

SHIREMANSTOWN BOROUGH COUNCIL
SHIREMANSTOWN BOROUGH STORAGE AND MAINTENANCE BUILDING

Section 6
Contract 15609.655-3

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ELECTRICAL - Contract 15609.655-3

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**SECTION 1
SPECIAL CONDITIONS
Contract 3 - Electrical**

A. GENERAL

1. Scope of Project

a. Location

The Project is a new municipal storage and maintenance building for the Owner (Shiremanstown Borough) located along East Strawberry Alley, adjacent to the municipal building on 1 Park Lane in Shiremanstown Borough, Cumberland County, Pennsylvania in accordance with the Contract Documents.

b. Scope

It is the intent of the drawings and specifications to describe the construction of the municipal garage to be performed under separate prime contracts (the "Prime Contracts") as described below. Each Prime Contractor shall furnish all labor, materials, equipment, machinery, apparatus and tools and perform all operations necessary to install, equip and put into satisfactory operation the Work specified and shown on the Plans.

Any labor, materials, equipment, or apparatus not specifically mentioned in the plans or specifications which may be necessary for the proper completion of the entire Work shall be furnished by each Prime Contractor without additional compensation.

c. Contract Documents

The Contract Documents as defined in the Standard Contract Provisions which are made a part hereof. In the event of any inconsistency, the provisions of this Division I shall control.

d. Starting and Completing Work

The Contract work shall be started immediately upon receipt of a written notice from the Owner and shall be continued in full force until completion, unless approval to suspend work is granted by the Owner or unless delays occur due to unfavorable weather.

Before filing his bid, the Bidder shall have made all arrangements to be fully equipped to expeditiously carry on all work in case he is awarded a Contract and shall have made all arrangements to permit immediate transportation to the site of the work of all equipment, materials and other facilities required to execute the work.

In scheduling his operations, the Contractor shall take into consideration all delays that may occur due to unfavorable weather; failure of public utilities or others to install, remove or adjust their structures when required; and the uncertainties prevailing on account of a national emergency in regard to obtaining critical materials and labor to complete the various portions of such work in time.

e. Release of Lien

The Contractor shall provide to the Shiremanstown Borough Council a Release of Lien in a format acceptable to the Borough and properly signed by all tradesmen or suppliers which provided either materials or labor for the work performed under this contract. This Release of Lien shall be presented to the Shiremanstown Borough at the time of application for final payment.

2. Summary

- a. This Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- b. Specific requirements of each contract are also indicated in individual Specification Sections and on Drawings.
- c. Related Sections include the following:
 - 1) Section 2- Work Restrictions: Use of the Project site and for requirements for continued Owner occupancy of premises.
 - 2) Section 3 - Submittal and Testing Procedures.

3. Definitions

a. Permanent Enclosure

As determined by Architect/Engineer, permanent or temporary roofing, which is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

4. Prime Contracts

- a. Prime contracts for Project include the following:
 - Contract 1 – General Construction (Contract 15609.655-1)
 - Contract 2 – Mechanical Construction (Contract 15609.655-2)
 - Contract 3 – Electrical Construction (Contract 15609.655-3)
 - Contract 4 – Plumbing Construction (Contract 15609.655-4)

5. Coordination

a. Project Coordinator shall be responsible for coordination among all Prime Contractors.

- 1) General Construction Contractor ("General Contractor") shall act as the Project Coordinator.

b. General Contractor

- 1) The General Contractor shall have coordination responsibility of all and each prime contractors. This shall include:

- a) Providing a master project schedule ("Master Project Schedule") which includes each separate Prime Contractor's scheduled responsibilities for delivery dates, installation, construction and critical activities for the Project.

- b) Direct, schedule and control onsite activities of each separate Prime Contractor.

- c) Provide specific directions to each Prime Contractor when unforeseen interferences impact the progress of the work.

- 2) The General Contractor shall be experienced in administration and supervision of building construction, including the scheduling and coordination of plumbing, HVAC and electrical work.

- 3) The coordination activities of the General Contractor include, but are not limited to, the following:

- a. Provide overall coordination of the Work.

- b. Coordinate shared access to workspaces.

