

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions to the Construction Contract", "Special Conditions" and "Division 01 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. General administrative and procedural requirements.
 - 2. Electrical demolition.
 - 3. Cutting and patching for electrical construction.

1.3 GENERAL STIPULATIONS

- A. The contractor shall procure all necessary permits to carry out their work. They shall also arrange for all tests required on any and all parts of their work by local authorities, paying all regular and proper charges for same. They shall also obtain all certificates of inspection and approval from all required authorities and the Underwriters. Underwriters' certificates in duplicate shall be furnished to the Department at the completion of the project. Also, the contractor shall furnish two copies of each intermediate Underwriters' inspection report to the Department. All fees and permits required shall be satisfied and obtained by the contractor and the cost shall be included in the contract price.
- B. When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of representatives of the Department to ascertain whether it complies with the specifications and Contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings, and any additional tests that may be required shall be entirely at the Contractor's expense.
- C. This Contractor shall be entirely responsible for all apparatus, equipment, and appurtenances furnished under this Contract in connection with the work, and special care shall be taken to protect all parts thereof in such a manner as may be necessary or as may be directed. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment. Special care shall be taken to keep all open ends of conduit and other equipment closed while in storage and during the course of installation. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy waterproof tarps and kept dry at all times. Where equipment has been subjected to moisture, it shall be suitably dried out before placed in service. All apparatus, equipment, conduit and other appurtenances shall be stored in areas designated by the Department.

1.4 DEFINITIONS

- A. Approved Equal: The term "approved equal", "approved", "equal", "equivalent", etc. shall mean equal in all respects in the opinion of the Professional.
- B. As Required: The term "as required" refers to making final connections to and/or coordinating with the appropriate authorities regarding the installation of the indicated equipment.
- C. Contractor: The term "Contractor", "this Contractor" or "Electrical Contractor" when used in the Contract Documents refers to the Contractor responsible for all work specified in Division 26 and as indicated on the Electrical Drawings.
- D. Directed: Terms such as "directed," "requested," "authorized," "selected," and "permitted" when used separately without referencing any authority, shall mean directed by the Professional, requested by the Professional, and similar phrases.
- E. Disconnect: Disconnect electrical service to indicated items. Associated conduit and wire shall be disconnected and removed, complete, back to its source. Where electrical equipment (i.e. generator) is connected to radiator, fuel, and exhaust piping, intake and exhaust ductwork, etc., this Contractor shall disconnect and remove all associated appurtenances, complete, back to their source unless noted otherwise.
- F. Existing to Remain: Protect construction and/or indicated items to remain against damage and soiling during selective demolition. When permitted by the Professional, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- G. Finished/Unfinished Space: The term "finished space" shall mean areas where drywall is hung and installed with wall coverings and/or painted, floors are polished or coverings are installed on the floor, and the ceiling is plaster/gypsum board and/or suspended A.C.T. The term "unfinished space" refers to any area that does not meet the definition for a "finished space" as specified above. Mechanical rooms, electrical rooms, garages, etc. are typically considered "unfinished spaces".
- H. Furnish: The term "furnish" when used separately, shall mean to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations by others.
- I. Indicated: The term "indicated", "shown," "noted," "scheduled," and "specified" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents.
- J. Install: The term "install" when used separately, shall mean to mount in place, connect and make operable. Installation operations at the Project site shall include, but not be limited to, the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- K. Provide: The term "provide" when used in these specifications, shall mean to furnish and install, complete and ready for the intended use. See above definitions for additional requirements.
- L. Regulations: The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

