procedures in addition to, and in accordance with, the requirements of the Project Safety Manual (PSM).

1. The Contractor shall be responsible for training personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel on hazards particular to this project and update the information as the project progresses.

2. The Contractor shall secure electrical rooms, to limit access, prior to energizing high voltage (1000V or higher) equipment, and shall control access during the project after energization. The Contractor shall post and maintain warning and caution signage in areas where work is ongoing near energized equipment. The Contractor shall cover energized live parts when work is not being done in the equipment. This includes lunch and breaks.

3. The Contractor shall strictly enforce OSHA lockout/tagout procedures. Initial infractions shall result in a warning. A second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.
PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Condition. Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified.

B. NEC and UL.
   1. Products must conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products and issued labels, products used must be listed and labeled by UL.
   2. Materials and equipment shall be labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended. Where no specifications or specific model numbers are given, provide materials of a standard industrial quality.

C. Space Limitations: Equipment selected must conform to the building features and must be coordinated with them. Electrical installation shall comply with the requirements of Article 110.26 and Article 110.34 of the National Electrical Code (NEC) for working space, access, and dedicated equipment space. Do not provide equipment that will not suit arrangement and space limitations. Scaled drawings (1/4” = 1'-0'”) of electrical and telecommunication rooms shall be submitted for review by the Architect/Engineer and the Owner's Representative prior to installing equipment. See paragraph 1.07E above.

D. Factory Finish. Equipment shall be delivered with a hard surface, factory-applied finish so that no additional field painting is required except for touch-up as required.

E. Physical Size of Equipment: Equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless the Contractor demonstrates by product data, shop drawings, and coordination drawings that ample space exists for proper installation, operation, and maintenance.

F. Enclosure: Provide NEMA 1 enclosure for indoor installation and NEMA 3R for outdoor enclosure, unless noted or specified otherwise. The enclosure shall be suitable for the environment per NEC, NEMA and ANSI standards.

G. Conductors in Conduit: Conductors shall be installed in conduit. Exceptions are listed in individual Sections of the Division 26 and Division 28 specifications.

H. Non-Ferrous: Use non-ferrous materials in rooms with equipment employing magnetic equipment with elevated gauss fields, such as Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment. Use non-ferrous materials where gauss fields extend into adjacent spaces, and other locations as indicated on Drawings.
2.2 MANUFACTURER

A. Where two or more units of the same class of material are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer, except as specifically noted in individual Sections of the specifications.

B. Common Source:

1. Generator, Automatic Transfer Switches, and Bypass-Isolation Switches: Equipment specified in Sections 26 32 14, 26 36 23, and 26 36 25 shall be provided by the same supplier, and shall be the responsibility of the supplier for the packaged electric generating plant. Responsibility for warranty service shall not be a justification for substitution of products of a manufacturer other than those listed for equipment in the individual Sections 26 32 14, 26 36 23, and 26 36 25.

2.3 SUBSTITUTIONS

A. Refer to Division 01 section on Material and Equipment, and to paragraph 1.08 of this Section.

2.4 NAMEPLATES AND DEVICE MARKING

A. Refer to Section 26 05 53, Identification For Electrical Systems.

2.5 AUTOMATED EQUIPMENT AND CONTROLS

A. Equipment and control systems where applicable, shall match, integrate, communicate and cooperate with new and existing systems, such as building automation, energy management, direct digital controls (DDC), fire detection and alarm, circuit breakers, transformers, etc.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturer’s Recommendations: The manufacturer’s published directions shall be followed in the delivery, storage, protection, installation, wiring, and connection of equipment and material. Promptly notify the Architect/Engineer and the Owner’s Representative in writing of conflicts between the requirements of the Drawings and specifications and the manufacturer’s directions, in accordance with paragraphs 1.05B and 1.06C of this Section. Obtain instructions from the Owner’s Representative before proceeding with the work. Should the Contractor perform work that does not comply with the manufacturer’s directions or such instructions from the Owner’s Representative, he shall bear costs arising in connection with the deficiencies.

B. Site Observation: Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Drawings, specifications, and other applicable Contract Documents. Site observation by the Architect/Engineer shall not be construed as construction supervision, or indication of approval of the manner or location in which the work is being
performed, or as being a safe practice or place. Site observation by the Architect/Engineer shall not be construed as inspection by the Authority Having Jurisdiction (AHJ) or other applicable code enforcement authority.

C. Installation: Where product data or shop drawings are required, do not install equipment or materials until submittals are accepted by the Architect/Engineer and by the Owner’s Representative. Use only equipment and materials accepted by the Architect/Engineer and the Owner’s Representative. Equipment and materials installed prior to acceptance by the Architect/Engineer and Owner’s Representative shall be removed at no additional cost to Owner and replaced at the Contractor’s expense.

D. Supervision:

1. The Contractor of the work under this Division shall keep a competent superintendent or foreman on the job throughout the period of construction. Refer to Division One requirements and the Uniform General Conditions for additional information concerning supervision.

2. It shall be the responsibility of such superintendent to study the Drawings, specifications, and other applicable Contract Documents, and familiarize himself with the work. He shall coordinate his work with other trades before material is fabricated or installed, and ensure that his work will not cause interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the Contractor. Where interferences cannot be resolved without major changes to the Drawings, the matter shall be referred to the Architect/Engineer and the Owner’s Representative for resolution in accordance with paragraphs 1.05B and 1.06C of this Section.

3.2 PROTECTION OF EQUIPMENT AND MATERIALS

A. General:

1. The Contractor shall follow the manufacturer’s directions completely in the delivery, storage and handling of equipment and materials.

2. Equipment and materials shall be tightly covered and protected against dirt, water, chemical, physical or weather damage and theft. At the completion of the work, fixtures, equipment and materials shall be cleaned and polished thoroughly and shall be returned to “as new” condition.

3. Electrical cable, wire, and conductors shall be stored to prevent moisture and mechanical damage.

B. Moisture. During construction, protect switchboard, transformers, motors, control equipment, and other items from insulation moisture absorption and metallic component corrosion by appropriate use of strip heaters, lamps or other suitable means. Apply protection immediately on receiving the products and maintain continually.

C. Clean. Keep products clean by elevating above ground or floor and by using suitable coverings.
D. Damage. Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.

E. Finish. Protect factory finish from damage during construction operations and until acceptance of the project. Satisfactorily restore finishes that become stained or damaged.

F. Weather. Protect equipment and materials from weather and sunlight by use of suitable coverings and storage indoors, or in suitable weather-protected containers. Materials and equipment marked by their manufacturer as suitable for storage outdoors may be stored according to manufacturer’s markings. Maintain factory-installed coverings and wrappings until material is to be installed.

3.3 PREPARATION

A. Coordination Drawings: The Contractor shall prepare one complete set of composite drawings. The shop drawings for sheet metal ductwork shall be used as the basis for this coordination. When the sheet metal drawings have been prepared, the raceway, luminaires, mechanical piping, plumbing piping, and fire protection piping shall be overlaid and drafted onto the composite drawing. The intent of this process is to define areas of potential conflict and resolve those conflicts prior to fabrication or installation of work. In areas of congestion (where simply overlaying and drafting will create an unreadable product), the plan view scale shall be increased and multiple layered views shall be developed. Elevations of the individual elements shall be established, and elevations shall be drawn to illustrate that the ductwork, piping, raceway, and other systems and components will co-exist within the available space, and that the proper access to equipment, luminaires, valves, filters, etc. has been established for operation, service, removal and replacement. In addition to the above, the Contractor shall also prepare the following:

1. Electrical and Telecommunications Rooms. Prepare 1/4-inch scale coordination drawings of electrical and telecommunications rooms indicating location of equipment. Indicate the exact location of each component in relation to other mechanical, electrical, and plumbing (MEP) components within each room. Include location(s) and quantity of raceway(s) and sleeve(s) stubbed up through floor slab for power, lighting, control, grounding, communications, and low-voltage system(s). These coordination drawings shall take into account the configuration of the mechanical, electrical, and telecommunications equipment which has been proposed for use in the project, particularly where it differs in configuration from the equipment shown on the Drawings.

2. Mechanical and Pump Rooms. Prepare 1/4-inch scale coordination drawings of mechanical and pump rooms indicating location of electrical equipment. Indicate the exact location of each component in relation to other MEP components within each mechanical and pump room. These coordination drawings shall take into account the configuration of the mechanical and electrical equipment which has been proposed for use in the project, particularly where it differs in configuration from the equipment shown on the Drawings.

3. Auditorium, Lecture, Conference and Audio-Visual (A/V) Rooms. Prepare 1/8-inch scale coordination drawings showing receptacles, snap switches, occupancy sensors, lighting controls, dimmers, communication outlets, and Audio-Visual (AV) outlets and devices (including projector mounts). Indicate locations and mounting heights of outlets and devices. Electrical, communication and AV devices shown in proximity to each other shall be grouped.
4. Corridors. Prepare 1/4-inch scale coordination drawings, including sections, of corridors indicating equipment and material.

5. Building Information Modeling (BIM). Where a BIM-model of the project has been developed by the Architect/Engineer or Contractor, the BIM model may be used to develop and produce the coordination drawings. The Contractor and the individual trades shall confirm in writing that the BIM-model and related coordination drawings accurately match the components and systems to be fabricated and installed.

6. Review: The completed “Composite Drawings” shall be prepared prior to installation. Work that proceeds without appropriate coordination will be subject to removal and relocation at no additional cost to the Owner.

B. Test Procedures:

1. Furnish documentation from equipment manufacturer for the startup and field testing procedures for equipment installed as a part of this project.

2. Startup and testing procedures shall include prerequisite conditions, system and equipment alignments and lineups, sequential steps for execution of the test, shutdown procedures, and criteria for satisfactory test completion and test failure.

3. Startup and testing procedures shall address and demonstrate modes of system or equipment operation, including startup, manual, unattended/automatic, and shutdown procedures, as well as procedures for testing and demonstration of abnormal or emergency operating conditions.

4. Include forms and logs to be used during field testing. Forms and logs shall include the range of permissible values for monitored parameters, as applicable.

3.4 SAFETY

A. Implement the following safety procedures in addition to, and in accordance with, the requirements of Division One and the Uniform General Conditions:

1. The Contractor shall be responsible for training personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel of hazards particular to this project and update the information as the project progresses.

2. Prior to energizing panelboards within the scope of work, secure affected electrical rooms to limit access to line voltage. Line voltage shall be defined as above 50 volts, for the purpose of controlling access. During and after energization of panelboards, control access to electrical rooms for the duration of the project. Post and maintain warning and caution signage in areas where work is on-going near energized equipment. Cover energized live parts when work is not being done in the equipment. This includes lunch and breaks.

3. Strictly enforce OSHA lockout/tagout procedures. Initial infractions shall result in a warning. A second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.
3.5 INSPECTION

A. Examination. Examine the areas and conditions under which equipment and systems are to be installed, and notify the Owner’s Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordination. Carefully investigate structural and finish conditions and coordinate the work in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases, suspended ceilings, and similar elements in finished portions of the building, unless specifically noted to be exposed. Work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

3.6 INSTALLATION

A. Cooperation with Other Trades. Cooperation with trades of adjacent, related or affected materials or operations, and of trades performing continuations of this work under subsequent contracts, is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades. Provide other trades, as required, templates, patterns, setting plans and shop details for the proper installation of the work and for purposes of coordinating adjacent work. Electrical power connections for mechanical and plumbing equipment are in this Division unless noted otherwise. Verify electrical characteristics of equipment with other Divisions before roughing in the electrical connections.

B. Workmanship. Work shall be performed by workmen skilled in their trade. The installation shall be complete and installed in a neat and workmanlike manner in accordance with NEC 110.12 and FPM accompanying, and as described in ANSI/NECA 1-2000 “Standard Practices for Good Workmanship in Electrical Contracting”, and other ANSI approved installation standards.

C. Concrete Equipment Pads.

1. Refer to structural Drawings and specifications for design criteria.

2. Where not otherwise indicated, install 3-1/2 inch thick concrete foundation pads for indoor floor-mounted equipment, except where direct floor mounting is required. For equipment mounted outdoors, provide concrete foundations a minimum of 6 inches above grade. Provide reinforcing steel as recommended by the structural engineer and as detailed on the Drawings. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond equipment. Trowel pads smooth and chamfer edges to a 1-inch bevel. Secure equipment to pads as recommended by the manufacturer.

3. Anchor Bolts. Furnish and install galvanized anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates. When equipment is placed on vibration isolators, the equipment shall be secured to the isolator and the isolator secured to the floor, pad, or support as recommended by the vibration isolation manufacturer.
D. Setting of Equipment. Provide permanent and temporary shoring, anchoring, and bracing required to make parts stable and rigid; even when such shoring, anchoring, and bracing are not explicitly called for.

1. Equipment must be leveled and set plumb.

2. Sheet metal enclosures mounted against a wall shall be separated from the wall not less than 1/4 inch by means of corrosion-resistant spacers, or by 3 inches of air for freestanding units. Use corrosion-resistant bolts, nuts and washers to anchor equipment.

3. In sufficient time to be coordinated with work under other divisions, provide shop drawings and layout work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases.

4. Provide adequate support for freestanding panels, switchboards, enclosures, and other equipment. This shall include bolting to the floor, concrete equipment pad, or solid structural steel to prevent tipping. Install free-standing electrical equipment on concrete equipment pads in accordance with paragraph 3.05C, this Section, except where equipment is noted and designed for mounting directly on the concrete floor slab. Under no condition shall equipment be fastened to non-rigid building steel such as removable platform steel gratings, handrails, etc.

5. Provide racks and supports, independently mounted at structure, to support electrical equipment and systems supplied and installed under this contract. Do not mount or suspend equipment from supports provided for equipment and systems by other Divisions, except where specifically noted or indicated on Drawings.

6. Refer to Section 26 05 29, Metal Framing and supports, for additional requirements.

E. Sealing of Equipment. Seal openings into equipment to prevent entrance of animals, birds and insects, as well as to prevent ingress of moisture, dust, dirt, and similar contaminants.

F. Motors.

1. Motors are specified in Divisions 21, 22 and 23.

2. Electrical work includes the electrical connection of motors, except those which are wired as a part of equipment.

3. Refer to Division 23 and other applicable Divisions for wiring and connection of motors and equipment furnished by those Divisions.

4. The Contractor shall note that the electrical Drawings are based on the equipment scheduled and indicated on the Drawings. Should mechanical equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

5. Provide interconnecting wiring for the installation of the power required. Provide disconnect switches as required for proper operation, as indicated on the Drawings or required by applicable code. Combination starters, individual starters, and other motor starting apparatus, not specifically scheduled or specified as provided by the equipment manufacturer under the scope of other Divisions shall be provided under the scope of Division 26.
6. Other Divisions will provide complete wiring diagrams indicating power wiring and interlock wiring. Diagrams shall be submitted to the Architect/Engineer for review. Diagrams will be based on accepted equipment and be complete full phase and interlock control drawings, not a series of manufacturer’s individual diagrams. They will be followed in detail. For additional clarification, refer to Division 23, Controls.

G. Concealed Work. Conceal electrical work in walls, floors, chases, under floors, underground and above ceilings except:

1. Where shown or specified to be exposed. Exposed is understood to mean open to view.
2. Where exposure is necessary to the proper function.
3. Where size of materials and equipment preclude concealment. Obtain the written consent of the Owner’s Representative and the Architect/Engineer to leave materials exposed in finished spaces of the building.

H. Application. Unless otherwise indicated, power will be utilized as follows:

1. 480 volts, three phase: motors 3/4 horsepower and larger.
2. 120 volts, single phase: motors 1/2 horsepower and smaller.
3. 277 volts, single phase: fan powered boxes.
4. 120 volts, single phase: incandescent lighting.
5. 277 volts, single phase: fluorescent and high-intensity-discharge lighting.
6. 120 volts, single phase: convenience outlets, dedicated equipment, lab-track terminal boxes without fans.
7. 208 volts, single and three phase: specialty outlets.
8. 480 volts, three phase: special power and equipment; verify for each unit of equipment.

I. Transformers. Use transformers to change the service to the required utilization voltages.

J. Connections to Equipment - Other than Division 26. For equipment furnished under other Divisions, and for equipment furnished by the Owner, provide final electrical connections to such items of equipment. Obtain detailed shop drawings of equipment from the applicable Division or supplier indicating the exact number and location of rough-in points. Such final shop drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions. Making adjustments to field conditions is considered a part of the work required.

1. Roughing-in: When roughing-in, provide electrical branch circuits to various items of equipment. Terminate at proper points as indicated on detailed equipment shop drawings, or as directed. Use Drawings accompanying these specifications only for general routing of circuiting. Do not use Drawings accompanying these specifications for rough-in locations.
2. Final Connections: Millwork, casework, and similar equipment will include service fittings such as switches, duplex receptacles, data/communications outlets, and luminaires on the casework or equipment. Provide branch circuit connection to match electrical connection requirements of service fittings.

K. Accessories. Offsets, fittings, expansion joints, anchors and accessories that are required for a complete system shall be provided, even if not specifically indicated on the Drawings or mentioned in the specifications. Offsets, transitions and changes in direction of conduit, cable trays, raceways and busways shall be made to maintain proper headroom. Provide pullboxes, fittings, etc., required as a result of these transitions and changes in direction.