- c. Coordinate product selections for compatibility.

- d. Provide overall coordination of temporary facilities and controls.

- e. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.

- f. Coordinate construction and operations of the Work with work performed by each contract.

- g. Prepare Coordination Drawings (if and as required) to coordinate work by more than one contract.

- h. Coordinate sequencing and scheduling of the Work.

- j. Provide quality-assurance and quality-control services.

- k. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections with the testing laboratory.
- l. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
- m. Set elevations provided by the Engineer. The General Contractor shall also be responsible for setting all corners, batterboards, off-set stakes and other construction lines from property lines or other reference points provided by the Engineer.
- n. Provide waste collection and progress cleaning of common areas and coordinate waste collection, recycling and progress cleaning of areas or pieces of equipment where more than one contractor has worked.
- o. Coordinate cutting and patching of all the Work.
- p. Coordinate protection of the Work.
- q. Coordinate preparation of Project Record Documents; all information from all contractors is to be integrated to form one combined record set.
- r. Print and submit Record CAD Drawings if installations by more than one contractor are indicated on the same Contract Drawing or Shop Drawing.
- s. Collect Record Specification Sections from other contractors, collate Sections into numeric order, and submit one complete set.
- t. Coordinate preparation of operation and maintenance manuals; all information from all contractors is to be integrated to form one combined record set.

c. Prime Contractors

- 1) Each Prime Contractor shall be responsible to the General Contractor to coordinate that Prime Contractor's onsite activities. This includes submission of detailed information relating to the scheduling activities of material procurement, delivery dates, installation timeframes and notification of required work to be completed by other Prime Contractors prior to the installation of each Prime Contractor's work.
- 2) All onsite interferences with other trades shall be coordinated with the General Contractor. Unforeseen conditions that may arise and necessitate a Construction Change Directive shall be conveyed to the Engineer but shall be coordinated with the General Contractor.

- 3) The General Contractor shall be experienced in administration and supervision of building of building construction, including the scheduling and coordination of mechanical, plumbing and electrical work.

6. Schedules

a. Pre-Award Information

The apparent low bidder for each Prime Contract shall, within ten (10) working days following notification of its status as apparent low bidder, provide the Engineer with an intended schedule for work to be completed. The Engineer shall transmit the information to the apparent General Contractor low bidder.

b. Master Project Schedule

Within ten (10) working days following receipt of the information set forth in subsection a. above, the apparent low bidder for the General Construction Contract shall provide the Engineer with a Master Project Schedule which incorporates the schedules of the other Prime Contractors and which Master Project Schedule shall be controlling on all of the Prime Contractors thereafter.

Upon receipt, the Engineer shall provide a copy of the Master Project Schedule to each Prime Contractor along with the Notice of Award. No changes or deviations from the Master Project Schedule shall be permitted without approval from the Engineer and, if the change or deviation involves an extension in the time for completing the required Work, a written change order or directive as the case may be.

c. Form of Schedule

The Master Project Schedule shall be a critical path schedule in such form as is approved by the Engineer.

- d. Failure to adhere to the Master Project Schedule by any Prime Contractor shall be considered a default of that Prime Contractor.

7. All Prime Contracts

a. Extent of Contract

Unless the Contract Documents contain a more specific description of the Work, names and terminology on Drawings and in Specification Sections determine which contract includes a specific element of Project.

- 1) All Work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.

- 2) Local custom and trade-union jurisdictional settlements do not control the scope of the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall negotiate a reasonable settlement to avoid or minimize interruption and delays.
- 3) Trenches for the Work of each contract shall be coordinated with and provided by the General Contractor unless otherwise specified (electrical service). See General Contractor specification for trenching specifications.
- 4) Selective demolition for the work of each contract shall be coordinated with the General Contractor and shall be provided by each Prime Contractor for its own work.
- 5) Cutting and patching for the Work of each contract shall be coordinated with the General Contractor and shall be provided by each Prime Contractor for its own Work.
- 6) Firestopping for the Work of each contract shall be coordinated with the General Contractor and shall be provided by each Prime Contractor for its own Work.

b. Substitutions

Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the Work.

c. Temporary Facilities and Controls

Each Prime Contractor is responsible as follows:

1) Access to the Construction Site

Access for all Prime Contractors to the Project site is the responsibility of the General Contractor, which shall construct and maintain temporary roads as necessary. Temporary roads shall be adequate to permit the entrance and egress of construction and supply vehicles of all contractors at all times during the construction period. No contractor/worker, or any subcontractor or supplier shall be permitted to use the existing driveways or any portion of the existing parking facilities without the approval of the Engineer.