- M. Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- N. Remove: Remove and legally dispose of items except those indicated to be reinstalled or salvaged or to remain the Department's property as directed.
- O. Salvage (Turn Over to Department): Items indicated to be salvaged remain the Department's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Department's designated storage area.
- P. Subcontractor: The term "Subcontractor" when used in these Contract Documents refers to an experienced installer (i.e. manufacturer, vendor, etc.) whom has successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction. Any reference to, or letting of work contained in these Contract Documents to any Subcontractor does not relieve this Contractor of his/her responsibility for all work, material and equipment indicated in these Contract Documents.
- Q. Work: The term "work" refers to all labor and materials provided by the Contractor and/or Subcontractor to make a complete and operable system.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and as indicated below.
 - 1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - 3. Do not submit Product Data on the following items and/or systems until compliance with requirements of the Contract Documents has been confirmed. See "Substitutions" article specified elsewhere in Part 1 for the Compliance Report requirements
- B. If the Contractor submits a product of a manufacturer which appears as a second or third name without corresponding catalog numbers and/or the manufacturer is not listed by name, the submittal shall include a Compliance Report. See "Substitutions" article specified elsewhere in Part 1 for the Compliance Report requirements and additional substitution requirements.
- C. All drawings, etc., submitted for approval shall be marked with the name of the project and shall bear the stamp of approval of the Contractor as evidence that the material has been checked by the Contractor. Any drawings, etc., submitted without this stamp of approval will not be considered and will be returned to the Contractor for resubmission.

- D. Additional copies may be required by individual sections of these Specifications.
- E. None of the items throughout the electrical specifications which require a submission and/or review, shall be installed in the work or orders placed for same until final review has been given by the Professional.
- F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Control" article of this Section.
- G. Selective Demolition
 - 1. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut off of electrical service, and details for dust and noise control.
 - a. Coordinate sequencing with construction phasing and Department occupancy as directed.
 - 2. Inventory of items removed and salvaged by the Contractor for the Department for inclusion in the Operation and Maintenance Manuals.
 - 3. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.
 - 4. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."

1.6 SUBSTITUTIONS

- A. General: In order to establish standards of quality and performance, all types of materials listed hereinafter by manufacturer's names and/or manufacturer's catalog number shall be provided as specified. If this Contractor desires to substitute an item, he/she shall comply with the following administrative and procedural requirements which are included in this Section to expand the requirements as defined by Part 1 paragraph "Related Documents".
- B. Substitutions will be permitted only on products specified with the phrase "or approved equal", "or as approved", "or equal", "or equivalent", etc. and the burden shall be upon the bidder to prove such equality. If the Contractor elects to prove such equality, he/she must request the Professional's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty.
 - 1. Samples: When requested, samples of items that the Contractor proposes to use as substitutions for the specified products/systems shall be submitted as follows.
 - a. A sample of both the specified item and the proposed substitute item shall be submitted simultaneously. The scheduling of the submission of such samples shall be as directed and shall in no way delay the progress of the Project.
 - b. Fixtures shall be submitted complete with lamps and a line cord ready for temporary operation.
 - c. The Professional will assume no responsibility whatsoever for any samples submitted.
- C. When the phrase "or approved equal", "or as approved", "or equal", "or equivalent", etc. appears and the Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he/she shall include a complete specification of the substituted item, along with each

submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Documents.

1. Compliance Report: Along with each submission copy of the product data and/or shop drawing, the manufacturer shall indicate the necessary modifications to the product and/or system to satisfy the requirements of the Contract Documents. Each paragraph including all subparagraphs shall bear the same paragraph number as the contract specification so that a close comparison can be made to the manufacturer specified herein by catalog number(s).
 2. Each paragraph for the substituted product/system shall be identified as follows:
 - a. Comply: The term “comply” shall only be used when the product/system indicated by the paragraph is completely equal in all respects to the type of material used, functionality, programmability, size, accessories to be provided, future capabilities, mounting, etc. to that which was specified. Anything less is not to be considered as complying and shall not be indicated as “Comply”.
 - b. Exception: The term “exception” shall be used when the product/system indicated by the paragraph does not meet the definition of “comply” as indicated above. The manufacturer shall provide a brief, clear and non-technical description of why the product/system does not meet the requirements of the specification and why it is not necessary to provide the specified materials, components, features, etc.
 - c. Deviate: The term “deviate” shall be used when the product/system indicated in the paragraph does not fully comply but the manufacturer is willing to provide all the necessary materials, components, features, accessories, future capabilities, etc. to meet the intent of the Contract Documents as determined by the Professional. The manufacturer shall provide a brief, clear and non-technical description of what additional items are to be provided and how these items affect the product/system.
 3. Compliance report may be submitted prior to the submission of the substituted product data and/or shop drawings but the Professional reserves the right to request that certain product data, shop drawings, wiring diagrams, certificates, etc. be included as requested.
- D. All costs involved in changes in the building, to the equipment, to the arrangement of equipment, or to the work performed or to be performed under other sections of the specifications, due to the substitution of equipment in lieu of that shown on the drawings or specified, shall be borne by the Contractor making such substitutions, and shall include, but not necessarily be limited to, costs or fees in connection with resubmission of drawings for approval, if required, by the Authority Having Jurisdiction, local authorities or insuring agencies having jurisdiction over the work.