L. Observation prior to cover-up or seal-in of walls and ceilings. Perform the following in accordance with the applicable requirements of Division One and the General Conditions:

1. Prior to the installation of ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner’s Representative so that arrangement can be made for observation or inspection of the above-ceiling area about to be “sealed” off. The Contractor shall provide advance notice in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required, or directed elsewhere, provide not less than 10 working days’ advance notice.

2. Above-ceiling areas will be subject to a formal inspection before ceiling panels are installed, or installation is otherwise concealed from view. Electrical work at and above the ceiling, including items supported by the ceiling grid, shall be complete and installed in accordance with contract requirements, including power to luminaires, fans, and other powered items. The purpose of this inspection is to verify the completeness and quality of the installation of the electrical systems and other above ceiling special systems such as cable tray systems. The ceiling supports shall be in place so that access panel and luminaire locations are identifiable, and so that clearances and access provisions may be evaluated.

1. No ceiling materials may be installed until the resulting deficiency list from this inspection is completed and approved by the Owner’s Representative.

M. Finish. Coordinate with Division 9 to paint exposed conduit to match adjacent walls, unless otherwise directed.

3.7 EXISTING FACILITIES

A. Responsibility. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and maintenance of electrical services for new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing such temporary protection upon completion of the work.

B. Services. The Contractor shall provide temporary or new services to existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Access. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, luminaries, air
conditioning ductwork and equipment, etc., to provide this access, and shall reinstall same upon completion of work in the areas affected.

D. Existing Devices. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, remove and reinstall in locations approved by the Architect/Engineer devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature controls, system devices, electrical switches, relays, luminaires, fixtures, piping, conduit, etc.

E. Outages. Outages of services as required by the new installation will be permitted, but only at a time approved by the Owner. The Contractor shall coordinate with the Owner’s Representative to arrange for service outages. The Contractor shall allow the Owner sufficient time to schedule for required outages, in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required or directed elsewhere, allow a minimum of 21 working days for the Owner to schedule for required outages. The time allowed for outages will not be during normal working hours or during hours of research and instruction, unless otherwise approved by the Owner’s Representative. Costs of outages, including overtime charges, shall be included in the contract amount.

F. Adjacent Facilities. Coordinate work among the various trades to minimize disruption to existing processes, procedures, and equipment in spaces adjacent to areas of demolition and renovation work. Coordinate with Owner’s Representative to schedule work producing noise or structure-born vibrations, including but not limited to cutting, drilling, coring, and use of impact tools.

3.8 EQUIPMENT AND DEVICE MARKING

A. Designations. Identify equipment, devices, feeders, branch circuits and similar items with the same designations as indicated on the Drawings.

B. Nameplates. Externally mark electrical equipment with nameplates identifying each and the equipment served. Supply blank nameplates for spare units and spaces.

C. Refer to Section 260553 for additional requirements.

3.9 SLEEVES, PENETRATION, CUTTING AND PATCHING

A. General. Cut and patch walls, floors, etc., resulting from work in existing construction. Provide for the timely placing of sleeves for raceway and exposed cabling passing through walls, partitions, beams, floors and roof while same are under construction. If openings, sleeves, and recesses are not properly installed and cutting and patching become necessary, it shall be done at no expense to the Owner. Secure permission from the Owner’s Representative before cutting or patching a constructed or existing wall. Where roofs or walls are fire rated, penetrations shall be completely sealed using UL-listed materials and procedures sufficient to preserve the fire rating. Comply with special requirements of local authorities.

B. Structure. Do not cut or core through structural beams, joists, load-bearing walls, grade beams, or similar load-bearing structure. Where limited space is available above the ceilings below concrete beams or other deep projections, notify the Owner’s Representative in writing, including a proposed
solution, and request a resolution. Approval shall be obtained from the Owner’s Representative and the Architect/Engineer for each penetration.

C. Penetrations.

1. This contract requires core drilling of floor or wall penetrations as indicated on Drawings. Core drilling shall be in accordance with structural specifications. Floor penetrations shall include a sleeve that extends above the floor 2 inches, except where plugs and caps are specified or indicated flush with floor or foundation pad. Electrical penetrations shall be coordinated with structure during design, and shall be made in compliance with structural requirements specified in the structural Drawings and specifications. Field modifications are required to be reviewed and approved by structural engineer prior to installation.

2. Penetrations shall be sealed in accordance with the requirements of Division 7, Firestopping. Coordinate with Division 7 to provide firestopping systems and materials that are compatible with the penetrations for systems and equipment furnished and installed under Division 26.

3. Provide sleeves for conduit penetrations of smoke, fire, and sound rated partitions. Install sleeve with a minimum of 1 inch diameter where penetrating the exterior drywall.

4. Provide proper sizing of sleeves or core-drilled holes to accommodate their through-penetrating items. In general, provide conduit sleeves two standard sizes larger than their through-penetrating items. Provide larger sleeves as required to allow passage of couplings for through-penetrating items.

D. Sealing and Firestopping.

1. Voids between sleeves or core-drilled holes and pipe passing through fire-rated assemblies shall be firestopped to meet the requirements of ASTM E 814, in accordance with Division 7 requirements for Firestopping.

2. Where the routing of cable tray passes through fire-rated walls, floors or other fire-rated boundaries, coordinate with Division 7 to provide removable firestopping system.

3. Furnish and install UL Systems Classified, intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250° F, for the sealing of holes or voids created to extend electrical systems through fire rated floors and walls, in order to prevent the spread of smoke, fire, toxic gas or water.

4. Fire barrier products shall be used to create through-penetration firestop systems as required. Firestop systems shall be listed in the Underwriter’s Laboratories Building Materials Discovery, Through Penetration Firestop Systems (XHEZ).

5. Install firestop materials and systems according to their UL Systems Classifications, manufacturer instructions, manufacturer recommendations, and the requirements of applicable Division 7 specifications.

E. Conduit Sleeves. Conduit sleeve shall be two standard sizes larger than the size of conduit it serves, except where “Link Seal” casing seals are used in sleeves through walls below grade. Sleeves in floor shall extend a minimum of two inches above the finished floor. Conduit passing through concrete masonry walls above grade shall have 18-gauge galvanized steel sleeves. Sleeves set in
concrete floor construction shall be at least 16-gauge galvanized steel except at conduit supports. Sleeves set in concrete floor construction supporting conduit risers shall be standard weight galvanized steel. Sleeves supporting conduit risers 3 inches and larger shall have three 6 inch long reinforcing rods welded at 120 degree spacing to the sleeve, and shall be installed embedded in the concrete or grouted to existing concrete. Where the conduit passes through a sleeve, no point of the conduit shall touch the sleeve. Seal around penetrations through sleeving as indicated under firestopping as specified herein, and in compliance with the requirements of Division 7 specifications.

F. Penetrations Below Grade. Sleeves penetrating walls below grade shall be standard weight black steel pipe with 1/4-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be two inches wider in radius than the sleeve it encircles. The entire assembly shall be hot-dipped galvanized after fabrication. Seal off annular opening between conduit and sleeve with “Link Seal” casing seal as manufactured by Thunderline Corporation of Wayne, Michigan. Size conduit sleeve to accommodate the casing seal. Use Series 300 casing seals for pipe 3/4-inch through 4-inch and Series 400 casing seals for pipe sized 5-inch and larger.

G. Methods of Cutting: Openings cut through concrete and masonry shall be made with masonry saws and core drills, and at such locations acceptable to the Owner's Representative. Impact type equipment shall not be used except where specifically accepted by the Owner's Representative. Openings in precast concrete slabs for conduits, outlet boxes, etc., shall be core drilled to exact size.

H. Restoration. Restore openings to “as new” condition under the appropriate specification Section for the materials involved, and match remaining surrounding materials and/or finishes.

I. Masonry. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Provide adequate supports during the cutting operation to prevent damage to the masonry caused by the cutting operation. Structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner’s Representative.

J. Structure. No cutting, boring, or excavating which will weaken the structure shall be undertaken. Coordinate with structure for placement of conduit, sleeves, and the like through beams, joists, slabs, mats, and other structural components and systems prior to forming of those structural components and systems.

K. Watertight. Where sleeves pass through roof or floors requiring waterproof membrane, lead flashing with a density of at least three pounds per square foot shall be built into the membrane a minimum of six inches to provide a watertight installation. Provide other watertight installation materials as detailed on the Drawings and as specified under Division 7 – Roofing.

L. Escutcheons. Provide heavy chrome-plated or nickel-plated plates on conduit passing through walls and ceilings in finished areas. Escutcheons shall be B&C No. 10, or accepted substitution, chrome-plated steel plates with concealed hinges.

M. Roof Penetrations and Flashings. Furnish and install pipe, conduit and duct sleeves, and flashing compatible with the roofing installation for roof penetrations. Coordinate with Division 7.
3.10 CLEANING, ADJUSTING AND START-UP

A. Cleaning. Clean electrical equipment, components, and devices prior to installation of final finish or covers, prior to startup and testing, prior to final observation by Architect/Engineer and Owner’s Representative, and as required under individual Sections of the Division 26 specifications.

B. Adjusting. Adjust equipment, devices, and systems as specified under individual Sections of these Specifications and in accordance with manufacturer’s instructions for proper functioning during modes of operation, including emergency and shutdown conditions.

C. Factory Authorized Representative. Where specified for an individual item of electrical equipment, provide a factory authorized representative for adjustment, start-up, and testing of equipment, and instruction of Owner’s operating personnel. Certify that these services have been performed by including a properly executed invoice for these services or a letter from the manufacturer.

3.11 TESTING

A. Test Conditions. Use field startup and testing procedures submitted in accordance with paragraph 1.07H of this Section and accepted by the Owner’s Representative and the Architect/Engineer. Place circuits and equipment into service under normal conditions, collectively and separately, as necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's Representative. Furnish instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Drawings and specifications. Special tests on certain items, when required, are specified in the individual specification Sections. Where testing is specified or otherwise required to be performed by an independent testing company, use an Owner-approved NETA-certified testing company.

B. Test Conditions. Use field startup and testing procedures prepared in accordance with paragraph 3.03B of this Section. Place circuits and equipment into service under normal conditions, collectively and separately, as necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's Representative. Furnish instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Drawings and specifications. Special tests on certain items, when required, are specified in the individual specification Sections. Where testing is specified or otherwise required to be performed by an independent testing company, use an Owner-approved NETA-certified testing company.

C. Test Dates. Schedule final acceptance tests sufficiently in advance of the contract completion date to permit adjustment and alterations within the number of days allotted for completion of the contract. Inform the Owner’s Representative in advance of test dates in accordance with the applicable requirements of Division One and the General Conditions. Where not specified, required, or directed otherwise, allow a minimum of at least 10 working days advance notice.

D. Retests. Conduct retests as directed by the Owner's Representative of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Delays resulting from retests do not relieve the Contractor of his responsibility under this contract.

E. Commissioning. Coordinate with commissioning agent, as applicable, for field testing and commissioning of electrical components and systems.
F. Test Reports. Submit copies of test reports to the Architect/Engineer in accordance with Division One requirements.

3.12 OPERATING AND MAINTENANCE MANUALS

A. General. The Contractor shall provide, in loose-leaf binders, complete operating and maintenance data of each manufactured item of equipment used in the electrical work at least four weeks before Architect/Engineer’s final review and observation of the project. Descriptive data and printed installation, operating and maintenance instructions for each item of equipment will be included. A complete double index will be provided as follows.

B. Format and content. The Operating and Maintenance Manual will be submitted in quantities and format as specified under Division One for Submittals. Provide quadruplicate where quantity is not specified. Operating and Maintenance Manual shall include:

1. Descriptive data of each system and piece of equipment, including ratings, capacity, performance data, operating curves and characteristics, and wiring diagrams.

2. Full detailed spare parts list, including source of supply for each piece of equipment.

3. Printed instructions describing installation, operation, service, maintenance, and repair of each piece of equipment.

4. Typewritten test reports of tests made of materials, equipment and systems under this Division. Test reports will include the dates of the tests, name of person conducting and witnessing the tests, and record of conditions relative to the tests.

5. Copies of “Reviewed” shop drawings and submittals.

6. Print copies of the record Drawings. Refer to paragraph 1.07I of this Section.

END OF SECTION
SECTION 26 05 19-LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section specifies the furnishing and installation of insulated conductors.

1.2 REFERENCE STANDARDS

A. ANSI/UL 83 - Thermoplastic-Insulated Wires and Cables.

B. ANSI/UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

C. ICEA S-61-402 (NEMA WC 5) - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.3 SUBMITTALS

A. Provide product data on the following:

1. 600-volt conductor, splicing and terminating materials.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Provide new insulated conductors marked according to NEC Article 310.

2.2 600-VOLT INSULATED CONDUCTORS

A. Size. As shown on the drawings.

B. Construction.


2. Insulation. Unless otherwise noted on the drawings, use THHN/THWN-2 for general wiring.

C. Use. For general wiring use No. 12 minimum. For field-installed control wiring use No. 14 or larger stranded conductors.

D. Listing. Single Conductor. UL 83.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Protection. Unless otherwise indicated, mechanically protect conductors for systems by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use Polywater J cable lubricant when pulling conductors. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600-volt insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension.

B. Splices and Terminations. Use pressure-type lugs or connectors for terminations or splices of all stranded conductors. Use ring-tongue type terminators on all control wiring.

C. Appearance. Neatly and securely bundle or cable all conductors in an enclosure using nylon straps with a locking hub or head on one end and a taper on the other.

3.2 600-VOLT INSULATED CONDUCTORS

A. Size. Install conductor sizes as indicated.

B. Home Runs. Except where specifically indicated, provide branch circuit home runs with not more than two different line conductors and a common neutral in a single raceway for 3-wire, single-phase systems, nor more than three different line conductors and a common neutral in a single raceway for 4-wire, 3-phase systems. Use home run circuit numbers as indicated for panelboard connections. Each isolated ground circuit shall include a neutral for each phase conductor. Provide No. 10 AWG conductor for the entire circuit length for single-phase, 20 ampere circuits for which the distance from panelboard to the last outlet is more than 100 feet for 120 volt circuits and 200 feet for 277 volt circuits.

C. Color Code. Use factory-colored insulated conductors for No. 10 and smaller conductors and color code larger insulated conductors with an approved field-applied tape. Use different colors for control wiring. Follow the color scheme below.

<table>
<thead>
<tr>
<th>Line</th>
<th>208/120</th>
<th>208/120 (ISOL.GND.)</th>
<th>480/277</th>
</tr>
</thead>
<tbody>
<tr>
<td>A or L1</td>
<td>Black</td>
<td>Black/Yellow</td>
<td>Brown</td>
</tr>
<tr>
<td>B or L2</td>
<td>Red</td>
<td>Red/Yellow</td>
<td>Purple</td>
</tr>
<tr>
<td>C or L3</td>
<td>Blue</td>
<td>Blue/Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>White/Yellow</td>
<td>Gray</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Green/Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Switch Leg</td>
<td>Pink</td>
<td></td>
<td>Pink</td>
</tr>
</tbody>
</table>

Where more than one conductor of the same phase or more than one neutral conductor occur at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings. All wiring associated with isolated ground receptacles (line, neutral, ground) shall have a yellow tracer on each conductor.

D. Field Testing. Insulation resistance of all conductors shall be tested. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are
made except connection to or into its source and point (or points) of termination. Insulation resistance of conductors which are to operate at 600 volts or less shall be tested by using a Biddle Megger of not less than 1000 volts d-c. Insulation resistance of conductors rated at 600 volts shall be free of shorts and grounds and have a minimum resistance phase-to-phase and phase-to-ground of at least 10 megohms. Conductors that do not exceed insulation resistance values listed above shall be removed at Contractor's expense and replaced and test repeated. The Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward copies of the test readings to the Owner in accordance with Section 26 05 00. These test reports shall identify each conductor tested, date and time of test and weather conditions. Each test shall be signed by the party making the test.

END OF SECTION
SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 WORK INCLUDED

   A. This section specifies the furnishing and installing of grounding and bonding equipment for electrical systems.

1.2 REFERENCE STANDARDS


   C. ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

   D. ANSI/UL 467 - Grounding and Bonding Equipment.


   G. NFPA 70 - National Electrical Code (NEC).

1.3 RELATED WORK

   A. Section 26 41 00, Lightning Protection System.

   B. Section 26 27 30, Isolated Power Systems.

   C. Division 27, Communications.

   D. Division 28, Electronic Safety and Security.

1.4 SUBMITTALS

   A. Product Data. Submit product data sheets, including complete descriptive information on materials and installation methods.

   B. Shop Drawings.
1. Provide detailed plans prepared to 1/8-inch scale with 1/8-inch text which indicate the work to be performed. Details of component mounting and connections shall be included on separate detail drawings. Manufacturer's catalog numbers and generic identification shall be indicated for components shown on the Drawings.

2. Shop drawings shall include locations of conductors and their compatibility with provisions made during the construction. Once the contract has been established the Contractor shall make a review of provisions being made for the system installation and comment, in writing, with changes or compliance within two weeks of finalizing the contract. Failure to coordinate these requirements shall not relieve this Contractor from properly completing this work.