2) Temporary Services

Each Prime Contractor is specifically responsible for the installation, operations, maintenance and removal of each temporary service or facility, usually recognized as related to that contractor's normal scope of work.

3) Use/Utility Charges

a) General

All utility charges for temporary facilities shall be paid for by the General Contractor. The Owner will not assume responsibility for any utility costs until the Certificate of Completion has been issued for the Project. Use charges (i.e., tapping fees, 3Ø power) will be paid by the Owner.

b) Sanitary Sewer Service

There shall be no discharge into the existing sanitary sewer system without prior written authorization by the Borough Engineer.

c) Water Service

Cost of all metered water service used by each Prime Contractor shall be the responsibility of the General Contractor.

For Shiremanstown Borough facility construction, water can be provided by the Borough from the existing service line at the Borough Office for low volume service, at the discretion of the Borough. Borough reserves the right to halt provision of water at its discretion.

d) Electrical Power Service

The cost for all temporary electric power service at the Project Site by all Prime Contractors shall be the responsibility of the General Contractor.

For Shiremanstown Borough facility construction, electricity can be provided by the Borough from the existing service line at the Borough building or alternate location for general service, at the discretion of the Borough. Borough reserves the right to halt provision of electricity at its discretion.

e) Utility Extensions

The cost of extending utilities to and on the Project Site shall be as is otherwise set forth in the plans and specifications.

f) Security and Protection Facilities

The General Contractor shall be responsible for installing temporary enclosures around partially completed areas of construction and provide lockable entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security. Each Prime Contractor shall be responsible for securing that contractor's own equipment and materials. In the event of loss, the Owner shall not be responsible. Each Prime Contractor shall be responsible to secure the Project work area at the end of each workday.

d. Right of Property

No Prime Contractor shall have any right in any property or materials taken from any excavation and no earth, sand or other material from the Site shall be removed before any fill operations, except with the approval of the Engineer. The provisions of this paragraph shall not be construed to relieve any Prime Contractor of any of its obligations to remove and dispose of any excavated material with or without re-handling at its cost and expense as otherwise provided in the specifications.

e. Concrete Mix Computations

In addition to the requirements of the specification "Concrete Construction," the Contractor shall employ a testing laboratory to prepare computations of the concrete mixes to be used, and submit the computations to the Engineer for approval. Such approval will not relieve the Contractor of responsibility of the mixes.

f. Minimum Wage Rates

The applicable Pennsylvania prevailing wage determination for this Project are attached to the Contract Documents and shall be complied with in accordance with the instructions to bidders.

g. Painting Work by Others

All pipe, conduit, equipment installed under the Electrical Prime Contract (Contract 15609.655-3) shall be painted by the General Contractor (Contract 15609.655-1). Colors shall be as directed by the Engineer.

h. Safety and Health Regulations

Each Prime Contractor shall comply with the Department of Labor, Safety and Health Administration Regulations for construction promulgated under the Occupational, Safety and Health Act of 1970 (P.L. 91-596) and under Section 107 of the Contract Hours and Safety Act (P.L. 91-54).

i. Miscellaneous

1) Vehicle Removal and Barricades

Removal of vehicles, barricading and other operations necessary for the completion of the required work for each Prime Contractor is the responsibility of that Contractor.

2) Designated Representative

Each Prime Contractor shall provide at least one responsible worker to answer emergency calls on a 24-hour basis and perform emergency service during non-working hours for any condition resulting from that Prime Contractor's construction activities which may present a hazard to the Project or to the public. This worker shall make himself available at any time of the day or night and any day of the week for any required emergency work and shall have available a proper vehicle, supplies and materials together with such authority as is required from the Prime Contractor to adequately perform his duties hereunder. If a contractor is notified of a deficiency which is not corrected within two hours from the time of notification, then the Owner may initiate repairs and the responsible Prime Contractor will be back charged.