1.7 REGULATIONS

- A. All laws, ordinances, rules and regulations of public bodies bearing on the conduct of the work are hereby incorporated and made a part of these specifications.
1. Americans with Disabilities Act.
 2. Pennsylvania Uniform Construction Code.
 3. City and Local Codes.
 4. National Fire Protection Association (NFPA), i.e. National Electric Code - NFPA 70, Electrical Safety in the Workplace – NFPA 70E, National Fire Alarm Code – NFPA 72, Life Safety Code - NFPA 101 and Emergency and Standby Power Systems – NFPA 110.
 5. National Electrical Safety Code - ANSI C2.
 6. Department's insuring agency.
 7. International Building Code (IBC)

- B. The Contractor shall comply with all rules, regulations and recommendations of any public utility serving this project.
- C. The entire electrical system shall be installed in accordance with the latest edition of the National Electrical Code, approved by the governmental body having jurisdiction, including amendments thereto.

1.8 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and indicative of the work to be installed. Exact locations of equipment and points of termination shall be reviewed with the Professional. Should it be found that any system or equipment cannot be installed as shown on the drawings, the Professional shall be consulted before installing or making changes to the layout.
- B. The drawings and specifications are intended to function as a common set of documents. Anything shown on the drawings but not in the specifications, or mentioned in the specifications and not shown on the drawings, shall be equally binding as if both noted on the drawings and called for in the specifications.
- C. No measurement of a drawing by scale shall be used as a working dimension. Working measurements shall be taken from figured dimensions and through cooperation with all other Contractors.
- D. This Contractor shall carefully examine the Structural, HVAC, Plumbing and Miscellaneous Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, the discrepancies shall be reported to the Professional in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Drawings shall be made without prior written instructions from the Professional.
- E. All items of labor, material and equipment not specified in detail or shown on the drawings but incidental to or necessary for the complete and proper installation and proper operation of the several branches of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the specifications or drawings.

1.9 FAMILIARITY WITH CONTRACT REQUIREMENTS

- A. It is the responsibility of the Contractor, prior to submitting a bid on this Project, to satisfy himself as to the nature and location of the work, the conformation of the ground, soil characteristics, the character, quality and quantity of the materials which will be required, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and of all other matters which can in any way affect the work under this Contract.
- B. Failure to make an on-site inspection prior to submitting a bid, or failure to comply with any or all of the above requirements will not relieve this Contractor from the responsibilities of properly estimating the requirements or costs of successful completion of the work nor from the responsibility for the faithful performance of the provisions of this Contract.
- C. The Electrical Contractor shall confer with all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from that indicated on the drawings. Outlets, equipment or wiring improperly placed because of the

Electrical Contractor's failure to obtain this information shall be relocated and reinstalled by the Electrical Contractor without additional expense to the Department.