C. Coordinated Submittal.

1. Submit product data and shop drawings for grounding system and lightning protection system at the same time and as one package. Indicate common components and interconnections between grounding and lightning protection systems. Refer to Section 26 41 00 for Lightning Protection system.

2. Note to specifier: confirm this requirement with Division 27 communications designer/specifier.

3. Coordinate submittal for grounding system with telecommunications grounding system, as indicated on telecommunications Drawings. Refer to Division 27 telecommunications systems grounding system and grounding requirements.

D. Approvals: Secure formal approval of shop drawings and product data prior to ordering material. Secure approvals in sufficient time to allow installation of concealed system components without delaying the project.

E. Testing: Submit documentation for field testing of completed grounding system.

F. Note to specifier: edit for Owner preferences on file format and media

G. As-Built Record Drawings. The Contractor shall maintain a master set of As Built record drawings that shows changes and deviations from the Drawings, in accordance with Division One requirements and Section 26 00 00. Deliver As-Built record drawings to Owner upon Owner acceptance of project. Where not specified otherwise in Division 1 or the General and Supplementary Conditions of the construction contract, deliver one set of As-Built record drawings plotted full-scale on mylar with permanent ink, prepared to 1/8-inch scale with 1/8-inch text. Also deliver one set of As-Built record drawings on CD-Rom or similar electronic media acceptable to the Owner. Drawing files shall be in AutoCAD (.dwg) and Adobe Acrobat (.pdf).

PART 2 - PRODUCTS

2.1 CONNECTIONS

A. Materials. Unless otherwise noted, provide exothermic welded type grounding connections for bonds and connections made below grade, embedded in structure, or otherwise concealed. For above grade connections not embedded in structure or otherwise concealed, provide mechanical
bolted-type connections utilizing high-conductive copper alloy or bronze lugs or clamps. Where required, provide plated connectors which will not cause electrolytic action between the conductor and the connector.

B. Listing. UL 467.

2.2 CONDUCTORS

A. Materials. Provide grounding conductors fabricated from annealed copper with conductivity $> 98$ percent IACS conductivity.

1. Use solid conductor for No. 12 and No. 10 AWG.

2. Use stranded conductor for No. 8 AWG and larger.

3. Use stranded conductor for applications subject to continuous vibration, such as engine generators and terminations at motors.

4. Use stranded, tinned, annealed copper cable for #2 AWG or larger installed inside the building or structure.

B. Insulation. Where insulated grounding conductors are specified or required, provide green-colored 600-volt rated insulation, type XHHW, THWN, or RHW. Insulation type shall be compatible with associated power and lighting system conductors.

C. Location and Application.

1. Inside building or structure. Provide insulated copper grounding conductors, except where bare copper grounding conductors are indicated on Drawings or specified in this or other Sections.

2. Outside building or structure. Use bare copper grounding conductors, including below-grade building grounding ring (counterpoise).


D. Listing. UL 83.

2.3 MANUFACTURER

A. Copperweld.

B. Cadweld.

C. Burndy.

D. Harger.
PART 3 - EXECUTION

3.1 GENERAL

A. Install grounding system in accordance with the requirements of the National Electrical Code (NEC), Article 250, and other applicable codes and standards. Coordinate installation of grounding and lightning protection system components with structural and civil work and placement of building structural mat.

B. Install grounding conductors continuous, without splice or connection, between equipment and grounding electrodes. Connection to ground busbars is permitted as an exception to the restriction against splices in grounding conductors. Grounding conductors shall be as short and straight as possible, and protected from mechanical damage.

C. Install fusion welded (exothermic) grounding connectors where they are below grade, concealed, or inaccessible. Above grade at accessible locations, use copper or bronze lugs and clamps. Grounding and lightning protection system connections made in conjunction with placement of the building structural mat shall be exothermic ground connectors.

D. Strap grounding clamps shall not be used. Connections requiring bolting shall be made up with Monel metal bolts, washers and nuts. Connections shall be made only after surfaces have been cleaned, or ground to expose virgin metal.

E. Where grounding conductors are installed in raceway, provide Schedule 40 PVC conduit inside the footprint of the building, and Schedule 80 PVC conduit for exterior or other locations outside the footprint of the building. Where exposed inside the envelope of the building, install grounding conductors in metallic raceway unless specifically indicated on Drawings to omit raceway. Where grounding conductors are installed in metallic raceway, bond to each end of metallic raceway where grounding conductors enter or exit the metallic raceway system. Metallic raceway systems that would form electrically inductive chokes shall not be used.

F. Conductor connections shall be made by means of solderless connectors such as serrated bolted clamps or split bolt and nut type connectors.

3.2 SYSTEM DESCRIPTION

A. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

3.3 EQUIPMENT GROUND

A. Raceway Systems and Equipment Enclosures.

1. Bond cabinets, cable trays, junction boxes, outlet boxes, motors, controllers, raceways, fittings, switchgear, switchboards, panelboards, transformer enclosures, other electrical
equipment and metallic enclosures. Bond equipment and enclosures to the continuous-grounded, metallic raceway system in addition to other specific grounding shown. Ground each outlet by the use of an approved grounding clip attached to the outlet box in such a position to be readily inspected upon removal of the cover plate, or by the use of an approved grounding yoke type receptacle.

2. Provide bonding jumpers and grounding conductors throughout the raceway system to ensure electrical continuity of the grounding system and the raceway.

3. Provide grounding-type insulated bushings for metal conduits 1-1/2 inches and larger terminating in equipment enclosures containing a ground bus. Connect the bushing to the ground bus in the equipment enclosure.

4. Provide a green insulated equipment grounding conductor for each feeder and branch circuit. Terminate each end of grounding conductor on a grounding lug, bus, or bushing.

5. Provide internal grounding conductor on liquid tight flexible metal conduit (“sealtite”) with ground bushings.

6. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

B. Size. Where grounding and bonding conductors are not sized on Drawings, size the grounding conductors in accordance with NEC Table 250.122. Size bonding jumper so that minimum cross-sectional area is greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250.122.

C. Taps, Splices and Connections: Make grounding (earth) conductor approximately 2 inches longer than the ungrounded (phase) conductors at both ends.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Testing: Test the completed grounding system by fall-of-potential method. Measure ground resistance from system grounding electrode main conductors to convenient ground reference point using suitable ground testing equipment.

1. Prepare test procedures and test forms to be used for field testing of completed grounding system. Procedures and forms shall include documentation of test equipment proposed for use in field testing of completed grounding system.

2. Resistance shall not exceed 1 ohm.

3. Testing points shall include measurement of ground resistance from system neutral at electrical service entrance to convenient ground reference point using suitable ground testing equipment.
4. Where measured resistance to ground exceeds 1 ohm, add additional ground rods to grounding system to achieve system resistance to ground of 1 ohm or less, and document measured resistance to ground after ground rods are added. Repeat as required to achieve resistance to ground of 1 ohm or less, at no additional cost to Owner.

C. Refer to Sections 26 05 19 and 26 27 30 for testing of isolated power systems per NFPA 99.

D. Documentation: Submit report of field testing of completed grounding system to Architect/Engineer and to Owner’s Representative.

3.5 CONFLICTS

A. In the event a conflict exists between this specification and the referenced standards, the requirements of this specification shall be regarded as secondary and the necessary variances made in order to obtain a UL Master label for the lightning protection system.

END OF SECTION
SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies the furnishing and installation of electrical raceway systems.

1.2 REFERENCE STANDARDS
A. ANSI/ANSI C80.1 - Rigid Steel Conduit - Zinc-Coated.
B. ANSI/ANSI C80.3 - Electrical Metallic Tubing - Zinc-Coated.
C. ANSI/UL 1 - Flexible Metal Conduit.
D. ANSI/UL 5 - Surface Metal Raceways and Fittings.
E. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.
F. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.
G. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.
H. ANSI/UL 797 - Electrical Metallic Tubing.
I. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.
J. UL 6 - Rigid Metal Conduit.

1.3 SUBMITTALS
A. Surface metal raceways and fittings.
B. Provide product data on cable tray and fittings.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS
A. Rigid Metal Conduit.
   2. Fittings. Threaded steel or malleable iron, either cadmium plated or hot-dipped galvanized.
B. Electrical Metallic Tubing (EMT).
   2. Fittings. Steel compression type or steel set screw fittings, either cadmium plated or hot-dipped galvanized. Connectors shall have insulated throat bushings.

C. Rigid Nonmetallic Conduit.
   2. Fittings. Solvent weld socket type.

D. Flexible Metal Conduit.
   2. Fittings. One-screw and two-screw for 1-1/2 inches and larger, double-clamp steel or malleable iron, either cadmium plated or hot-dipped galvanized.

E. Liquid-tight Flexible Steel Conduit.
   1. Conduit. Spiral-wound, square-locked, hot-dipped galvanized steel strip plus a bonded outer jacket of PVC.
   2. Fittings. Compression type, malleable iron, with insulated throat, either cadmium plated or hot-dipped galvanized.

F. Elbows.
   1. Provide large radius elbows.

PART 3 - EXECUTION

3.1 CONDUIT AND FITTINGS

A. Minimum Trade Size. 3/4 inch, except that 1/2-inch flexible metal conduit may be used in lengths not exceeding 72 inches for tap conductors supplying lighting fixtures.

B. Types According to Use.
   1. Use hot dipped galvanized rigid steel conduit (RGS) outside above ground where exposed to weather.
   2. Use EMT in interior walls or ceiling spaces and where exposed in open work areas, mechanical rooms or electrical rooms. Conduit that enters or leaves the top of panelboards or enclosures may be EMT, provided such panelboards and enclosures are located in mechanical or electrical rooms.
3. Conduits may not be embedded in slabs without approval of the owner and the structural engineer.

4. Use rigid nonmetallic conduit (Type EB) encased in concrete with minimum 3-inch-thick walls, where installed below grade. Concrete encasement may be omitted when conduit is used for site lighting circuits. In these cases use Schedule 40 PVC. All horizontal to vertical transitions shall be made using RGS elbows RGS conduit stub-ups. Seal all conduits weather tight.

5. Connect all indoor electrical equipment subject to vibration or movement with flexible metal conduit 24 inches minimum length. Where the equipment is located in a duct or plenum used for environmental air, the length of conduit shall not exceed 4 feet and the conduit shall be flexible metal conduit. Where the equipment is located outdoors or exposed to water, liquid-tight flexible metal conduit shall be used.

6. Transitions.
   a. Continue the heavier, more protective type conduit application not less than 4 inches into the area where lighter, less protective type conduit is permitted.
   b. For below-grade to above-grade outdoor locations, extend concrete encasement around conduit 4 inches above finished grade and slope top away from conduit with a 6-inch-per-foot slope.
   c. For below-grade to above-grade locations using PVC to metal conduit, make the transition from PVC to metal conduit before turning up with RGS elbow.

C. Preparation. Place sleeves in walls and floor slabs for the free passage of cables or conduits. Set sleeves in place a sufficient time ahead of concrete placement so as not to delay the work. Seal all openings and voids around sleeves through floors and walls. Be sure that plugs or caps are installed before concrete placement begins.

D. Installation Requirements.

1. Metallic conduits must be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. For EMT terminations, provide insulated throat bushings and on rigid metallic conduits, provide nonmetallic insulating bushings for conductor protection. Where feeder conduits, 1-1/2 inches and larger, terminate in equipment having a ground bus, such as in switchgear, motor control centers and panelboards, provide conduit with an insulated grounding bushing and extend a suitable grounding wire to the ground bus.

2. Have rigid nonmetallic conduit adequately solvent welded at joints to form a tight, waterproof connection.

3. Run concealed conduit as directly and with the largest radius bends as possible. Run exposed conduit parallel or at right angles to building or other construction lines in a neat and orderly manner. Conceal conduit in finished areas. Unless otherwise shown, remaining conduit may be exposed. Provide chrome-plated floor and ceiling plates around conduits exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Select properly sized plates to fit the conduit when securely locked in place.
E. Installation Methods.

1. Install each entire conduit system complete before pulling in any conductors. Clean the interior of every run of conduit before pulling in conductors to guard against obstructions and conduit omissions.

2. Cut all joints square, then thread and ream smooth. Coat cuts, threads or scratches on steel conduit with an approved zinc chromate or with a 90 percent based zinc paint. When dry, draw up tight.

3. Make bends with minimum 24” radius. Make field bends using equipment designed for the particular conduit material and size involved. Bends must be free from dents or flattening. Use no more than the equivalent of four 90-degree bends in any run between terminals and cabinets, or between outlets and junction boxes or pull boxes.

4. Conduit bodies may be used in lieu of conduit ells where ease of installation and appearance warrants their use. Conduit bodies larger than 1 inch may be used only where approved.

5. Securely fasten and support conduit to structure or metal framing using hot-dipped galvanized, malleable iron pipe straps or other approved means. Wires of any type may not be used for securing conduits. Branch circuit raceways which are 1 inch or smaller may be attached to wall studs by use of manufactured clips.

6. Provide a No. 30 nylon pulling line in conduits in which wiring is not installed under this work. Identify both ends of the line by means of labels or tags reading "Pulling Line - Telephone," etc.

7. Suitably cap conduit during construction to avoid water, dirt and trash entrance.

8. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

9. Use expansion fittings in conduit that terminates at sensitive equipment.

10. With a coupling, terminate concealed conduit for future use at structural surfaces. Install a pipe plug flush with the surface.

11. Openings around electrical penetrations of fire-resistance rated walls, partitions, floors or ceilings shall be firestopped to maintain the fire resistance rating using approved methods.

END OF SECTION
SECTION 26 05 37 - BOXES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies the furnishing and installation of outlet boxes, floor boxes, junction boxes and pull boxes.

1.2 REFERENCE STANDARDS
A. ANSI/NEMA Publication No. OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.
B. ANSI/UL 514A - Metallic Outlet Boxes.
C. ANSI/UL 514B - Fittings for Conduit and Outlet Boxes.

1.3 SUBMITTALS
A. Provide product data.

PART 2 - PRODUCTS

2.1 OUTLET BOXES
A. Flush Device Boxes. Provide galvanized steel boxes of sufficient size to accommodate wiring devices to be installed at outlet. Provide an extension ring for the device(s) to be installed. Square or rectangular boxes may be used. Unless otherwise noted, provide minimum 2-1/8-inch deep by 4-inch square minimum size box. For data outlets provide minimum 2-1/8-inch deep by 4-11/16 inch square minimum size box.
B. Exposed or flush Device Boxes. Provide FS or FD cast boxes for surface mounting in areas having exposed rigid metal conduit systems.
C. Boxes for Lighting Fixtures. Provide galvanized steel octagonal boxes with fixture stud supports and attachments as required to properly support ceiling and bracket-type lighting fixtures. Unless otherwise noted, provide 2-1/8-inch deep by 4-inch box.
D. Masonry Boxes. Provide galvanized steel, 3-1/2-inch deep, masonry boxes for all devices installed in masonry walls.
E. Switch Boxes. Not permitted.
F. Listing. UL 514.
2.2 FLOOR BOXES
   A. Box. See AV plans.
   B. Cover. See AV plans.
   C. Location. Specific floor box locations are indicated on the electrical and AV plans.

2.3 JUNCTION, PULL AND SPLICE BOXES
   A. Construction. Provide galvanized steel boxes conforming to NEC Article 314.
   B. Interior Spaces. Provide NEMA 1 type boxes at least 4 inches deep.
   C. Exterior Spaces. Provide NEMA 4X type boxes at least 4 inches deep.
   D. Embedded. Provide NEMA 4 cast iron type with flush flanged cover when cast in concrete.
   E. Listing. UL 514.

PART 3 - EXECUTION

3.1 OUTLET BOXES
   A. Flush Boxes. Unless otherwise indicated, mount all outlet boxes flush within 1/4 inch of the finished wall or ceiling line. Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Securely fasten outlet boxes. Provide plaster covers for all boxes in plastered walls and ceilings.
   B. Fixture Boxes. Where boxes for suspended lighting fixtures are attached to and supported from suspended ceilings, adequately distribute the load over the ceiling support members.
   C. Mounting Height. Mounting height of a wall-mounted outlet box means the height from finished floor to horizontal center line of the cover plate. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall. Verify the final location of each outlet with Owner's representative before rough-in. Remove and relocate any outlet box placed in an unsuitable location.
   D. Back-to-Back Boxes. Do not connect outlet boxes back to back unless approval is obtained from the Owner's representative. Where such a connection is necessary to complete a particular installation, fill the voids around the wire between the boxes with sound insulating material.
   E. Box Openings. Provide only the conduit openings necessary to accommodate the conduits at the individual location.
3.2 FLOOR BOXES

Verify locations of all floor boxes with the Owner's representative before installation. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required to obtain a minimum of 2 inches of concrete below bottom of box. Adjust covers flush with finished floor.

3.3 JUNCTION AND PULL BOXES

A. Installation. Install boxes as required to facilitate cable installation in raceway systems. Provide a junction box for terminating of flexible metal conduit to light fixtures. In general provide boxes in conduit runs of more than 100 feet.

B. Covers. Provide boxes so that covers are readily accessible and easily removable after completion of the installation. Include suitable access doors for boxes above inaccessible ceilings. Select a practical size for each box and cover.