3) Changes in the Project

Any changes in the Project which involve cost adjustments shall be only in accordance with the change order procedures otherwise set forth in the General Conditions.

4) Payments

Payments to each Prime Contractor shall be in accordance with payment applications as otherwise set forth in the general conditions and shall be in accordance with a lump sum contract price.

5) Time for Completion and Liquidated Damages

The responsibility to perform the Work for each Prime Contract shall commence upon receipt of a Notice to Proceed from the Engineer and shall continue in full force until completion which shall be within **180 (one hundred eighty) calendar days** from the date of receipt of the Notice to Proceed from each Prime Contract. No delays will be permitted unless a change order granting an extension of time is issued and approved by the Owner.

The parties recognize that the Owner will incur damages if the Project is not completed within the 180 day time period, and also recognize that these damages shall be difficult to ascertain or quantify. After reasonable investigation and consideration, and by executing the Contract, each Prime Contractor agree that **\$1000 per day** is a best effort estimate for damages resulting from delay in completion to the Owner. The Prime Contractors also agree that any damages resulting from failure to perform and complete the Work under each Prime Contract shall result in additional damages as are otherwise permitted to the Owner under applicable Pennsylvania law and which shall include additional engineering fees, inspection work and any other damages which are properly recoverable.

6) Insurance

Each Prime Contractor shall provide evidence of coverage of insurances as required under the General Conditions.

7) Indemnification

Each Prime Contractor shall indemnify and hold harmless the Owner, the Engineer and their respective agents and employees from and against all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the performance of that Prime Contractor's Work, providing that any such claim, damage, loss or expense is:

- a) attributable to bodily injury, sickness, disease or death or to injury to or destruction of tangible property including the loss of use resulting therefrom.
- b) caused in whole or in part by any intentional or negligent act or omission of a Prime Contractor, its employees, subcontractors, suppliers or materialmen or anyone directly or indirectly employed by any of them or anyone for whose acts may be liable, regardless of whether or not it is caused in part by anyone indemnified hereunder.
- c) in any and all claims against the Owner or any of its agents or employees by any employee of any Prime Contractor, any subcontractor, supplier or materialmen of any of them, the indemnification obligation under this section shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor under workman's compensation acts, disability acts or other employee's benefit acts.

8) Release of Liens

All Contractors shall provide Owner a release of liens properly signed by all tradesmen, suppliers, subcontractors and subcontractors of subcontractors or anyone who has provided materials or labor for the Work performed under any Prime Contract. The release of liens shall be presented to the Engineer prior to the payment of the final retainage for any Prime Contractor's entitlement.

9) Operation and Maintenance Manuals

Each Prime Contractor shall collect two sets of catalog data including instructions for operations and care of all equipment, diagram, drawings, etc. for all pieces of equipment furnished under that Prime Contractor's

contract. The data shall be submitted to the General Contractor who shall reduce it into a single notebook form and suitably indexed. In addition to the data provided herein, the information contained shall include any and all manufacturer or supplier warranties which are issued pursuant to the required Work under the Contract. The General Contractor shall cause the same to be delivered to the Engineer prior to the release of final payment. This record shall also include the plan location and elevation of all underground piping and utilities and shall include "as built" buildings.

8. General Construction Contract

- a. Work in the General Construction Contract includes, but is not limited to, the following:
- 1) Site preparation, including cleaning and relocations and earthwork.
 - 2) Site improvements, including site development furnishings and equipment and seeding/restoration.
 - 3) Stormwater inlets, piping, stone and all components to install the required stormwater management system.
 - 4) Sanitary sewer lateral from oil/water separator to existing lateral.
 - 5) Water supply lateral from existing supply to new building.
 - 6) Oil-Water Separator and installation.
 - 7) Tunnels and trenching for site utilities.
 - 8) Foundations, including footings, foundation walls.
 - 9) Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
 - 10) Paving and concrete as depicted on the plan for the site.
 - 11) Permanent Signs installation (signs provided by Borough).
 - 12) Concrete Bollards, Wheel Stops, and Concrete Bin Blocks and installation
 - 13) Below-grade building construction, including excavation, backfill, and thermal and moisture protection.
 - 14) Superstructure, including floor mezzanine and roof construction.
 - 15) Exterior closure, including walls, parapets, doors, windows and louvers.
 - 16) Roofing, including coverings, flashings, roof specialties and openings.