1.10 COORDINATION DRAWINGS

- A. Coordination drawings shall be initiated by the contractor responsible for the ductwork installation. That contractor shall indicate, on the mechanical floor plans, equipment and duct locations and dimensions drawn to scale, taking into consideration and incorporating proper clearances. The drawing shall then be given to the contractors installing piping, conduit for the inclusion of their work on the coordination drawing. All discrepancies and conflicts with the architectural layout of the building shall be noted on the coordination drawings. The contractors shall meet as required to resolve discrepancies with ductwork, piping, and conduit prior and to coordinate those elements on the coordination drawing. The contractor who initiated the coordination drawings shall submit them for review. Coordination and installation of any equipment not indicated on the coordination drawing shall be the responsibility of the contractor responsible for that equipment. Any modifications required by any contractor for equipment to be installed that is not shown on the coordination drawing shall be the responsibility of the contractor who failed to indicate that equipment.
 - 1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - 2. Clearances for installing and maintaining insulation.
 - 3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - 4. Equipment and accessory service connections and support details.
 - 5. Exterior wall and foundation penetrations.
 - 6. Fire-rated wall and floor penetrations.
 - 7. Sizes and location of required concrete pads and bases.
 - 8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 - 9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
- B. Electronic Files: Provide electronic files of all shop drawings and coordination drawings in Autocad 2010 format or later version unless directed to provide a specific vintage in Division 1. Also provide drawings in a PDF format.
- C. Electrical Maintenance Manual
 - 1. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
 - a. Description: Provide a complete description of each unit and related component parts, including the following:
 - 1) Equipment or system function.
 - 2) Operating characteristics.
 - 3) Limiting conditions.
 - 4) Performance curves.
 - 5) Engineering data and tests.
 - 6) Complete nomenclature and number of replacement parts.
 - b. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:
 - 1) Printed operation and maintenance instructions.

- 2) Assembly drawings and diagrams required for maintenance.
- 3) List of items recommended to be stocked as spare parts.
- c. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - 1) Routine operations.
 - 2) Troubleshooting guide.
 - 3) Disassembly, repair, and reassembly.
 - 4) Alignment, adjusting, and checking.
- d. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - 1) Startup procedures.
 - 2) Equipment or system break in.
 - 3) Routine and normal operating instructions.
 - 4) Regulation and control procedures.
 - 5) Instructions on stopping.
 - 6) Shutdown and emergency instructions.
 - 7) Summer and winter operating instructions.
 - 8) Required sequences for electric or electronic systems.
 - 9) Special operating instructions.
- e. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
- f. Controls: Provide a description of the sequence of operation and as installed control diagrams by the control manufacturer for systems requiring controls.
- g. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel boards, including the following:
 - 1) Electric service.
 - 2) Controls.
 - 3) Communication.
- D. In addition to the number of maintenance manuals referenced in the "Related Documents" paragraph, prepare one (1) additional copy to be kept by the Professional.

1.11 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Labels and Listings: "Labels and Listings" for appliances and equipment provided meet the requirements of the Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories (ETL) and other standards organizations.
- C. Current Models:
 - 1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
 - 2. Replacement parts shall be available.

3. There shall be a permanent service organization maintained or trained by the manufacturer to provide satisfactory service.
- D. Experience: Manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than three years prior to the date of bid opening for this project.
- E. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. The quality of workmanship shall be subject to the approval of the Professional. Any work found by the Professional to be of inferior quality and/or workmanship shall be replaced and/or reworked until approval of the Professional is obtained. Any cost involved in obtaining said approval shall be the responsibility of the Electrical Contractor.

1.12 CONTINUITY OF SERVICE

- A. When it becomes necessary to temporarily interrupt electric service to any portion of the buildings on the site, the Contractor shall notify the Department in writing at least seven days in advance to enable necessary arrangements to be made. No interruptions will be permitted without the expressed written permission of the Department.
- B. The existing fire alarm system shall be fully maintained in service during the execution of work under this Contract. The Contractor shall furnish and install, and later remove any temporary equipment, wiring or other appurtenances necessary to provide the continuity of service for the system.

1.13 INSTRUCTIONS TO OPERATING PERSONNEL

- A. The Contractor shall furnish the services of a person, or persons, approved by the Professional and thoroughly familiar with the completed installation to instruct the Department's Operating Personnel in the proper operation of the electrical systems and the proper care of all equipment and apparatus included under this Contract. These services shall be furnished for a minimum of two 8-hour days.
- B. During the instruction period, the Contractor and his approved qualified personnel shall demonstrate to the Department, in the presence of the Professional's representative, the complete operation of the various systems installed under this Contract. Manufacturers' certificates of tests and performance shall be delivered to the Professional and the Department as hereinafter specified with the various systems or equipment.
- C. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel including manufacturer's representatives and subcontractors that will be giving the instructions. Likewise on this same letter, spaces shall be provided for the Department's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Department's personnel shall also sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Department, one copy to the Professional, and one copy shall be retained by the Contractor.
- D. In addition to the verbal instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a

brochure on his equipment, including instructions on operation, lubrication, recommended spare parts, and instructions on preventative, routine, and breakdown maintenance.