END OF SECTION
SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Conduit color coding and labeling.

1.2 REFERENCES

A. NFPA 70 – National Electrical Code (NEC).

1.3 SUBMITTALS

A. Provide submittals in accordance with and in addition to Section 26 00 00, Electrical General Provisions, and Division 01, for submittal requirements.

1. Furnish nameplate identification schedules to Owner’s Representative for review and acceptance, listing equipment type and nameplate data with letter sizes and nameplate material.

2. Nameplate Schedules. Prior to fabrication of nameplates, furnish to Owner for review and acceptance a schedule of nameplates for electrical equipment. For each equipment and circuit identified, provide 4-line nameplate as follows:

   a. Line 1: Device designation, switchgear or MCC cubicle, switchboard circuit, etc. as indicated on plans, schematics, or schedule Drawings.
   b. Line 2: Leave blank for Owner’s use.
   c. Line 3: Source or voltage characteristics, as applicable.
   d. Line 4: Load served.

3. Refer to Parts 2 and 3 of this Section for nameplate requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Equipment Nameplates:

   1. For normal power electrical equipment, provide engraved three-layer laminated plastic nameplates, engraved white letters on a black background.
2. For emergency equipment, provide engraved three-layer laminated plastic nameplates with engraved white letters on a red background.

3. For UPS powered equipment, provide engraved three-layer laminated plastic nameplates with engraved white letters on an orange background.

4. For fire alarm system, provide engraved three-layer laminated plastic nameplates with white letters on a yellow background.

5. For security and CCTV system panels, provide engraved three-layer laminated plastic nameplates with white letters on a blue background.

6. Nameplate minimum size shall be 1 inch high by 3 inches long with engraved white letters. Generally, the number and name shall be at least 1/4 inch high and other data at least 1/8 inch high.

B. Underground Warning Tape:

1. Manufactured polyethylene material and unaffected by acids and alkalines.

2. 3.5 mils thick and 6 inches wide.

3. Tensile strength of 1,750 psi lengthwise.

4. Printing on tape shall include an identification note “BURIED ELECTRIC LINE”, and a caution note “CAUTION”. Repeat identification and caution notes over full length of tape. Provide with black letters on a red background.

5. Detector Strip. Metallic tape or similar detector strip, integral to warning tape.

C. Conductor Color Tape and Heat Shrink:

1. Colored vinyl electrical tape shall be applied perpendicular to the long dimension of the cable or conductor.

2. In applications utilizing tray cable, heat shrinkable tubing shall be used to obtain the proper color coding for the length of the conductor in the cabinet or enclosure. Variations to the cable color coding due to standard types of conductor or cables are not acceptable.

D. Conduit Labels (15 kV Conduits Only): 2-inch black letters on yellow background reading "DANGER - 13,200 VOLTS". Labels shall have adhesive backing, and shall be installed at intervals not exceeding 50 feet and on pull boxes located to be visible from floor.

E. Warning labels: Provide warning labels with black lettering on red background with a minimum of 1/2 inch lettering.

F. Tape Labels: Provide device labels of plastic adhesive tape, with minimum 1/4-inch letters for labeling receptacles, switches, control device stations, junction and pull boxes and manual motor starter units, etc.
1. Normal power. Black letters on clear background. Provide white letters on black background where specifically indicated on Drawings or specified in other Sections.

2. Emergency/standby power. Red letters on clear background. Provide white letters on red background where specifically indicated on Drawings or specified in other Sections.

3. UPS power. Orange letters on clear background. Provide white letters on orange background where specifically indicated on Drawings or specified in other Sections.

4. Provide device label with black letters, one half inch wide tape with one quarter inch high letters, minimum.

5. Manufacturer. Brother type “P-Touch”, or accepted substitution.

G. J-Box and Cover plate Voltage Labels: Black stenciled letters 1/4 inch high. Adhesive back tapes may be used if a clear tape is applied over the label for protection.

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in individually wrapped factory-fabricated fiberboard-type containers.

B. Store materials in a clean and dry space, elevated above grade, and protected from weather and sunlight.

C. Handle materials carefully to avoid damage, breaking, denting and storing. Damaged materials shall be rejected and shall not be installed.

3.2 INSTALLATION

A. Degrease and clean surfaces to receive nameplates or tape labels.

B. Install nameplates parallel to equipment lines.

C. Secure plastic nameplates to equipment fronts using stainless steel self-tapping screws or rivets. Use of adhesives shall be per Owner’s approval. Stick-on or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates. Secure nameplate to outside face of flush mounted panelboard doors in finished locations.

D. Designations: Externally mark equipment, feeders, branch circuits and similar items with nameplates with the same designations as indicated on the Drawings.

3.3 WIRE AND CONDUCTOR IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, ground busbars and at load connection.
1. Identify with branch circuit or feeder number for power and lighting circuits.

2. Label control conductor with number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

3. Label grounding conductors at ground busbars, electrical equipment, and test wells with metal tags indicating the cable purpose and point of termination at opposite end of cable. Securely fasten metal tags along the length of the grounding cable or conductor. Place metal tags to avoid creating short circuits, inadvertent grounding paths, or other contact with grounded or energized terminals, conductors, or components.

B. Existing Facilities. Where the Contractor encounters conductor identification in existing electrical distribution systems different from the colors scheduled in this Section, notify the Owner's Representative in writing and propose a resolution, in accordance with the requirements of Part 1 of Section 26 00 00, Electrical General Provisions.

C. Conductors for power and lighting circuits shall be identified per the following schedule.

<table>
<thead>
<tr>
<th>Conductor</th>
<th>480/277V</th>
<th>208/120V</th>
<th>Medium Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td>Brown</td>
<td>Black</td>
<td>One White Band</td>
</tr>
<tr>
<td>Phase B</td>
<td>Purple</td>
<td>Red</td>
<td>Two White Bands</td>
</tr>
<tr>
<td>Phase C</td>
<td>Yellow</td>
<td>Blue</td>
<td>Three White Bands</td>
</tr>
<tr>
<td>Neutral</td>
<td>Gray</td>
<td>White</td>
<td>N/A</td>
</tr>
<tr>
<td>Grounding</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Isolated Ground (IG)</td>
<td>N/A</td>
<td>Green w/Yellow Tracing Stripe</td>
<td>N/A</td>
</tr>
</tbody>
</table>

D. Where more than one conductor of the same phase or more than one neutral or ground conductor occurs at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings. The neutral tracer color shall match the phase conductor color with which it is associated.

E. Switch leg conductors. Pink.

1. The color of switch leg conductors shall be pink, marked with tape matching the color of the associated branch circuit phase conductors.

F. Low voltage wiring systems. Conductors for low voltage circuits shall be identified as follows.

1. Fire Alarm. Red

2. Security. Blue and Yellow. Coordinate wiring color with Division 27 and telecommunications supplier

3. Clock. Green and White

4. Telephone. White. Coordinate wiring color with Division 27 and telecommunications supplier
5. Data. Bright Blue. Coordinate wiring color with Division 27 and telecommunications supplier.

6. HVAC Controls. Dark Blue. Coordinate wiring color with Division 23 and controls supplier.

3.4 NAMEPLATES

A. Provide nameplates of minimum letter height as scheduled below. Nameplates shall be same as equipment names indicated on the Drawings.

1. Externally mark electrical equipment with nameplates identifying each and the equipment served.

2. Supply blank nameplates for spare units and spaces.

B. Nameplate Fasteners. Fasten nameplates to the front of equipment by means of stainless steel self-tapping screws. Stick-on or adhesives are not allowed unless the NEMA enclosure rating is compromised, then use only epoxy adhesive to attach nameplates.

C. 15 KV-Class Switches.

1. On main switches or circuit breakers: 3/8 inch: identify the equipment designation. 1/4 inch: identify system voltage and characteristics (i.e., 12.47 KV, 3PH, 3W).

2. For each switch or circuit: 3/8 inch; identify the circuit or cubicle. 1/4 inch: identify the load served.

D. 480-volt Switchboard/switchgear:

1. On the main switches or circuit breakers: 3/8 inch: identify the equipment designation. 1/4 inch: identify the source and voltage characteristics (i.e., 480/277V, 3PH, 4W).

2. For each branch circuit protective device: 3/8 inch: identify the circuit or cubicle. 1/4 inch: identify the load served.

E. Individual Circuit Breakers in Distribution Panelboards, Disconnect Switches, Motor Starters, and Contactors: 1/4 inch: identify source to device and the load it serves, including location.

F. Dry Type Transformers Not in Substations: 3/8 inch: identify equipment designation. 1/4 inch: identify primary and secondary voltages, primary source, and secondary load and location.


H. Provide complete circuit directory for each new panel board. Provide complete circuit directory for each existing panelboard with circuits added, removed, demolished, moved, renovated, or otherwise altered as part of this project or as work required by or incidental to this project. Refer to Section 26 24 16 for directory requirements.
I. Identification tags on items in finished areas, such as special switches, etc., shall be securely attached on, or in the immediate vicinity, of the item. Supply blank nameplates for spare units and spaces.

3.5 ENCLOSURE COLOR CODING

A. The following systems shall have each enclosure and cover completely painted as follows:

1. Fire Alarm. Red, with black “FA” text.

B. The following systems shall have each junction and pull box cover completely painted per the following:

<table>
<thead>
<tr>
<th>System</th>
<th>Color of Box Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Backbone</td>
<td>Blue</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Brown</td>
</tr>
<tr>
<td>FCMS</td>
<td>Green</td>
</tr>
<tr>
<td>Emergency Power</td>
<td>Red, with black “E” text</td>
</tr>
<tr>
<td>Security**</td>
<td>White</td>
</tr>
<tr>
<td>Fire Alarm</td>
<td>Red, with black “FA” text</td>
</tr>
<tr>
<td>Clock</td>
<td>Fluorescent Violet</td>
</tr>
</tbody>
</table>

**Security shall include, but not be limited to, the following systems:
- Card Access
- Duress Alarms
- Perimeter Door Alarms

C. CCTV

3.6 EQUIPMENT AND DEVICE MARKING

A. Pull, Junction and Outlet Boxes.

1. With 1/2-inch high permanent lettering, identify conduits connected to pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Identify complete circuit numbers on box cover and on the conduit.

2. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation. Identify both phase and associated neutral conductors.
3. Boxes and covers containing emergency power or emergency lighting circuits shall be painted red. Factory finish is acceptable in lieu of painting in the field. No other raceway, conduit, boxes, or enclosures shall be painted red.

1. Fire alarm boxes and covers shall be painted red. Using permanent lettering, identify box cover as “F/A” or “FAS”, with fire alarm zone served. Factory finish is acceptable in lieu of painting in the field. No other raceway, conduit, boxes, or enclosures shall be painted red.

B. Equipment and Raceways Over 600 Volts: Provide “WARNING - HIGH VOLTAGE - KEEP OUT” signs on equipment. With 2-inch-high lettering, mark exposed raceways containing conductors operating in excess of 600 volts every 50 feet, or in each room or space or compartment of penetration, and at each wall or floor penetration, with the words "WARNING - HIGH VOLTAGE –13,200 VOLTS”.

C. Power Receptacles: Use a clear plastic tape label, nameplate or engraved device plate to identify power receptacles where the nominal voltage between a pair of contacts is greater than 150 volts with circuit number, voltage and phases. If nameplates are used, attach to wall directly above device plate. Nominal 120 volt power receptacles shall be labeled with the complete circuit number.

D. Snap Switches:

1. Where the equipment served is not in sight of the snap switch, or where snap switch controls dedicated outlets or special equipment, provide a clear plastic tape label or an engraved switch plate to identify equipment served.

2. Where snap switches are grouped together, provide clear plastic tape labels or engraved switch plates to identify non-lighting equipment served.

E. Dedicated Outlets: For dedicated outlets, provide a clear plastic tape label or an engraved coverplate indicating the equipment served. Dedicated is understood to be specific equipment listed by equipment number in the panel schedules or identified on the plans. Dedicated also includes computer outlets.

F. Remote Ballasts: For remote ballasts not within five feet of their luminaire, provide appropriate permanent lettering on both the ballasts and the luminaire to identify which units are mated to the other.

END OF SECTION
SECTION 26 51 00 - INTERIOR AND EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies the furnishing and installation of luminaires complete with lamps, ballasts, and other accessories. Provide poles for exterior luminaires requiring such.

1.2 REFERENCE STANDARDS
A. ANSI C78 Series - Lamps.
B. ANSI C82 Series - Ballasts.
C. ANSI/UL 844 - Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
D. ANSI/UL 935 - Fluorescent-Lamp Ballasts.
E. ANSI/UL 1029 - High-Intensity-Discharge Lamp Ballasts.
F. ANSI/UL 1570 - Fluorescent Lighting Fixtures.
G. ANSI/UL 1571 - Incandescent Lighting Fixtures.
H. ANSI/UL 1572 - High-Intensity-Discharge Lighting Fixtures.
I. ANSI/UL 1574 - Track Lighting Systems.
K. NFPA 70 - National Electrical Code (NEC).
M. UL 924 - Emergency Lighting and Power Equipment.

1.3 RELATED WORK
A. Section 26 00 00, Electrical General Provisions.
B. Section 26 05 33, Raceways.
C. Outdoor lighting for state-funded project shall meet “cutoff luminaire” criteria set forth by Texas House Bill 916 (1999).
1.4 SUBMITTALS

A. Submit product data on each luminaire, emergency lighting unit, exit sign, and pole, with separate sheet for each luminaire, assembled by luminaire "type" in alphabetical order, with the proposed luminaire, ballast or Driver, lamps, and accessories clearly labeled. Submit at one time in booklet form.

1. Include with submittal data dimensioned drawings and performance data including coefficients of utilization, candela distribution, spacing to mounting height ratio, efficiency, efficacy, and visual comfort probability.

B. LED: Provide documentation for performance of LED luminaires including LM 79, LM 80 reports and L70, L80 or L85 test results. Provide documentation for listed tolerances for variation in temperature color, or “binning”. Binning documentation shall include MacAdam steps diagram with range of binning clearly indicated. Provide testing data that clearly indicates listed environmental conditions for installation of luminaire including ambient temperature.

1. LED luminaires with remote drivers shall clearly indicate required wattage and voltage tolerance of driver and maximum range for which driver can be installed remote to LED luminaire.

2. Provide power requirements for complete LED fixture package clearly indicating the lumen package and power consumption of the entire fixture package.
   a. Data indicating only lumen package and power requirements for individual LED modules incorporated into the complete fixture package is not acceptable.

C. Samples.

1. When requested in writing by the Owner’s Representative or the Architect/Engineer, furnish samples of luminaire types.

2. Deliver samples for luminaire types as requested, at a time and place designated by the requestor (Owner’s Representative or the Architect/Engineer).

3. Samples shall be complete product models as proposed for use on the project.

4. Furnish samples to the Owner at no additional cost.
   a. Samples shall not be installed on the project without the written consent of the Owner’s Representative and the Architect/Engineer.
   b. Upon written concurrence from the Owner’s Representative, samples furnished for the project may be retained by the Contractor for delivery as “spares” following Owner’s acceptance of the completed project.

PART 2 - PRODUCTS

2.1 LUMINAIRIES

A. Lens. Lenses for fluorescent luminaires shall have a nominal thickness of 0.125 inch.
B. Disconnecting Means. Provide linear fluorescent luminaires for indoor locations with factory-installed disconnecting means complying with NEC-410.73(G).

C. Frames.
1. Frames shall be flush steel, hinged and equipped with rotary-action cam latches. Alternate materials are indicated in Luminaire Schedules on Drawings.

D. Listings.
1. Fluorescent. UL 1570.
2. High-Intensity-Discharge. UL 1572.

E. Manufacturer. Luminaires are specified by type and manufacturer in the Luminaire Schedule on the Drawings. Equivalent products of manufacturers listed below will be considered upon submission of product data in accordance with paragraph 1.7 of Section 26 00 00 and with paragraph 1.4 of this Section.
1. Linear fluorescent. Acuity/Lithonia, Columbia, Cooper, Finelite, Focal Point, Kenall, LiteControl, Peerless, Prudential, Zumtobel.
3. High intensity discharge/Interior. Acuity/Lithonia, Cooper, Gotham, Hubbell, Kurt Versen.
4. Incandescent/LED. Acuity/Lithonia, Cooper, ILEX, Hubbell, Ledos.
5. Exterior area lighting. Architectural Area Lighting, Cooper, Hubbell, Kim, WideLite.
6. Exit Signs. Refer to paragraph 2.6 this Section.
7. Emergency Lighting Units. Refer to paragraph 2.4, this Section.

2.2 LAMPS

A. General. Provide lamps for luminaires. Types are specified in the Luminaire Schedule on the Drawings.

B. Fluorescent.
1. Linear Fluorescent.
   a. Where T-8 lamps are indicated, use T-8 type fluorescent lamps nominally rated 32 watts, 4100K, unless indicated otherwise on Luminaire Schedule on Drawings. Minimum color rendering index (CRI) of 85. Provide lamps with average rated life of 24,000 hours, minimum.
   b. Pentron. Where T-5 lamps are indicated, use T-5 type linear fluorescent lamps nominally rated 28 watts, 4100K, unless indicated otherwise on Luminaire Schedule on Drawings. Minimum color rendering index (CRI) of 85. Provide lamps with average rated life of 24,000 hours, minimum.
c. High Output. Where high-output linear fluorescent lamps are indicated, use T5HO type linear fluorescent lamps nominally rated 54 watts, 4100K, unless indicated otherwise on Luminaire Schedule on Drawings. Minimum color rendering index (CRI) of 85. Provide lamps with average rated life of 24,000 hours, minimum.