- 17) Interior construction, including partitions, doors, interior windows, and fittings.
- 18) Interior finishes.
- 19) Furnishings, including casework (no furniture or appliances).
- b. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
 - 1) Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, HVAC/Mechanical Contract or Electrical Contract.
 - 2) Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers. There shall be no discharge into the sanitary sewer system without prior written authorization by the Owner.
 - 3) Stormwater control, including the following:
 - a. Erosion and sediment controls
 - b. Foundation drainage system.
 - c. Site drainage system.
 - 4) Unpiped portable or temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
 - 5) Temporary enclosure for building exterior, except as indicated.
 - 6) Dewatering facilities and drains.
 - 7) General hoisting facilities for materials and personnel, up to 2 tons (2000 kg).
 - 8) Project identification and temporary signs as shall be designed and paid for by the General Construction Contractor.
 - 9) General waste recycling and disposal facilities.
 - 10) Temporary fire-protection equipment.
 - 11) Security enclosure and lockup.
 - 12) Traffic Control
 - 13) Environmental protection.
 - 14) Restoration of Owner's existing facilities used as temporary facilities.
 - 15) Soil stabilization; sedimentation and erosion control.

c. Miscellaneous

- 1) The General Contractor shall be responsible for determining the exact location of all utilities on the site and shall protect the utilities during the course of the work performed by all Prime Contractors. Notwithstanding, each Prime Contractor, shall at the discretion of the utility involved, repair or have repaired all damage to any utility which the result of the work of that Prime Contractor at no cost to the Owner. In the event that any utilities interfere with the installation of new building or appurtenances, each Prime Contractor must allow for such interference in his bid. Each Prime Contractor is required to comply with all provisions of Act 287 of the Commonwealth of Pennsylvania effective April 9, 1975. The cost of any required utility location shall be included in the General Contractor's lump sum bid on the proposal form.
- 2) Safety of the General Public. The General Contractor shall be responsible for the safety of the general public in or about the site at all times. All excavated areas shall be backfilled daily or roped off with lighted barricading.
- 3) The General Contractor is responsible for the obtaining of all necessary permits (i.e., building permit, excavation permit, etc.) from Shiremanstown Borough, Cumberland County or any governmental body having legal jurisdiction over the same. The cost of all permits shall be included in the bid price of the General Contractor.

9. Plumbing Contract

- a. Work in the Plumbing Contract includes, but is not limited to, the following:
 - 1) Site water supply and distribution.
 - 2) Site sanitary sewer, including oil/water separator.
 - 3) External and internal trench drains up to storm sewer system and oil/water separator on sanitary sewer.
 - 4) Site gas line service connection
 - 5) Site special plumbing systems.
 - 6) Plumbing fixtures.
 - 7) Domestic water distribution.
 - 8) Sanitary waste.

- 9) Plumbing connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC/Mechanical Contract and Electrical Contract.
- b. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:
 - 1) Piped water service.
 - 2) Piped temporary toilet fixtures, wash facilities, and drinking water facilities.
 - 3) Plumbing connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, HVAC/ Mechanical Contract and Electrical Contract.

10. HVAC/Mechanical Contract

- a. Work in the HVAC/Mechanical Contract includes, but is not limited to, the following:
 - 1) Heat generation.
 - 2) Refrigeration.
 - 3) HVAC distribution.
 - 4) Terminal and packaged units.
 - 5) HVAC instrumentation and controls.
 - 6) HVAC testing, adjusting, and balancing.
 - 7) Mechanical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC/Mechanical Contract and Electrical Contract.
- b. Temporary facilities and controls in the Mechanical Contract include, but are not limited to, the following:
 - 1) Temporary heat and ventilation.