- E. The Contractor shall combine the written instructions and the manufacturers' equipment brochures in complete volumes with hard back binders which shall be turned over to the Department before final acceptance of the Contract work. Unless otherwise directed, three (3) copies of the volumes shall be furnished.
- F. All brochures and formats must be approved by the Professional.
- G. It is the intent that this entire system, with its complement of equipment and auxiliary equipment, operate properly in accordance with the design concept and functional intent. It is also the intent that the Department be given complete instructions for the proper operation and maintenance of the entire system.

1.14 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.15 GUARANTEE/WARRANTY

- A. Written one (1) year full warranty guarantees shall be submitted for the entire electrical installation installed under this project (except for lamps). Where manufacturer's standard guarantee provides for a longer period, the longer period shall apply.
- B. Where defects in the material, equipment and/or workmanship become evident within this guarantee period, the Contractor shall be responsible for replacing such material and equipment with the approved type of new items; and/or correcting the defective workmanship without any costs to the Department.

1.16 SEQUENCING, SCHEDULING AND COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wire ways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Arrange selective demolition so as not to interfere with Department's on site operations.
- D. Coordinate electrical equipment installation with other building components.

- E. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.
- F. Coordinate connecting electrical service to components furnished under other Sections.
- G. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

PART 2 - PRODUCTS

2.1 CONCRETE BASES

- A. Concrete: 4000-psi, 28-day compressive strength

2.2 SLEEVE SEALS

- A. The Contractor shall furnish and install modular wall seals where conduits pass through exterior walls. Seals shall be "Link-Seal" modular wall and casing seal, as manufactured by Thunderline Corporation, or approved equal. Sleeves shall be of appropriate size for the size of conduits to be installed, in accordance with the manufacturer's recommendations. The seal shall be composed of identical solid rubber links, bolted and interlocked to form a belt. As belt bolts are tightened, rubber links form an automatic protective seal. The seal shall be rated for 40 feet of head or 20 psig. Seal shall be capable of absorbing shock transmitted either from changes in internal pipe pressures or from ground disturbances. Seal shall be made of synthetic rubber material especially compounded to resist aging, ozone, sunlight, water, and chemical action, and shall provide low temperature flexibility and resistance to high temperature environments. Bolts and metal parts shall be of carbon steel and zinc phosphate plated to resist corrosion. The seal shall be capable of providing air tightness in above ground installations and hydrostatic sealing in below grade installations. Seal shall be capable of maintaining cathodic protection with Delrin plastic pressure plates. Install seals in accordance with Manufacturer's Bulletin LS-104. Brush underground metal parts with a good grade of mastic before backfill.

2.3 GROUT

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

2.4 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold Formed Steel Tubing: ASTM A 500.
- C. Hot Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.

- E. Fasteners: Zinc coated, type, grade, and class as required.

2.5 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light framing size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP 2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inches.

2.6 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.7 REPAIR MATERIALS

- A. Use repair materials identical to existing materials. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. This Contractor shall expedite the work for a specific area, section or part of the Project to make provision for, or protect equipment or to permit the installation of another part of the work.
- B. All materials and equipment supplied by this Contractor shall be new, of the best of their respective kinds, without imperfections and blemishes, and shall be protected from the elements prior to installation.
- C. All conduits, wire, cable, wiring devices and equipment shall be installed in such a manner as to preserve access to any existing equipment or to any new equipment installed under this specification or under other specifications or contracts for this Project and with sufficient space provided for proper operation and maintenance.
- D. The drawings are generally indicative of the work to be installed but do not indicate all bends, fittings, boxes, etc., which may be required. The Contractor shall carefully investigate the structural and furnish conditions affecting his work, arrange his work accordingly, and furnish such fittings as may be required to meet such conditions.
- E. This Contractor shall coordinate his work with other trades so that all work may be installed in the most direct manner and so that interference between piping, ducts, equipment, architectural

or structural features will be avoided. In cases of interference, conflicts, or fouling results, the Professional shall decide which work is to be relocated, regardless of which was installed first. Such relocation shall be at no additional expense to the Department.