2. Compact Fluorescent. Use T-4 type compact fluorescent lamps as specified in the luminaire schedule, 4100K, unless indicated otherwise. Minimum color rendering index (CRI) of 82. Provide lamps with average rated life of 10,000 hours, minimum.

3. Environmental. Lamps shall be low-mercury type and shall pass federal TCLP test requirements in effect at the time of manufacture.

C. High Intensity Discharge (HID).

1. Metal halide shall be phosphor coated, suitable for burning in the position required.

2. High-pressure sodium lamps shall be clear.

D. Manufacturers.

1. Fluorescent and Compact Fluorescent: General Electric, Philips, Sylvania.

2. HID: General Electric, Philips, Sylvania, Venture.

3. Incandescent: General Electric, Philips, Sylvania.

E. Light Emitting Diodes (LED) or Solid State Lighting

1. Provide luminaire package with temperature variance limited to three MacAdam steps as defined in ANSI C78.377.

2. Provide luminaire that is factory tested as a complete package with a LM-79 and LM-80 report.

3. Provide luminaire with individual LED boards. Replacement of individual LED boards shall be capable to be performed in the field and shall not require replacement of the entire unit or fixture.

4. Provide fixture with minimum 5 year warranty covering complete luminaire package.

5. Provide LEDs with phosphorous coating, for creation of white LEDs, at the individual LEDs and not at the luminaire lens or housing.

6. Provide luminaire with quick disconnect for LED drivers and individual LED boards.

7. Provide LED fixtures compatible with 0-10V or DALI non-proprietary controls.

8. Provide LED luminaires with appropriately sized heat sink.
2.3 BALLASTS

A. General. Provide ballasts for luminaires as required and as scheduled.

B. Fluorescent. Provide luminaires with program-start electronic ballast, THD 10% or less, 0.98 power factor, and 0.88 ballast factor. Instant start ballasts are not acceptable.

1. Compact fluorescent luminaires: as above, 4-pin, high power factor.

2. Voltage. Ballasts shall be rated for 277-volt operation, unless indicated otherwise on luminaire schedule. Ballasts in luminaires for under-counter lighting shall be rated for 120-volt operation.

3. Ballasts shall be Class P thermally protected and include automatic end-of-life protection to shut off lamp upon failure.

4. Unless scheduled or noted otherwise (i.e. dual switching, etc.), provide one ballast per luminaire.

5. Ballasts shall meet the following regulatory requirements:
   a. Comply with FCC requirements governing electromagnetic and radio frequency interference.
   c. Tested or approved by Electrical Testing Laboratories and Certified Ballast Manufacturers.


7. Dimming Ballasts.
   a. Where dimming control is specified, the dimming control and ballasts shall be compatible and shall be designed to operate together.
   b. Provide fluorescent dimming ballasts that produce smooth, flicker free dimming from 100 percent light output to 5 percent light output. Where architectural dimming is specified or scheduled, provide fluorescent dimming ballasts that produce smooth, flicker free dimming from 100 percent light output to 1 percent light output.
   c. Ballast manufacturer shall provide a complete dimming system including ballasts, wall controllers and auxiliary devices as required. Ballast manufacturer shall be responsible for the compatibility of the equipment and correct operation of the system.

C. High Intensity Discharge (HID).

1. Metal Halide. Provide pulse start electronic ballasts with high power factor.

2. High-Pressure Sodium. Provide constant wattage ballasts with high power factor. Ballasts must be suitable for operation in ambient temperature of 55°C.

3. Ballast shall start and operate the lamp at ambient temperatures ranging from minus 20°F to 130°F.
4. Ballasts shall have automatic thermal protection, and high power factor, minimum of 90%. Ballasts shall be compatible with the lamps selected, for the specific burning position (lamp orientation: horizontal or vertical), and compensate for the loss in efficiency.

5. Ballasts for exterior site luminaires shall be encased and potted.

6. Provide isolation mounting and insulation of HID ballasts to reduce sound transmission and radiation.

D. Light Emitting Diode (LED) Drivers

1. UL Listed as a complete assembly with luminaire,
2. RoHS and FCC compliant.
3. Minimum 5 year warranty.
5. UL Class 2 power limited per UL1310.
6. UL dry and damp location listed.

E. Power factor greater than 0.90 and <20% THD.

1. Driver shall operate at specified input voltage with sustained variation of +/- 10% with no damage to the driver.
2. Integral surge protective device.
3. Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.

F. Minimum operating temperature -20C.

1. Driver output regulated +/- 5% over published load range. Output shall be compatible with LED board in specified luminaire.
2. Output current controls local to the driver (trimpot or programmable).
3. If specified on the Drawings, the driver shall dim within the range specified on the fixture schedule with no flicker.

G. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.

H. Listings.

1. Fluorescent. UL 935.
2. High-Intensity-Discharge - UL 1029.
3. LED - UL1310 - Class 2 power supplies

I. Fuses. Provide in-line fuses in base of the pole for pole-mounted luminaires.

J. Manufacturers.
   2. Dimming fluorescent. Lutron, Advance, Osram-Sylvania.

2.4 EMERGENCY BATTERY PACK/BALLAST

A. Where indicated on luminaire schedule or plans, provide luminaires with emergency ballasts. Emergency ballasts shall automatically provide for a minimum of 90 minutes of illumination in the event of loss of normal power to the building. Where larger capacity is indicated on plans or schedules, provide unit with larger capacity.

B. Emergency battery packs/ballasts shall comply with the following requirements:
   1. Exceed the NEC, LSC, and UL 90-minute requirements, and carry the UL label.
   2. Contain high-temperatures nickel cadmium batteries that are maintenance free and fully recharge within 24 hours.
   3. Are backed by full (non pro-rata) warranties, 5-year for linear fluorescent lamps and 2-year for compact fluorescent lamps.
   4. Capable of operating one or two lamps, with minimum lumen output as indicated on the Drawings.

C. Manufacturer. Bodine, and the scheduled luminaire manufacturers.

2.5 EMERGENCY LIGHTING UNITS

A. See plans.

2.6 EXIT SIGNS

A. See plans.
PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Deliver luminaires, exit signs, emergency lighting units, and accessories individually wrapped in factory-fabricated fiberboard type containers.

B. Handle luminaires, exit signs, emergency lighting units, and accessories carefully to prevent breakage, denting and scoring the luminaire finish. Do not install damaged units.

C. Store luminaires, exit signs, emergency lighting units, and accessories in a clean, dry space, elevated above grade, and protected from the weather and sunlight.

D. Refer to paragraph 3.2 of Section 26 00 00, Electrical General Provisions.

3.2 COORDINATION

A. Prior to ordering luminaires, check the type of ceilings to be installed in each room and verify that the luminaires are proper and compatible for the type of ceiling as specified and as indicated on the architectural Drawings. Provide a frame compatible with the type of ceiling in which the luminaire is installed. Refer to the Drawings and the Architectural Room Finish Schedule for the specified ceiling type. Advise the Owner’s Representative of discrepancies before placing the luminaire order.

B. Check the building electrical system requirements and architectural finishes, and regardless of the catalog number prefixes and suffixes shown, furnish luminaires with the proper trim, frames, plaster rings, supports, hangers, stems, mounting brackets, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with said conditions. Verify with Owner’s Representative prior to ordering.

C. If a luminaire type designation is omitted, furnish luminaire of the same type as shown for rooms of similar usage. Verify with Owner’s Representative before purchase and installation.

D. Examine the areas and conditions which luminaires are to be installed and notify the Owner’s Representative and the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Include written plan for correction of deficiencies and conditions noted. Do not proceed with the work until unsatisfactory conditions have been corrected.

E. Verify that the occupancy sensors are compatible with the specified ceiling systems as indicated on the Drawings. Advise the Architect/Engineer of discrepancies before placing the device order.

F. Verify that the fluorescent dimmers are compatible with the specified dimming ballasts, as indicated on Drawings.

G. Coordinate luminaire installation with lighting controls per Section 26 09 23, with architectural dimming system per Section 26 09 33, and with digital network addressable lighting controls per Section 26 09 43.
3.3 INSTALLATION

A. Install luminaires in accordance with the manufacturer's written instructions, Owner’s requirements, the applicable requirements of NEC and local and national Codes, Standards, and regulations.

B. Install luminaires at locations as shown on the Drawings, install aligned, aimed, and leveled. Install luminaires in accordance with manufacturer's installation instructions complete with mounting accessories, trim and support materials.

C. Support.

1. Provide hangers and support members for luminaires as required for proper installation. Provide appurtenances which include stud supports, stems, mounting brackets, frames and plaster rings.

2. Support luminaires from the building structure or from furring channels. Furring channels must be a minimum size of 1-1/2 inches. Luminaires in suspended ceilings shall be supported in accordance with NEC 410.16.

3. Fasten luminaires securely to structural support members of the building. Support grid-type lay-in luminaires from the structure above at each corner of luminaire. 1/4 inch expansion slip ring anchorage with eye and ceiling-type support wire is permitted. Two wires may be supported by one anchorage if required by construction conditions, such as obstructions by other system. Solid pendant luminaires shall be plumb.

4. Provide support for 1/2 inch pre-manufactured flexible metal conduit (FMC) whips from structure above. Whips shall not touch ceiling system as finally installed. Whips shall be kept 12 inches clear of ceiling except where required for termination at luminaires. Use of “fixture support wire installation” with caddy clip is permitted.

5. Flexible metal conduit from junction box to luminaire shall not touch the ceiling as finally installed.

D. Coordinate with other crafts to avoid conflicts between luminaires, supports, fittings and mechanical equipment.

E. Surface Mounted Luminaires.

1. Mount with support rails attached to ceiling suspension support system, provided ceiling system has been certified to be suitable to support weight of luminaires.

2. Where ceiling system has not been certified to support weight of luminaires, luminaires shall be supported at four points near each corner of luminaires.

3. Provide a minimum 5/8" air space between the luminaires and the ceiling.

F. Recessed Luminaires.

1. Handle specular/semi-specular louvers and down light cones using only new clean white cotton or silk gloves. Do not touch louvers or cones with bare hands. Leave luminaires clean
and free of visible dust, debris, or fingerprints with lamps operational at time of acceptance of work.

2. Recessed fluorescent luminaires in lay-in grid shall be supported independently from building structure above ceiling with galvanized steel wire at not less than 4 points near corners of luminaires. Size of wire shall be capable of supporting weight of luminaires. This requirement is separate and apart from hanger wire requirements of the ceiling grid.

3. Recessed luminaire trims shall fit snugly to the mounting surface and shall not exhibit light leaks or gaps. Provide feed-through junction boxes or provide separate junction boxes. Components shall be accessible through the ceiling opening.

G. Pole-mounted Lighting.

1. Provide in-line fusing at handhole for pole-mounted luminaires.

2. Provide removable unitized ballast/component tray with separable connector in pole-mounted luminaires.

3. Construct base of reinforced concrete with dimension and depth as noted on the structural drawings.

4. Install anchor bolts with minimum projection above top of bases, as specified by pole manufacturer. Ground pole as indicated on drawings.

5. Mount standards on bases plumb and true using shims as necessary. Grout thoroughly between base-plate and foundation.

6. Touch up chips and scratches on poles to match new finish upon completion.

H. Protect installed luminaires from damage during the remainder of the construction period.

I. Luminaires must be completely wired and lamps installed. Luminaires must be operating properly at final completion.

J. Adjustment.

1. Adjust luminaires to illuminate intended areas as directed.

2. Adjust exterior luminaires during hours of darkness. Where acceptable to the Owner’s Representative, exterior luminaires may be adjusted during daylight hours; verification of adjustments shall be conducted during hours of darkness.

K. Upon completion of installation of interior luminaires, and after circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

L. Immediately before final observation, clean luminaires, inside and out, including plastics and glassware, and adjust trim to properly fit adjacent surface, replace broken or damaged parts and lamp, and test luminaires for electrical as well as mechanical operation.
M. Fluorescent lamps may be used in the final finishing of the building. Those lamps that have exceeded more than 10% of their rated life (as established by construction records), or that have darkened ends shall be replaced with new lamps before final acceptance.

N. Linear and compact fluorescent lamps installed in luminaires with fluorescent dimming ballasts shall be "burned-in" at full brightness for 100 hours prior to dimming operation of lamps, and prior to final acceptance by Owner.

O. Lamp Disposal. The procedure for disposal of lamps that contain mercury shall follow the guideline set by EPA (definitions in Title 40 Code of Federal Regulations 261 Subpart C, January 2000).

P. At Owner’s option, up to 30% of the fluorescent luminaires shall be opened by the Contractor for inspection. The luminaires may be inspected prior to or after installation. If instant-start ballasts are found, luminaires shall be opened, inspected and the instant start ballasts replaced with approved programmed rapid start ballasts at Contractor’s expense.

3.4 TESTING

A. The Contractor shall demonstrate to the Owner the proper operation of luminaires, systems and equipment specified in this Section and related Sections. The Contractor shall adjust, repair or replace as necessary components that do not perform as specified, until able to demonstrate proper operation of equipment in normal, automatic, manual, emergency, power-loss, and power-restored modes of operation, as applicable.

END OF SECTION
SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 - GENERAL

Subsurface data is available from the Engineer. Contractor is urged to carefully analyze the site conditions. A topographic and subsurface survey was performed by Kuo and Associates dated 08/16/2017, Project No. 17062.

1.1 SCOPE

A. This section pertains to the specifications for clearing and grubbing, topsoil removal and stockpiling, disconnecting, capping or sealing, and abandoning site utilities in place, and disposal of all vegetation, rubbish and excess material, as required for site grading and related staging areas as noted on the drawings and in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 22 13 Site Grading
B. Section 31 23 33 Trenching Backfill and Compaction
C. Section 31 25 00 Erosion and Sedimentation Control

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.
C. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
D. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner’s Rep. Unauthorized excavation, as well as remedial work directed by the Owner’s Rep shall be at the Contractor's expense.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographic and/or video graphic documentation, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements must be prepared. Unless otherwise documented, any damage discovered to trees, plantings, and site features denoted to
remain, will be considered the responsibility of the contractor to correct. The owner may at his/her discretion request such photographs and/or video tapes be submitted at any time.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated on drawings to be salvaged and store on Owner's premises where indicated. Contractor to contact Owner for coordination.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. General site narrative - The site consists of an existing concrete pavement parking lot and detention pond. The south end of the parking lot is being expanded to include more spaces for parking. The existing lot is to remain untouched except where a new covered walkway is being installed.

F. Staging Areas - Approval must be obtained from the Owner to use any area for staging that is not specifically identified as such on the plans. The Contractor shall restore all areas used for staging, the extent of said restoration to be defined by the Owner upon granting approval for the use of said area for staging.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section 31 22 13 "Site Grading."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.
B. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.
C. Locate and clearly flag trees and vegetation to remain or to be relocated
D. Control dust and noise, perform work in accordance with requirement of authorities having jurisdiction. No explosives are permitted. No on-site burning is permitted.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL
A. Provide temporary erosion and sedimentation control measures per Section 31 25 00 “Erosion and Sedimentation Controls”.
B. Provide measures according to a sediment and erosion control plan, specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal

3.3 UTILITIES
A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
B. Known utilities are shown on drawings. If utility discovered that is not shown contact Owner for direction. Do not interrupt unknown utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than (2) two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner’s written permission.

3.4 CLEARING
A. Construction - That portion of the site required for constructing the work under these specifications shall be cleared of all vegetation, such as trees, brush, grass and weeds and all other objectionable matter to the limits as depicted in the plans. Stumps and roots shall be completely removed.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 STRIPPING

A. Topsoil stripping:
   1. Remove sod and grass before stripping topsoil.
   2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. A minimum of six (6) inches of soil shall be stripped.
      a. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
   3. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
      a. Limit height of topsoil stockpiles to 72 inches.
      b. Do not stockpile topsoil within tree protection zones.
      c. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.
   4. Strip man-made fills under structures and pavements to minimum 12” below the ground surface and dispose of all waste materials.

B. At all times during clearing and stripping operations the area shall be kept in a manner to prevent ponding. Refer to Section 31 25 00 "Erosion and Sedimentation Control."

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

A. Disposal of cleared materials - Subject to approval of the Owner, material from clearing operations shall be disposed of by removal from the worksite.
   1. Disposal of Material by Removal
      a. Material disposed of by removal from the construction area shall be removed from the areas prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.
      b. Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements.
with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the Contractor.

c. In hauling any material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site or area streets and roads. The Contractor shall promptly remove any debris which falls from vehicles.

d. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.8 STOCKPILING

A. All topsoil from the stripping operations shall be stockpiled in the areas so designated on the drawings. Materials shall be deposited and spread in such a manner to ensure proper drainage and prevent severe erosion of the stockpile.

B. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

END OF SECTION
SECTION 31 22 13 - SITE GRADING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the earthwork generally consisting of excavation, filling, backfilling and subgrade preparation as required for construction of site retaining walls/structures, slab on grade walks, pavement surfaces, landscaped areas and the general shaping of the site as shown, described or reasonably inferred on the drawings.

B. Subsurface data is available from the Engineer. Contractor is urged to carefully analyze the site conditions. A topographic and subsurface survey was performed by Kuo and Associates dated 08/16/2017, Project No. 17062.

C. Construction Means, Methods, Techniques, Sequences and Procedures:
   1. The Contractor is solely responsible for, and has sole control over, construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work.
   2. Shoring that is required to complete the Work, is considered a method or technique and is the sole responsibility of the Contractor. If a regulatory agency requires a licensed engineer to design, approve or provide drawings for shoring, then it is the sole responsibility of the Contractor to engage the services of a qualified Engineer for shoring design services.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 11 00 Clearing and Grubbing
B. Section 31 23 33 Trenching, Backfilling and Compaction
C. Section 31 25 00 Erosion and Sedimentation Control
D. Section 32 13 13 Concrete Paving
E. Contractor shall comply with all current, applicable codes and regulations, including the Uniform Building Code
F. Contractor shall comply as applicable with Standard Specifications for Public Works Construction, Current Edition, including all City and County Amendments (herein after referred to as "Standard Specifications").

1.3 PERMITS

A. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense unless otherwise specified in the Contract, Supplementary or General Conditions, all construction permits necessary to complete the site grading according to the plans and specifications.
1.4 APPLICABLE PUBLICATIONS

A. The following specifications of the latest issue listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent required by the references thereto.

   a. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort.
   b. D 1556 Density & Unit Weight of Soil in Place by the Sand-Cone Method.
   c. D 4253 Maximum Index Density & Unit Weight of Soils using a Vibratory Table.
   d. D 4254 Minimum Index Density & Unit Weight of Soils in Calculation of Relative Density.
   e. D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depths)

1.5 PROTECTION OF EXISTING UTILITIES AND ADJACENT WORK

A. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. Contractor shall contact the local utility coordinating committee or the utility company involved to locate all public and private utility company lines.

B. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.

C. For private property utilities found, if it is ascertained by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed. All work to cap and remove abandoned public utilities found, must be coordinated through the governing utility company.

D. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and damage is caused to said utilities, Contractor shall repair, at his own expense, such damage to the satisfaction of the Owner and the Utility Company.

E. Refer to Specification section 31 11 00 for other site related items requiring protection.

1.6 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner’s Rep. Unauthorized excavation, as well as remedial work directed by the Owner’s Rep shall be at the Contractor's expense.
F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

G. Unforeseen Excavation: Excavation of material, regardless of its character or nature, below the subgrade elevation required to construct the work as indicated on the drawings or specified herein.

H. Geotechnical Engineer: Person or company contracted by the owner to provide testing and onsite Geotechnical services during the construction schedule.

1.7 QUALITY ASSURANCE

A. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."

B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

D. Testing:

1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Engineer, and Contractor.

2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.

3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

4. All tests shall be performed by the Soil Engineer in accordance with ASTM D 1557, D1556, D2922, D3017, or other test method selected by Geotechnical Engineer.

1.8 PROJECT/SITE CONDITIONS

A. The site consists of an existing concrete pavement parking lot and detention pond. The south end of the parking lot is being expanded to include more spaces for parking. The existing lot is to remain untouched except where a new covered walkway is being installed.
1.9 SUBMITTALS

A. Samples: Submit samples of all materials used for Engineer's approval wherever specified or as directed by the Engineer.

B. Shoring and Slope Protection Design:

1. Prior to beginning any excavation, submit certification to the Engineer that the proposed shoring and slope protection system has been accepted and approved by all governing jurisdictions. Certification shall be signed and sealed by the engineer of record for the shoring design.

2. Provide signed letter from the Geotechnical Engineer stating that the proposed design complies with the recommendations of geotechnical reports.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill materials and sources must be approved by the Owner. The Contractor is responsible for providing adequate samples and testing results to the Owner for testing and approval.

B. Select fill per 2.2 below, shall be used beneath all site retaining walls and site structures where fill material is required to achieve the grades and elevations on the plans.

C. General fill per 2.3 below, material shall be used for fill in landscaping areas not supporting structures. Topsoil per 2.4 below, shall be spread over landscape areas as needed.

D. Fill material beneath paving can be per 2.2 and 2.3 below. Regardless of the fill material used, subgrade treatment shall be chemically stabilized for the thickness specified and detailed in the drawings.

E. Material excavated onsite may be used as fills, with prior Geotechnical Engineer approval.

1. Site Materials:
   a. Onsite fill materials shall be free of organic or deleterious products.
   b. Moisture content of existing soils may require adjustment for compaction approval.

2.2 SELECT FILL

The select fill shall consist of sandy clay, lime stabilized clays or clean sand, uniformly graded and free of objectionable material.

A. Sandy Clay Fill: Sandy clay fill shall have a plasticity index between 10 and 20. The fill materials shall be placed in loose lifts not exceeding eight inches in height and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as defined by ASTM D 698.

B. Lime Stabilized Clay Fill: Lime clays may be stabilized in place or mixed with lime at another location on the site and placed and compacted. Lime stabilization shall be performed in accordance with Section 02240 "Lime Stabilization". The percent of lime to be used shall be determined by the testing laboratory at the source prior to acceptance of the material for fill. The
material shall be placed in loose lifts not exceeding eight inches in thickness and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as determined by ASTM D 698.

C. Clean Sand Fill: Clean sand fill is defined as having less than 12 percent passing the No. 200 sieve and less than 12 percent retained on the No. 10 sieve and having a plasticity index below 10. Clean sand fill should be placed in loose lifts 12 inches thick and compacted using vibratory equipment to at least 80 percent relative density as determined by ASTM D 4253 and ASTM D 4254 or other equivalent test method. Where determined necessary by the Owner’s testing laboratory or soils engineer, cement stabilization will be required.

2.3 GENERAL FILL

A. General fill material shall be used for fill in landscaping areas not supporting structures, but may be used beneath pavement where approved by the Engineer. General fill material may be any native soil free of debris, trash, rocks over 2 inches in diameter and other objectionable material. General fill shall be placed and compacted in lifts not exceeding 12" in thickness to 95 percent standard density as defined by ASTM D 698. Where called for by the plans or by the landscape specifications, the fill shall be kept sufficiently low to accommodate the proper depth of topsoil and related sod or other vegetation.

2.4 TOPSOIL

A. Topsoil material shall be native earthen material suitable for growth of vegetation such as silty and sandy loams. The site stripplings may be used as topsoil unless otherwise dictated by the Owner. Topsoil shall be spread over landscape areas to a depth of 4 to 6 inches and compacted to 85 percent of standard density ASTM D 698. Stockpiling of Topsoil may not exceed 6 feet in height.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection:

1. Prior to performing the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where work may properly commence.

2. Verify that work may proceed in complete accordance with the design.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

C. General

1. Use all means necessary to control dust on or near the site resulting from the performance of the Work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site. Moisture level during compaction operations shall not exceed that amount as specified by Geotechnical Engineer.
2. Verify existing grades and dimensions before starting any grading operations. If any discrepancy exists, notify Engineer immediately.

3. Use all means necessary to protect all existing features, products, or items designated to remain, as well as all work of this Section. In the event of damage, repair or replace immediately to the approval of and at no additional cost to the Owner.

4. Protect and maintain existing benchmarks throughout the course of the work. Reestablish monuments or stakes disturbed or destroyed during the course of the Work at no additional expense to the Owner.

5. Conduct work so as to avoid injury to persons and damage to adjacent property. Provide appropriate shoring, bracing and barriers, including light when necessary.

6. Coordinate operations with, and provide access to, the Geotechnical Engineer or designated representative during demolition and construction for purposes of testing, investigation and inspection.

D. Preparation

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

2. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3. Protect subgrade from excessive drying or excessive moisture.

3.2 EXCAVATION

A. General - Contractor shall complete all excavation required regardless of the variations in hardness, type, or density of materials encountered, to the dimensions and elevations shown on the drawings. When unsatisfactory material is uncovered, that material shall be removed and replaced with select fill, the extent of such excavation to be directed by the Owner. Unsatisfactory material shall be removed to the stockpile area or from the site as directed by the Owner.

1. Unclassified Excavation: Excavation is unclassified and includes excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
   a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   b. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor’s expense.

2. Borrow Material: If excavated materials of a suitable nature are not of sufficient quantity to complete the work, contractor may provide borrow material in sufficient quantity to complete the work at Owner’s approval at no additional cost to the Owner.
3. Disposing of Excavated Material: Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in accordance with the provisions of this Section.

B. Excavation for Pavement

1. The material exposed after excavation shall be scarified to a depth of six (6) inches and compacted to at least 95 percent of Standard (ASTM D 698) Maximum Density within 3% percent of optimum moisture content of the soil. To achieve the required compaction, stabilization methods as outlined in paragraph 3.C.4 of this specification shall be used.

2. Excavation required beneath pavement sections shall comply with elevations and dimensions shown on the plans and detailed sections within a tolerance of plus or minus 0.10 foot. Contractor shall take care not to disturb areas that are designated to be protected or are outside the construction limits. Excavated areas shall be kept free of ground and surface water.

C. Cut Slopes and Ditches

1. Slopes and grades of ditches shall conform to the plans within a tolerance of plus or minus 0.10 foot. No exposed slopes shall be steeper than three feet horizontal to one foot vertical. Where slope protection is specified or called out on the plans, said protection shall be placed as soon as practical, after exposing the slope. Erosion and sedimentation controls shall be implemented in all cut areas as specified in Section 31 25 00, Erosion and Sedimentation Control.

3.3 FILL AND BACKFILL

A. Placement

1. Fill material shall be placed in loose lifts not exceeding eight (8) inches for areas beneath site structures and pavement, and twelve (12) inches for landscape areas not supporting structures. Fill areas shall be compacted to 95 percent of Standard Maximum Density at the proper moisture of that soil as defined by ASTM D 698.

2. Each lift shall be thoroughly compacted and shall have obtained satisfactory density prior to proceeding with the next lift.

3. The top six (6) inches of material beneath vehicular pavement shall be lime stabilized after placement as shown in the details. Material shall be free of trash and rocks over three (3) inches in diameter.

4. Fill shall be brought up to the proper elevations as determined from the lines, grades, sections and elevations shown on the plans.

5. Construction methods for embankments shall follow Harris County Standard Engineering Design Specifications for Construction and Maintenance of Roads and Bridges Item No. 132 EMBANKMENT.

B. Compaction and Finishing
1. Suitable compaction equipment commonly used to meet the requirements for this type of compaction work should be used.

2. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The surface grade shall be consistent with the drainage intent shown on the plans such that no unwanted ponding shall occur.

3. Surface shall not be more than 0.10 feet above or below the established grade, and all ground surfaces shall vary uniformly between indicated grades.

4. Cut material from the site may be used for fill material if approved by Owner. Where cut material is used as fill, each lift of such material shall be properly mixed to obtain a uniform material, with clay being the predominant material when mixed with silt, maintaining a plasticity index less than 20.
   a. Lime stabilization shall be used for clay material and shall conform to Section 31 32 13.19 - Lime Stabilization.

3.4 EROSION AND PROTECTION

A. There shall be at all times adequate protection to newly graded areas to prevent soil erosion as provided in Section 31 25 00, Erosion and Sedimentation Control.

B. Soil erosion that occurs prior to acceptance of the work shall be repaired at no expense to the Owner.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Owner’s Testing and Inspection Service; reshape and re-compact.

E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.5 GRADING

A. Rough Grading
   1. Cut and fill shall be left sufficiently high to require cutting by fine grading.
   2. Grade to subgrade depths required for controlled internal drainage of site.
3. Grade to subgrade depths required for construction of finished surface materials. Grades shown on the plans are top of surface elevations regardless of surface material (ie pavement, sidewalks, softscape, landscape, mulch, sod, etc.).

B. Fine Grading
   1. Fine grading shall conform to elevations required to insure finished elevations as indicated on the drawings for the finished surface materials required by the project for that area.
   2. Provide a smooth transition between adjacent existing grades and new grades

C. Maximum cross slope for all walkways shall be 2% for disabled access. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 0.1 foot (1.2 inches)
   2. Walks: Plus or minus ½ inch
   3. Pavements: Plus or minus ½ inch

3.6 TESTING AND INSPECTION

A. Testing of Materials and Installed Work
   1. Materials and installed work require testing to show that the specifications for the materials and work have been met. The Owner may, at the Owner’s expense, take random tests on materials and installed work. The Contractor shall allow free access to material stockpiles and facilities at all times. In fill areas each lift must be tested and approved before proceeding on the next lift. Tests, not specifically indicated to be done at Owner's expense including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.
      a. Testing to be provided by Owner
      b. Testing to be provided by Contractor
         1) All retesting for areas failing the first test.

B. Contractor shall notify Owner's testing laboratory 24 hours in advance of beginning any earth work operations and coordinate testing schedules to meet these specifications.

C. Maximum density tests per ASTM D 698 shall be taken on all fill materials at a rate of one test for each type of soil to be used and at least one test for every 1,000 cubic yards of fill.

D. Field density tests per ASTM D 1556 or ASTM D 2922 shall be taken on all fill material at a rate of one test for every 10,000 square feet and at least one test per lift.

E. All imported fill material shall be approved prior to importing.

3.7 DUST ABATEMENT

A. The Contractor shall comply with applicable Federal, State, and local laws and regulations concerning the prevention and control of dust pollution.
B. During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the Owner or elsewhere, the Contractor shall furnish all the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from the contractor’s operations from damaging crops, orchards, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from the contractor’s operations under these specifications.

C. Dust Control shall be accomplished by one of the following methods:

1. Whenever ordered by the Owner, the Contractor shall furnish and distribute over the traveled road surfaces, which have not yet been fully restored, an application of Calcium Chloride. The material used shall be Regular Flake Calcium Chloride having a minimum chemical content of Calcium Chloride of 77%. Unless otherwise specified or ordered by the Owner, rate of application shall be three (3) pounds per square yard of surface covered.

2. Whenever ordered by the Owner, the Contractor shall apply on traveled road surfaces "Bituminous Surface Treatment" in accordance with the current Texas Standard Specifications for Construction of Highways, Streets and Bridges.

D. The cost of sprinkling or of other methods of reducing formation of dust shall be included in the prices bid in the schedule for other items of work.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Stockpile Topsoil may not exceed 6 feet in height.

3. Stockpiles shall not be located within the floodway. Stockpiles on property within the floodplain shall be at the contractor’s risk and only temporary.

3.9 FIELD QUALITY CONTROL

A. General: Testing shall be the responsibility of the Owner and costs of initial testing shall be paid by Owner. Cost of all subsequent testing necessary due to non-compliance with specifications shall be paid by Contractor.

B. Density Test:

1. Density tests shall be performed by an approved commercial testing laboratory approved per ASTM D 1557.

2. Tests shall be performed in accordance with the referenced Standards.
3. Field and laboratory tests for moisture-density relations shall be determined in accordance with ASTM D 1557. The frequency and location of field density tests will be determined by the Geotechnical Engineer.

4. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

3.10 DRAINAGE CONTROLS

A. Provide all necessary temporary apparatus, pumps, curbs or ditches as required to divert or convey water from any source away from the Work. Do not allow water from any source to accumulate within or damage earthwork.

END OF SECTION
SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction activities shall be protected from erosion.

B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollutant Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 11 00 Clearing and Grubbing

B. Section 31 22 13 Site Grading

C. Texas Department of Transportation’s Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2014)

D. Harris County Public Infrastructure Department Engineering Division Specifications for the Construction of Roads and Bridges within Harris County, TX – latest printing October 2003.

1.3 PERMITS (NOT USED)

1.4 APPLICABLE PUBLICATIONS (NOT USED)

1.5 PROTECTION OF ADJACENT WORK (NOT USED)

1.6 DEFINITIONS

A. Best Management Practices (BMP's) means physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

B. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, Saint Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with these specifications.

C. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such areas as are designated on the plans and in accordance with these specifications.
D. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

E. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.

F. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Install and maintain erosion control systems in compliance with all authorities having jurisdiction.

1.8 PROJECT/SITE CONDITIONS (NOT USED)

1.9 SUBMITTALS (NOT USED)

PART 2 - PRODUCTS

2.1 SUSTAINABLE MATERIALS

A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.2 GRASS

A. Materials for erosion control seeding shall conform to TxDOT Item 164.

B. Materials for erosion control sodding shall conform to TxDOT Item 162.

2.3 FERTILIZER

A. Materials for fertilizing erosion control seeding and/or sodding shall conform to TxDOT Item 166.2

2.4 WATER

A. Use clean potable water for maintaining the grass developed after erosion control seeding and/or sodding. Water shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and appurtenance must be clearly marked with the words “non-potable” water.

2.5 SILT FENCE

A. Geotextile fabric for Silt Fences must meet the TxDOT Departmental Material Specifications DMS 6230 Temporary Sediment Control Fence Fabric.