11. Electrical Contract

- a. Work in the Electrical Contract includes, but is not limited to, the following:
 - 1) Site electrical distribution (See site drawings).
 - 2) Site lighting.

- 3) Electrical service and distribution.
 - 4) Lighting and branch wiring.
 - 5) Telecommunications, security, computer wiring and audio-visual wiring. Equipment will be supplied by others.
 - 8) Electrical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC/Mechanical Contract and Electrical Contract.
- b. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:
- 1) Electric power service and distribution.
 - 2) Lighting, including site lighting.
 - 3) Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, HVAC/ Mechanical Contract and Electrical Contract.

12. Separate Contracts

Any additional separate contracts will be secured by the Owner. Coordinate work prior to completion of rooms and final work. The following work will be provided by the Owner.

- a. Telephone and Data System Equipment
- b. Security System Equipment
- c. Furniture

13. Progress of the Work

- a. All scheduling and sequencing of the Construction Work shall be coordinated with the Owner.
- b. It is essential that the Contractors communicate on this job. A list of Contractors will be supplied by the Engineer prior to the start of work. The Contractors are directed to check on the progress of each contract to maintain a smooth flow of trades through the duration of the project. The General Construction Contractor (Contract 15609.655-1) shall act as the project coordinator. The Owner and Engineer will not be responsible for changes or rework necessary due to lack of coordination between Contractors.

Upon award of the project, the General Contractor (Contract 15609.655-1) shall arrange and conduct a sequencing and scheduling meeting with all contracts. Prior to construction, a master project schedule shall be submitted to the Borough for review and approval.

14. Subsurface Conditions

From investigations, including surveys made at the site, it is assumed that physical conditions are approximate, as indicated on the drawings, but the nature of the materials below the surface or the depth to satisfactory foundations, are not guaranteed. No additional compensation shall be paid for rock or any other subsurface condition. The Contractors expressly assumes the risk of any unexpected subsurface condition. No boring has been performed.

15. Non-Classified Excavation

All excavation shall be unclassified. The Contractors are hereby advised that where rock is encountered within the lines and grades shown on the drawings or described by the specifications for lump sum items on the contract proposal, removal of same will be paid for as a part of the applicable lump sum price bid and no extra compensation will be made therefore.

16. Project Photographs

Prior to construction, the General Contractor shall furnish three (3) sets of photographs of the site from four (4) views. During construction, the Contractor shall provide three (3) sets of detailed project photographs each month during construction. Copies of the photographs shall be supplied to the Engineer with pay applications.

17. Cleaning

a. General

1) Description

- a) Throughout the construction period, maintain the renovation area in a standard of cleanliness as described in this Section.
- b) Owner requires that this project generate the least amount of trash and waste possible. All Contractors shall comply with Section 017419 Construction Waste Management and Disposal.

2) Quality Assurance

- c) Conduct daily inspections and more often, if necessary, to verify that requirements for cleanliness are being met.
- d) In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

b. Products

1) Cleaning Materials and Equipment

Provide required personnel, equipment and materials needed to maintain the specified standard of cleanliness for a clean and neat site.

2) Compatibility

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

c. Execution

1) Progress Cleaning

a) General

- (1) Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic and providing required protection of materials.
- (2) Do not allow accumulation of scrap, debris, waste material and other items not required for construction of this work.
- (3) At least once each week, and more often if necessary, completely remove all scrap, debris and waste material from the job site.
- (4) Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the environment.

b) Building

- (1) At the end of each day's work, inspect the building and pick up all scrap, debris and waste material. Remove such items to the place designated for their storage.
- (2) At the end of each day's work, sweep interior spaces clean; free from dust and other material capable of being removed by use of reasonable effort and a handheld broom.
- (3) As required preparatory to installation of succeeding materials, clean the building or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

- (4) Following the installation of finish floor materials, the finish floor shall be kept clean and protected at all times while work is being performed in the space in which finish materials are installed; free from foreign material which may be injurious to the finish floor material.