- F. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building structure/construction as required.
- G. Scaffolding with ladders shall be furnished and erected, where required for the proper installation of wiring, equipment and fixtures.

3.2 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in other Specification Divisions and approved product data and shop drawings for rough-in requirements.

3.3 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
 - 4. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 6. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Professional.
 - 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - 10. Install systems, materials, and equipment giving right of way priority to systems required to be installed at a specified slope.

B. Performance of Equipment

1. All materials, equipment and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the Project in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance, and capacity. No approval either in written or verbal of any drawings, descriptive data, or samples of such material, equipment and/or appurtenances shall relieve this Contractor of his responsibility to turn over the same to the Department in perfect working order at the completion of the Project.
2. Any material, equipment or appurtenances, the operation, capacity or performance of which does not comply with the drawings and/or specification requirements or which is not new or which is damaged prior to acceptance by the Department will be held to be defective material and shall be removed and replaced with the proper acceptable materials, equipment and/or appurtenances or put in proper acceptable working order, satisfactory to the Professional with no additional expense to the Department.
3. All auxiliary systems specified herein such as the fire alarm system or other similar systems shall be furnished by manufacturers who have been regularly engaged in the manufacture of these products for a period of not less than five (5) years. This Contractor shall deliver to the Professional, prior to final payment, a statement from the manufacturer or his authorized representative, certifying that the equipment has been inspected by him and found to be properly installed and functioning satisfactorily. Installation, final connections and testing of such systems shall be performed under the direct supervision of competent authorized service engineers who shall be in the employ of the respective equipment manufacturer. Any and all expenses incurred by these equipment manufacturer's representatives shall be borne by the Contractor.
4. All details of the installation of all equipment shall be electrically and mechanically correct. All equipment shall operate without objectional noise or vibration should be produced and transmitted to occupied portions of the building by apparatus, conduit or other parts of a system, any corrections to eliminate noise and vibration shall be at no expense to the Department.

3.4 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Part 1 paragraph "Related Documents." In addition to the requirements referenced in the "Related Documents" paragraph, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Install equipment and materials in existing structures.
 - e. Upon written instructions from the Professional, uncover and restore Work to provide for Professional observation of concealed Work.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

B. Cutting, Patching, and Finishing (Existing Building)

1. Electrical Contractor shall be responsible for all cutting, patching, and finishing of existing construction for the proper installation of all electrical equipment and materials to be installed in the existing portion of this project. This will also be required for the removal of the existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project. Cutting, patching and finishing shall be done by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas perfectly and to the satisfaction of the Professional.
 - a. Cutting: Cut and remove existing construction only to the extent required by new Work and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1) Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2) Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3) Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
 - 4) Maintain adequate ventilation when using cutting torches.
 - 5) Cut concrete and masonry at junctures with construction to remain, using power driven masonry saw or hand tools; do not use power driven impact tools.
 - b. Patching: Return elements of construction and surfaces to remain to condition existing before start of cutting operations.
 - c. Painting
 - 1) All surfaces to be painted shall receive an undercoat 24 hours before the final coat is applied. Undercoats which show lumps or rough areas shall be smoothed with fine sandpaper or steel wool and dusted off before the final coat is applied. Final coat shall be solid, even color, free of lumps, drops, sags, run brush marks, laps, or other defects, finished to a line where they adjoin other colors or unpainted surfaces.
 - 2) Drop cloths shall be used to protect floors and all other work from damage. Any covering temporarily removed from any part of the work or finish shall be promptly replaced and any damage from neglect to so protect all surfaces shall be good at the Contractor's expense.
 - 3) Paint color shall match adjoining surfaces as closely as possible and to the satisfaction of the Professional.
2. No cutting shall be done which may affect the building structurally or architecturally including building systems without first securing the approval of the Professional. Cutting

shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons, or other construction. Where unsightly conditions are caused, the Contractor shall be required, at his own expense, to repair the damaged areas.