2.6 INLET PROTECTION BARRIERS

A. Geotextile per 2.5 Silt Fence above.

B. Hardwood Posts shall be 2x2 minimum length 4 feet.

C. Net reinforced fence shall be 2 inch by 4 inch welded wire fabric mesh. The mesh support height shall be the equivalent height, or greater, of the geotextile fabric to be attached.

2.7 STABILIZED CONSTRUCTION ACCESS

A. Materials to be per TxDOT spec section 506.2.E.1 for Type 1

PART 3 - EXECUTION

3.1 GENERAL

A. Protection

1. Protect benchmarks, monuments, existing structures, existing fences, existing roads, existing sidewalks, existing paving, existing curbs, and other features indicated on Drawings to remain, or not indicated to be removed, from damage and displacement. If damaged or displaced, notify Engineer and correct defects as directed.

2. Protect above and below grade utilities which are to remain.

B. Preparation:

1. Use all means necessary to control dust on and near the work, and on and near off-site storage, and spoil areas, if such dust is caused by performance of the work of this Section, or if resulting from the condition in which Project Site is left by Contractor.

2. Moisten surfaces, as required, to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on Project Site.

C. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations

D. Minimize the time areas are to be exposed without vegetative cover.

E. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.
F. Store construction materials in designated areas away from drainageways and low areas.

G. Provide portable toilets and properly dispose of sanitary sewage.

H. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.2 INSTALLATION OF EROSION CONTROL DEVICES

A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract.

1. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 Clearing and Grubbing.

1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints.
   a. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.

2. Drive support post into ground not less than 18 inches.

3. Excavate a 4 inch wide by 4 inch deep trench on up-slope side of silt fence.
   a. Line trench with silt fence fabric material.
   b. Backfill trench with soil or gravel.

C. Install inlet protection barriers at curb inlets and at area inlets.

D. Install Stabilized Construction Access per TxDOT specification 506.4.C.5.

3.3 EROSION CONTROL SEEDING

A. Exposed fill and stockpile areas shall be protected from windborne erosion if the phasing of the construction operations is anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. At completion of stockpiling operations, stockpiles shall be shaped and graded to drain. Provide a layer of mulch to all sides of the stockpile to protect the stockpile from windborne erosion.

B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.

C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.4 TEMPORARY SWALES

A. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.
B. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.

C. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.

D. Swales shall have erosion control barriers as required in these specifications.

3.5 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's Geotechnical engineer.

B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulch, seeding, sodding, or other method as approved.

D. Where cut slopes of more than 5 feet deep, extend more than 100 feet in length, contractor shall provide a backfill drain at the top of the slope to ease in drainage and erosion control.

3.6 MAINTENANCE

A. Check all erosion control measures after each rainfall event to ensure that they are in proper working order.

1. Immediately restore all measures to installed condition.

2. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, all temporary swales must be reworked to meet final conditions as set forth in the drawings and specifications.

3. The Contractor shall assure that all sub work with other contractors at the site understand the importance of the erosion control features. The Contractor shall require all subcontractors to respect the function of the erosion control features and enlist their coordination in maintaining existing swales and ditches.

B. Inspect silt and straw bale fences at least once a week.

1. Immediately replace damaged portions of the silt fences, including portions which have collapsed, contain tears, have decomposed, or have become ineffective.

2. Remove sediment deposits, as necessary, to provide adequate sediment storage and to maintain the integrity of fences. Dispose of accumulated sediment by spreading over upland areas of the site.

C. Maintain erosion control devices in place, as specified, until completion of the work of this Contract.
1. At completion of work, inspect all systems, make necessary repairs, remove and dispose of all accumulated sediment, and turn completely operable systems over to Owner for continued maintenance.

D. Where necessary for equipment and vehicular access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.

3.7 INSPECTIONS

A. Inspect all erosion control systems and devices at least once every seven calendar days.

B. Inspect all erosion control systems and devices within 24 hours of the end of any storm which results in precipitation of 1/2 inch or more.

C. During inspections, locations where stormwater leaves the site shall be inspected for evidence of erosion or sediment deposition.

D. Correct deficiencies within three calendar days.

E. Complete a report of each inspection. Report shall contain the following minimum information:

1. Inspector's name
2. Inspection date
3. Observations of the effectiveness of erosion control systems
4. Actions taken if necessary to correct deficiencies
5. Listing of areas where construction operations have permanently or temporarily stopped
6. Authorized signature

END OF SECTION
SECTION 31 32 13.19 - LIME STABILIZATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for treating and stabilizing existing subgrade material or select fill material under pavements or site structures as shown on the drawings, by pulverizing, adding lime, and finishing to the lines and grades shown on the drawings and constructed as specified herein.

1.2 APPLICABLE PUBLICATION

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:

A. Texas Department of Transportation 2014 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT):
   1. Item 260 - Lime Treatment (Road Mixed).
   2. Item 263 – Lime Treatment (Plant Mixes)

B. Texas Department of Transportation Departmental Material Specifications (DMS) latest edition.
   1. DMS 6350 – Lime and Lime Slurry

C. American Society for Testing and Materials Standards (ASTM):
   1. D 698-07e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Efforts (12,400 ft-lbf/ft³ (600 kN-m/m³))
   2. D 1556-07 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 11 00 – Clearing and Grubbing

B. Section 31 22 13 – Site Grading

C. Section 32 13 13 – Concrete Pavement

1.4 DEFINITIONS

A. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.

C. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
D. Geotechnical Engineer: Person or company contracted by the owner to provide testing and onsite Geotechnical services during the construction schedule.

1.5 SUBMITTALS
A. None required for this section.

1.6 PROJECT CONDITIONS
A. The site consists of an existing concrete pavement parking lot and detention pond. The south end of the parking lot is being expanded to include more spaces for parking. The existing lot is to remain untouched except where a new covered walkway is being installed.

1.7 QUALITY ASSURANCE
A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

C. Testing:
1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Engineer, and Contractor.

2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.

3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

4. All tests shall be performed by the Geotechnical Engineer in accordance with ASTM D 698, D1556, or other test method selected by Geotechnical Engineer.

PART 2 - PRODUCTS

2.1 LIME SLURRY
A. Lime slurry for use in treating the subgrade shall conform to the chemical and physical requirements listed in Tables 1 and 2 of TxDOT Departmental Material Specification (DMS) 6350 for Commercial Lime Slurry. Lime Slurry may be prepared at the job site or other Owner...
approved location by using Hydrated Lime or Quicklime as specified by chemical and physical requirements in Tables 1 and 2 of TxDOT Departmental Material Specifications (DMS) 6350.

2.2 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and appurtenance must be clearly marked with the words “non-potable” water.

2.3 SOIL

A. Soil should be a clayey type soil, free of organic material, large rocks and other unsuitable materials with a plasticity index greater than 15 and a liquid limit in excess of 30. The soil should not contain more than twenty percent sands or silts.

PART 3 - EXECUTION

3.1 GENERAL

A. Construction methods shall conform to the applicable specifications of the TxDOT specifications, Item 260, Lime Treatment.

B. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

3.2 APPLICATION

A. The percent of lime to the dry weight of the soil shall be eight (8) percent.

B. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.

C. The distribution of lime shall be uniformly placed in such quantity that all soil to be treated receives the minimum percentage of lime and successive passes made until the proper moisture and lime content is obtained.

D. The distributor truck shall be equipped with an agitator which will keep the lime and water in uniform mixture unless the prescribed consistency can be otherwise maintained. If an agitator is not used, a standby pump shall be available at the site for agitating the lime and water in case of delays in dispersing the slurry.

3.3 MIXING

A. The material and lime shall be thoroughly mixed by approved road mixers until a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps.
B. Immediately after the "first mixing" operation, the mixture shall be brought to the proper moisture content and sealed with a light pneumatic rubber tire roller and left to cure for 1 to 4 days, as directed by the Owner. If rework is required to obtain compaction after 72 hours of the last mixing, add 25% of the specified rate of lime.

C. After curing time the material shall be uniformly mixed. All clods shall be reduced in size by raking, blading, disk, harrowing, scarifying or other approved method.

3.4 COMPACTION

A. Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing.

B. The moisture content at time of compaction shall be at optimum to 4 percent above optimum.

C. The mixture when used as pavement subgrade shall be compacted by sheepsfoot rollers or 25 ton pneumatic self-propelled rollers until a minimum density of 95 percent of Standard Maximum Density (ASTM D-698-07e1) is obtained.

D. The mixture when used for support of a building slab or foundation shall be compacted, each lift at the optimum moisture content (±2%) to 95% maximum density or 85% relative density. (ASTM D-1557)

3.5 FINISHED SUBGRADE GRADING

A. Surface of the subgrade shall not show any deviation in excess of 1/4 inch above or one inch below established subgrade elevation.

B. The surface shall be uniform and smooth without large clumps or voids.

END OF SECTION
SECTION 32 13 13 - CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for forming and placing reinforced concrete curbs, pavement and sidewalks to the lines and grades shown on the drawings and constructed as specified herein.

1.2 APPLICABLE PUBLICATIONS

The following specifications and standards of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

A. Texas Department of Transportation 2014 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (TxDOT).
   1. Item 360 - Concrete Pavement
   2. Item 421 – Hydraulic Cement Concrete

B. American Society for Testing and Materials Standards (ASTM):
   1. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
   2. A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   4. A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   6. C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
   8. A 185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
   10. D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Typed)


1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 22 13 Site Grading

B. Section 31 32 13.19 Lime Stabilization

C. Section 32 17 23.13 Painted Pavement Markings

1.4 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.5 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Material Test Reports: From a qualified testing laboratory indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.

2. Steel reinforcement and reinforcement accessories.

3. Admixtures.

4. Curing compounds.

5. Applied finish materials.

6. Bonding agent or epoxy adhesive.

7. Joint fillers.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
B. Concrete Testing Service: Engage a qualified independent testing laboratory to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Cement, aggregates, admixtures, and water shall conform to the specifications of TXDOT, Item 421. Preparation of concrete mix shall be in accordance with article 360.4 of TxDOT, Item 360.

B. Maximum size of aggregate 1-1/2 inches. Maximum size aggregate on concrete curbs to be 3/8 inch.

C. Slump shall range from 2 to 5 inches.

D. Air entrainment concrete mixture shall have an air content by volume of 4.5 percent plus or minus 1.5%.

E. Concrete shall be mixed in accordance with TxDOT, Item 421.

F. Ready mixed concrete conforming to ASTM C 94 may be used.

G. The concrete mix shall be designed by a commercial testing laboratory, and submitted for approval. The concrete design must produce a compressive strength of 3,500 psi min at 7 days and 4,000 psi min at 28 days for vehicular pavements. For pavements supporting pedestrian sidewalks only, the compressive strength shall be 3,000 psi min.

2.2 REINFORCEMENT

A. Reinforcing steel shall meet the specifications of ASTM A615, Grade 60. Bars shall be deformed billet steel free of defects.

2.3 BOARD FILLER

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

B. Board filler shall be free of defects which will impair their usefulness as expansion joint fillers.

2.4 PREFORMED BITUMINOUS EXPANSION BOARD

A. Preformed bituminous expansion boards shall meet the specifications for ASTM D 994 and D 1751.
2.5 JOINT SEALING MATERIAL
   A. Curb and Pavement joint sealing material shall meet the requirements and specifications of TxDOT Items 360.2F and 360.4D.
   B. Sidewalk joint sealing materials shall be NR-201Self Leveling, Traffic Grade and Traffic Loop Sealant as manufactured by Pecora or approved equal.

2.6 DEFORMED CONTRACTION JOINT METAL STRIPS
   A. Deformed contraction joint metal strips shall be 28 ga. steel, galvanized 1.25 oz. per square foot or heavier and meet the specifications of ASTM A 653.

2.7 CURING COMPOUND
   A. Curing compound shall conform to the specifications of ASTM C 309, Type 1 or Type 2, white pigmented.

2.8 LOAD TRANSMISSION DEVICES FOR EXPANSION AND CONTRACTION JOINTS
   A. Load Transmission devices shall be as detailed on plans and conform to the properties specified in ASTM A615, Grade 60 steel.

2.9 STEEL DOWEL BARS
   A. Steel dowel bars and steel reinforcement shall be deformed or smooth bars conform in properties to ASTM A 615 Grade 40. Unless otherwise shown on the plans all reinforcing steel shall be deformed bars, all dowel bars at joints shall be smooth bars, and all curb dowels shall be deformed bars.
   B. Greenstreak two component speed dowel system can be used at construction joints pending engineer approval. Product submittal required for approval.
   C. Greenstreak two component speed load system can be used at expansion joints pending engineer approval. Product submittal required for approval.

PART 3 - EXECUTION

3.1 GENERAL
   A. The curb and sidewalk pavement shall be constructed to the lines and grades shown on the drawings.

3.2 PAVEMENT
   A. Preparation of Subgrade
      1. The subgrade shall be a previously prepared subgrade, stabilized if required, compacted to a minimum of 95% standard density ASTM D-698, and graded to the required section and grades shown on the drawings and as specified.
2. Rolling and sprinkling shall be performed to maintain the specified moisture content of the subgrade as necessary prior to placing the concrete curbs.

3. Refer to Section 32 22 13 Site Grading for applicable specifications for materials and placement.

B. Placing and Removing Forms

1. Forms shall be of wood or metal, properly treated to insure concrete does not adhere to the forms, straight, clean, free from warp or defect, and of sufficient depth.

2. The forms shall be so placed that when placed each form section will be firmly in contact for its whole length and base width and exactly at the established grade.

3. Any subgrade under the forms below established grade shall be corrected using suitable material, placed, sprinkled, and rolled.

4. Forms shall be securely staked and tightly jointed and keyed to prevent displacement.

5. Sufficient stability of forms to support equipment operated thereon and to withstand its vibration without springing shall be required.

6. Forms shall remain in place not less than 24 hours after concrete is placed.

C. Joints in Concrete Pavement

1. Shall be constructed in the pavement slab at locations and according to details as shown on the drawings. Stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and horizontal position.

2. When prefabricated plastic strips are used to form joints, they shall be placed after the concrete surface has been leveled and before the finishing is completed. The strips shall be of a type specifically manufactured for the purpose of forming joints in concrete pavement and to the dimensions as required to form the specified joints. The strips shall be removed after the concrete has set per the manufacturer's recommendations. Any blemishes caused by the removal of the strips shall be repaired immediately using approved methods.

D. Tie Bars and Load Transmission Devices shall be accurately placed and held securely (parallel to pavement surface and perpendicular to joint) during placing and finishing of pavement.

E. Expansion Joints shall be constructed with board filler and sealed at top. Board filler must be perpendicular to plane of concrete slab. Alignment of joint shall not vary more than 1/4 inch in 10 feet.

F. Reinforcing Steel shall be accurately placed as shown on drawings and secured in place. Each bar intersection shall be tied. All bars shall be supported on steel or plastic bar chairs. Laps shall be spaced per the details contained in the plans and tied. Wire fabric may not be used in vehicular pavement.

G. Concrete Placing andFinishing
1. Concrete not placed as herein prescribed within 90 minutes after mixing shall be rejected.

2. Concrete shall not be placed when temperature is below 40 degrees F and falling, but may be placed when the temperature is above 35 degrees F and rising, the temperature being taken in the shade and away from artificial heat.

3. Concrete shall not be placed before the time of sunrise, and shall not be placed later than will permit the finishing of the pavement during sufficient natural light.

4. Concrete shall be consolidated by a mechanical vibrator to remove all voids. Special care shall be exercised in placing and spading concrete against forms and at all joints to prevent the forming of honeycombs and voids and to prevent displacement of steel reinforcement and load transmission devices.

5. The concrete shall be struck off with an approved strike-off screed to such elevation that when consolidated and finished, the surface of pavement shall conform to the required section and grade. In no case shall the maximum ordinate from a 10 foot straight edge to the pavement be greater than 1/8 inch.

6. The strike template shall be moved forward with a combined transverse and longitudinal motion in the direction the work is progressing, maintaining the template in contact with the forms, and maintaining a slight excess of material in front of the cutting edge.

7. After completion of a strike-off, consolidation and transverse screeding, a hand-operated longitudinal float shall be operated to test and level the surface to the required grade.

8. Workmen shall operate the float from approved bridges riding on the forms and spanning the pavement. The longitudinal float shall be held in contact with the surface and parallel to the center line, and operated with short longitudinal strokes while being passed from one side of the pavement to the other. If contact with the pavement is not made at all points, additional concrete shall be placed if required, and screeded, and the float shall be used to produce a satisfactory surface. After a section has been smoothed so that the float maintains contact with the surface at all points in being passed from one side to the other, the bridges may be moved forward half the length of the float, and the operations repeated.

9. After completion of the straightedge testing, a pass with a burlap drag shall be made as soon as construction operations permit and before the water sheen has disappeared from the surface. This shall be followed by as many passes of the drag as required to produce the desired surface texture.

10. After completion of dragging and about the time the concrete becomes hard, the edge of the slab and joints shall be left smooth and true to line.

H. Curing

1. Concrete pavement shall be cured by protecting it against excessive loss of moisture for a period of not less than 72 hours from the beginning of curing operation.

2. Immediately after finishing operations have been completed, the entire surface of the newly laid concrete shall be covered and cured in accordance with the requirements of "Membrane Curing", TxDOT Item 360.41.
3. Special care should be exercised to keep spraying curing compound out of pavement joints.

3.3 CURBS

A. Dowelled on Curb

1. After curing the concrete pavement, dowelled on curbs, using secure forms shall be constructed to the size shown on the plans.

2. Dowels may be placed in the pavement slab before the concrete has set, or placed in drilled holes using epoxy adhesive to secure the bars in place.

3. Pavement joints shall extend through the curbs. Expansion joint material shall be the same thickness, type and quality as specified for the pavement.

4. When sawed joints are provided, the placement of curb shall be delayed until all transverse joints are sawed.

5. Weakened plane joints shall be formed by inserting an asphaltic board strip cut to conform to the shape of the curb.

6. All joints should be tool finished after sufficient curing of the concrete.

7. The concrete, reinforcement and curing of the curbs shall conform to the requirements specified for the concrete pavement.

8. In finishing the curbs, a thin coating of mortar shall be worked into the exposed face of the curb in order to obtain a brush finish free of all blemishes and form or tool marks.

9. Curbs shall have a straightness tolerance of 1/8 inch in 10 feet, measured longitudinally along the back and face of the curb.

10. The top of the curb shall not vary vertically in height more than 1/8" when measured up from the concrete pavement.

3.4 SIDEWALKS

A. Preparation of Subgrade

1. The subgrade shall be six (6) inches of compacted subgrade, compacted to at least 95% dry standard proctor ASTM D 698, placed in accordance with the elevations and section shown on the drawings.

B. Forms

1. Forms shall be of wood or metal, straight, free from warp, and of sufficient depth to finish the work to the plan required thickness.

2. Forms shall be securely staked to line and grade and maintained in a true position during the depositing of the concrete.

3. Forms shall be properly treated to insure that the concrete does not adhere to the forms.
C. Reinforcing Steel
   1. Reinforcing steel, shall be #3 reinforcing steel bars as per ASTM A615/A615M, Grade 60: deformed placed in position as shown on the plans.
   2. Care shall be exercised in the work and operation to keep all steel in its proper location and off the ground.
   3. Tie at all sheet overlaps and intersections. Support on steel or plastic bar chairs.
   4. Do not stand on steel to pour and finish concrete.

D. Expansion Joints
   1. Expansion joints shall be placed where shown on the plans and where two lines of sidewalks intersect, where meeting existing sidewalk or driveway, and at intervals not to exceed 30 feet.

E. Crack Control Joints
   1. Crack control joints for all sidewalks other than exposed aggregate or other special finish or as noted otherwise on the plans shall be marked off 1/4” deep, transversely at intervals equal to the width of the sidewalk and along the centerline of sidewalks eight (8) feet in width and greater.
   2. All edges shall be edged with a tool having a 1/4” radius.

F. Joint Sealant
   1. Joint sealant shall be placed in construction joints only where sidewalks meet structures and as shown on the plans.

G. Concrete Placing and Finishing
   1. Concrete shall be placed in the forms to the depth specified, thoroughly tamped and compacted, until the concrete mixture covers the entire surface.
   2. The top shall then be struck off with a wood strike off board to a smooth finish.
   3. Surface shall then be floated and finished to a gritty texture with a wood hand float working in circular motion.

H. Tolerances
   1. The surface shall be checked with a 10 foot straightedge and any irregularities of more than 1/8” in 10 feet shall be corrected.

I. Curing
   1. Curing shall conform to the above paragraph 3.2.H.
3.5 APPLICATION OF JOINT SEALING COMPOUND

A. Joints shall be thoroughly cleaned of loose scale, dirt, dust and curing compound. When necessary, existing joint material shall be removed to the depth as shown on the plans.

B. Joints shall be filled to the full depth of the joint opening. Pouring shall be done in a neat and workman like manner to give satisfactory results. Sufficient joint sealer shall be poured into the joints so that upon the completion of the work the surface of sealer within the joint shall be 1/4" above top of the pavement surface.

3.6 TESTS

A. Concrete Test Specimens

1. Test cylinders for compressive strength shall be taken and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

2. At least 3 cylinders shall be made for each day for each 100 cy of concrete or fraction thereof, placed. A testing laboratory for the tests shall be selected and paid for by the Owner.

3. Laboratory technician will prepare concrete test cylinders.

B. Testing of Concrete Surface

1. After finishing is complete and while the concrete is still workable, the surface shall be tested for trueness with an approved 10' steel straightedge.

2. The straightedge shall be operated from the side of the pavement placed parallel to the pavement center line and passed across the slab to reveal any high spots or depressions.

3. The straightedge shall be advanced along the pavement in successive stages of not more than 1/2 its length. A tolerance of 1/8" in 10' must be met.

4. Any correction of the surface required shall be accomplished by adding concrete if required and by operating the longitudinal float over the area.

5. The surface test with the straightedge shall then be repeated.

3.7 OPENING PAVEMENT TO TRAFFIC

A. The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least 7 days old or has attained a minimum average of 3,000 psi compressive strength.

B. Any damage to the pavement prior to acceptance by the Owner shall be repaired by the Contractor at no extra cost to the Owner.

C. This does not relieve the Contractor from the normal liabilities and maintenance responsibilities, implied or otherwise, for the pavement or other items.

END OF SECTION
SECTION 32 17 23.13 – PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the application of pavement marking as indicated on the drawings and as specified herein.

1.2 APPLICABLE PUBLICATIONS

A. Harris County Public Infrastructure Department Engineering Division Specifications for Roads and Bridges within Harris County, Texas, published April 1988 latest revision February 2011.

1.3 SUBMITTALS (NOT USED)

1.4 PROJECT CONDITIONS

A. The Contractor shall provide adequate public protection at all times, by erecting fences, barricades, and etc., as necessary.

B. All work shall be in accordance with the Texas Manual on Uniform Traffic Control Devices latest edition.

C. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees F (4 degrees C) for oil-based materials, 50 degrees F (10 deg C) for water-based materials, and not exceeding 95 degrees F (35 degrees C).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

PART 2 - PRODUCTS

2.1 PRODUCTS


PART 3 - EXECUTION

3.1 APPLICATION

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer and Owner.
B. Allow paving to age for 30 days before starting pavement marking.

C. The pavement surface to receive the striping shall be thoroughly cleaned of all dirt, organic growth, oil, grease, or other materials that will prevent adhesion of the paint to the roadway surface.

D. Paints shall be applied by brush, spray, or flow methods to clean and dry surfaces with surface temperature 50°F or above.

1. Paint shall have net film thickness of 0.015 inches with a uniform cross section. Minimum thickness of 0.010 inches measured in the dry condition prior to adding any glass reflective spheres.

2. Paint shall be applied no sooner than 14 days after seal coat has been applied.

3. Paint shall be applied in one (1) coat.

4. Paint shall be applied as shown on drawings.

5. Glass spheres or reflectorized granules shall be applied, before the paint sets or dries, evenly at a rate of 6 pounds of glass spheres or 1.7 pounds of reflectorized granules per gallon of paint.

END OF SECTION
SECTION 32 92 13 - HYDROMULCH SEEDING

PART 1 - GENERAL

1.1 SCOPE

A. Refer to the Drawings, Schedules and Details for type and locations of work required herein. Furnish all labor, materials, equipment and supervision for the installation of items included within these specifications. Such work includes, but is not limited to the following:

1. Furnishing and applying hydromulch seeding including all materials and equipment required for the specified method of lawn installation.

2. Site cleanup.

3. Maintenance and guarantee.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:

1. Texas Department of Transportation 2014 Standard Specifications for construction of Highways, Street and Bridges (TxDOT).
   a. Item 162 - Sodding for Erosion Control
   b. Item 164 - Seeding for Erosion Control

1.3 RELATED WORK

A. Section 31 22 13 - Site Grading.

B. Section 31 25 00 - Erosion and Sedimentation Control

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

1.5 SUBMITTALS

A. Samples:

1. The Owner reserves the right to request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of replacement of materials not meeting the specifications shall be paid by Contractor.
2. Typical requests from the owner may include copies of manufacturers’ literature, certifications, or laboratory analytical data for the following items:
   a. Fibre Mulch.
   b. Tank Mix Fertilizer.
   c. Top Dress Fertilizer.

1.6 SCHEDULE
   A. Submit a proposed work schedule to the Owner for approval at least fifteen (15) days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by the Owner.

   B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.7 PRODUCT DELIVERY, HANDLING AND STORAGE
   A. Furnish standard products in manufacturer’s standard containers bearing original labels showing quantity, analysis and name of manufacturer.

   B. Submit written requests for inspections to the Engineer at least seven (7) days prior to anticipated inspection date.

PART 2 - MATERIALS

2.1 SEED
   A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Engineer. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage by weight or pure live seed in each lot of seed shall be at least 85%. The seed shall be planted at the rate per acre indicated under pure live seed required per acre.

<table>
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<th>Season</th>
<th>Kind of Seed</th>
<th>Clay Soils Planting Rate</th>
<th>Sandy Soils Planting Rate</th>
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<td>Permanent Seeding</td>
<td>Green Sragletop</td>
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<td>0.3 lb. PLS/ac.</td>
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<td>Bermudagrass</td>
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<td>Temp Warm Season Seeding</td>
<td>Foxtail Millet</td>
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<tr>
<td>Temp Cool Season Seeding</td>
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</tr>
</tbody>
</table>

Note: % Pure Live Seed or PLS = (% Purity) X (% Germination)

   B. Weed seed shall not exceed ten (10%) of weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.
C. Source - Quality Control

1. Seed: The Contractor must follow the Federal Seed Act with respect to interstate commerce and transportation. Each lot of seed may be re-sampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Owner. The seed retests will be conducted by a testing laboratory allowed by the State of Texas Department of Agriculture Seed Control Office. Material found to be below specified content levels will be at the contractor’s responsibility to correct by removing and replanting and/or additional plantings.

2.2 FERTILIZER FOR TANK MIX

A. Shall be 13-13-13 grade, pelleted, uniform on composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warrant of the producer.

2.3 WOOD CELLULOSE FIBER MULCH

A. Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination of growth inhibiting factors. It shall be dyed a green color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that meets all of the foregoing requirements.

2.4 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words “non-potable” water.

2.5 SLURRY MIX COMPONENTS PER ACRE

A. Wood Cellulose Fiber Mulch = 2,000 pounds

B. Grass Seed = (as specified)

C. Fertilizer (13-13-13) = 800 pounds
2.6 TOP DRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:

1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Bed Preparation: Immediately after the finished grade has been approved, begin hydroteeding operation to reduce excessive weed growth.

B. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Engineer may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

C. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier’s recommendations and the equipment manufacturer’s written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

D. Application:

1. Contractor shall obtain approval of hydromulch area preparation from the Engineer prior to application.
2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
3. Keep hydromulch within areas designated and keep from contact with other plant material.
4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

5. After application, the Contractor shall not operate any equipment over the covered area.

6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.

7. Refer also to the maintenance portion of this section.

8. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall seed with required grasses or ground cover materials those areas missed by the hydromulch application. Method used to seed these missed surfaces shall be an alternate seeding operation approved by the Owner’s Representative and shall be accomplished at no additional cost to the Owner.

3.2 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations. Clean up and removal all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Engineer.

3.3 INSPECTIONS

A. Make written request for inspection prior to seeding and after areas have been seeded.

B. Submit requests for inspections to Engineer at least two (2) days prior to the anticipated inspection date.

3.4 MAINTENANCE BY THE CONTRACTOR

A. The Contractor's Maintenance Period shall begin upon inspection and approval at Substantial Completion and shall be for the period of 60 days.

B. The Contractor's maintenance of new planting shall consist of watering, weeding, repair of all erosion and reseeding as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydromulch planting under this Contract to the effect that a minimum of ninety five (95%) percent of the area planted will be covered with specified planting after sixty (60) days with no bare spots greater than ten (10) square feet. Any sod panels that are dead or dying shall be replaced.

C. The Contractor shall be responsible for one (1) mowing in the event that the time between seeding or sodding and Final Acceptance exceeds thirty (30) days.

D. Contractor shall make a second application of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Engineer. Such replanting to be performed within sixty (60) days of initial application and immediately upon notification by Engineer to replant.
E. Apply top dress fertilizer (16-6-8) at the rate of ten (10) pounds per 1,000 square feet at no less than nor more than twenty five (25) days after seeding unless approved in writing by the Owner.

3.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Engineer upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

B. For Seed: Ninety Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.

C. The Engineer and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION
CONSTRUCTION PLANS FOR PROPOSED
UT HEALTH RESEARCH PARK COMPLEX
PARKING LOT PHASE III
HOUSTON, TX 77054

SHEET INDEX

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<tr>
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<td>CIVIL SITE GRADING, UTILITY PLAN AND SWPPP</td>
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<td>PARKING LOT LIGHTING ADDITIONS</td>
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UT HEALTH RESEARCH PARK COMPLEX PARKING LOT PHASE III

IN ASSOCIATION WITH

WALTER P. MOORE AND ASSOCIATES, INC.
1301 MCKINNEY, SUITE 1100
HOUSTON, TEXAS 77010
PHONE: 713.630.7300
FAX: 713.630.7396

01/24/2018 ISSUE FOR CONSTRUCTION

C2.0 CIVIL SITE LAYOUT PLAN

SCALE 1:200

1. SW-designed area and layout for approval to be issued prior to construction of finished area.
2. All grading and paved area shall be inscribed with LAYOUT PLAN.

PRELIMINARY

(1) Proposed concrete slab
(2) Proposed finished area
(3) Proposed removal area
(4) Proposed grading area
(5) Proposed paving area
(6) Proposed parking area
(7) Proposed access area
(8) Proposed utility areas
(9) Proposed landscaping area
(10) Proposed drainage area
(11) Proposed utility lines

FOR REVIEW

1. Proposed concrete slab
2. Proposed finished area
3. Proposed removal area
4. Proposed grading area
5. Proposed paving area
6. Proposed parking area
7. Proposed access area
8. Proposed utility areas
9. Proposed landscaping area
10. Proposed drainage area
11. Proposed utility lines

SHEET INFORMATION:

01/24/2018 - 8:55am

X:\C03\2017\17032-00 UTHSC RPC Parking Lot Expansion Cad Site C03-17032-00-LA.dwg

01/24/2018
LIGHTING ADDITIONS

LUMINAIRE SCHEDULE

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<td>KELLY LIGHTING</td>
<td>POLARIS LED R2 150W/4K / 300W/4K 4000K</td>
<td>277</td>
<td>LED</td>
<td>POLE MOUNTED</td>
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GENERAL NOTES - GE101

A. ALL CONDUITS SHALL MATCH EXISTING IN SIZE AND TYPE.
B. ALL CONDUITS SHALL MATCH EXISTING IN SIZE AND TYPE.
C. ALL CONDUITS SHALL MATCH EXISTING IN SIZE AND TYPE.
D. FIELD-VERIFY EXISTING CONDITIONS PRIOR TO DISCONNECTING ELECTRICAL EQUIPMENT TO AVOID UNNECESSARY POWER OUTAGES.
E. COORDINATE PLANNED POWER OUTAGES AND ANY THERMAL POWER CONNECTIONS TO DETERMINE A PLANNED OUTAGE.
F. OUTPUTS FOR EXISTING PULL BOXES TO DETERMINE THE EXTENT OF WORK NECESSARY.
G. ENSURE ALL CONDUITS AT MINIMUM 30" BELOW FINISH GRADE.

KEYED NOTES - E101

1. INSERT EXISTING CONDUIT, P PROVIDED, 1/2" GA. WIRE AND CONNECT TO EXISTING CIRCUIT.
2. PROVIDE 3/4" GALVANIZED RODS AT 150" CITY OF SANTA FE CENTERPOINT ENERGY.
3. PROVIDE 1-1/2" AC 30'-0" CENTERPOINT ENERGY.
4. PROVIDE 3-1/2" DIA. PVC CONDUIT IN E.
5. PROVIDE 4" PVC RCP CONDUIT IN E.
6. PROVIDE 8" PVC CONDUIT ON DRränE.

LIGHTING POLE FOUNDATION DETAIL

NO SCALE

REMARKS

1. PROVIDE 1" SHIELDED RIGID METAL TUBE ALTERNATIVE REINFORCEMENT FOR ELECTRICAL FIXTURE ON POLE.
2. PROVIDE 4" W. IRON FENCE-GRATE INLET CONDUIT.
3. PROVIDE 6" W. IRON FENCE-GRATE INLET CONDUIT.
4. PROVIDE 8" WATER LINE-GRATE INLET CONDUIT.
5. PROVIDE 12" GAS LINE-GRATE INLET CONDUIT.
6. PROVIDE 15" STM. CONDUIT IN E.
7. PROVIDE 24" STM. CONDUIT IN E.
8. PROVIDE 42" STM. CONDUIT IN E.
9. PROVIDE 72" STM. CONDUIT IN E.

ACCESSORIES FOR FIXTURE ON POLE

INSTALLATION OF FIXTURE ON POLE

REVISITED 1/24/2018

WEATHER COORDINATE EXACT LOCATION WITH CIVIL ENGINEER.