3. Cutting of the construction excessively or carelessly done shall be repaired by this Contractor to match the original work and to the satisfaction of the Professional who will make the final decision with respect to excessive or careless cutting work.
4. This Contractor shall seal all openings he has made in plenum spaces, fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition material. Openings shall be suitably treated to prevent passage of stray light, air or sound.
5. Where present equipment is removed and unused openings remain in walls, floors, partitions, etc., this Contractor shall properly patch all such openings. All patching and repairing shall be done by workmen skilled by this type of work and shall match present or new finishes.
6. All holes or openings for the passage of conduit to be put in existing concrete shall be bored.
7. Cutting, patching, and repairing of openings in the existing exterior walls and roof shall be by this Contractor.

3.5 PROTECTION OF WORK, MATERIALS, AND EQUIPMENT

- A. This Contractor shall effectually protect at his own expense, all existing facilities and such of his new work, materials or equipment as is liable to injury during the construction period. All openings in to any part of the conduit system as well as all associated fixtures, equipment, etc. both before and after being set in place shall be securely covered or otherwise protected to prevent obstruction, damage, or injury due to carelessly or maliciously dropped tools or materials, grit, dirt moisture, water or any foreign matter. This Contractor shall be held responsible for all damage so done, until his work is fully accepted by the Professional. Conduit ends shall be covered with capped bushings.
- B. All surfaces, either finished or in preparation for finishing or finish material application, shall be protected against damage from painting, welding, cutting, burning, soldering or similar construction functions. The protection shall be accomplished by care in operations, covering and shielding. Special care shall be directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation and shall be at the expense of the Contractor causing the damage with no cost to the Department.
- C. Any damage caused by neglect on the part of this Contractor or his representative, or by the elements due to neglect on the part of this Contractor or his representatives, either to the existing work, or to his work or to the work of any other Contractor, shall be repaired at his expense to the Professional's satisfaction.

3.6 CONCRETE BASES

- A. General: Install concrete pads and bases as indicated.
- B. Forms and Reinforcing Materials
 1. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad. Anchor or key to floor slab.

2. Install reinforcing bars where required, tied to frame, and place anchor bolts and sleeves to facilitate securing units.
- C. Mounting: Anchor electrical equipment and other system components on concrete housekeeping bases. Provide anchorage according to manufacturer's written instructions, unless otherwise indicated.
1. Concrete Pad: Housekeeping bases shall be 4" high with 1" chamfer edges minimum and shall extend 4" beyond the edge of the electrical equipment on all accessible sides unless indicated otherwise. Coordinate size of equipment with actual unit size before proceeding with any formwork.
 2. Clearance: Maintain minimum workspace around components according to manufacturer's Shop Drawings and National Electrical Code.
 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- D. Concrete: Place concrete and allow to cure before installation of units. Use Portland cement that conforms to ASTM C 150, 4000 psi, 28-day compressive strength, and normal weight aggregate.

3.7 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7.

3.9 CLEAN-UP

- A. Daily, and when directed by the Professional, the Electrical Contractor shall remove all waste and debris resulting from his work.
- B. Upon completion of his work and when directed by the Professional, the Electrical Contractor shall remove all dirt, foreign materials, stains and fingerprints from all equipment, fixtures, panels, plates, etc., installed under this contract. Internal areas of all equipment must be cleaned of all construction dust etc., prior to pre-final and/or final inspection.
1. Clean paint, varnish spots and stains caused by finishing materials used by this Contractor from all walls, floors, trim, glass, hardware, fixtures, masonry or any other surface that is damaged by this Contractor's work.

2. Do not use solvents, that would remove or damage the finish of the finish hardware or other factory-finished materials. If damage occurs, the affected materials shall be returned to the factory for refinishing at no expense to the Department.
3. Repair all finishes damaged by this Contractor.

END OF SECTION