2) Final Cleaning

- a) Final cleaning shall be provided by skilled cleaners using commercial quality building maintenance equipment and materials.
- b) Prior to completion of the work, remove from the buildings job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article C.1 above.

c) Building

(1) Exterior

- (a) Remove all traces of soil, waste materials, smudges and other foreign matter from exterior surfaces.
- b) In the event of stubborn stains not removable with water, the Architect may require other additional cleaning at no additional cost to the Owner.

(2) Interior

- (a) Remove all traces of soil, waste materials, smudges and other foreign matter from interior surfaces.
- (b) Remove all traces of splashed material from adjacent surfaces.
- (c) Remove paint droppings, spots, stains and dirt from finished surfaces.

(3) Polished Surfaces

To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.

- d) Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean facility.

- e) Final acceptance of the building is contingent on approval of final cleaning.

3) Cleaning During Partial Occupancy

Should the Owner occupy the work of any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Engineer.

B. UTILITIES

The Contractor shall determine the exact location of all utilities affected by this work and shall protect the utilities during the course of the work. The Contractor shall, at the discretion of the utility involved, repair or have repaired all damage to the utilities, which is a result of the work, at no cost to the Owner. These utilities may interfere with the installation of the new lines or appurtenances and the Contractor must allow for such interference in his bid. The Contractor will be required to comply with all provisions of Act 287 of the Commonwealth of Pennsylvania, effective April 9, 1975. The cost of utility location shall be included in the Contractor's lump sum bid on the Proposal Form.

C. SAFETY OF GENERAL PUBLIC

The Contractor shall be responsible for the safety of the general public in or about the project site at all times. Excavated areas shall be backfilled daily or roped off with lighted barricading. Entrances to driveways and adjoining residents shall have sound steel plating or wood planking of uniform thickness, with handrails and adequate lighting across excavated areas to provide for a safe travel way to each residence. Notification to adjoining residents is to be given by the Contractor within a reasonable time to facilitate their arrival or departure from the residence. Notification to the Borough Council shall be given prior to any traffic restrictions, detours or road closings for coordination purposes.

D. COMPARISON OF BIDS

The bid proposals will be compared on the basis of the sum of the unit prices that appear on the Proposal Form. For a bid to be acceptable, unit prices for additions or deductions must agree with the total lump-sum price breakdown.

E. CONTRACT DRAWINGS AND SPECIFICATIONS

The plan copies or drawings of this project, prepared by Gibson-Thomas Engineering Co., Inc. and KD3 Design Studio, Inc., are included in these contract documents and on PennBID are hereby made an integral part of these contract Documents and Specifications. One set of the Contractor's drawings and Specifications shall be available at the job site at all times for use by the Engineer or his authorized representative.

F. BASIS OF PAYMENT

The work required by this Contract shall be paid for as detailed in the Standard Contract Provisions. Monthly payments will be made during the progress of the work, based upon the value of the work done as detailed in the Standard Contract Provisions. Adjustments in payments because of changes in the construction from that indicated in the Contract Drawings and Specifications, or by exigencies of the work and as authorized by the Engineer, will be in accordance with the requirements of the Standard Contract Provisions.

G. PAYMENT OF PREVAILING WAGES

The Contractor must compensate all employees associated with this project in accordance with the prevailing wage determinations made a part of these contract documents. The prevailing wage information must be displayed at a high-visibility site located in the contract work area. Pennsylvania Prevailing Wages apply to this project.

H. PRE-CONSTRUCTION CONFERENCE

A pre-construction conference will be held with Borough and Borough Engineer prior to the commencement of the project. Working sequence, scheduling, traffic control and safety will be discussed and determined with Borough President and Borough Engineer.

I. CONSTRUCTION STAKE-OUT

The contractor will be furnished with all benchmarks and field information from the original survey notes. The contractor will be responsible for the stakeout of all construction work included in this contract. This work shall be subject to the approval of the Engineer.

J. TEMPORARY SERVICES

It shall be the responsibility of the General Contractor to provide temporary services throughout the entire period of construction and until the work performed under his contract is completed and the placed in operation with the Owner's personnel. The temporary services shall include heat and water, as follows:

a. Temporary Heat

Prior to enclosure of the pump pit building or portions thereof, and when weather conditions indicate the necessity for temporary heat as determined by the Engineer, the General Contractor shall provide, maintain, operate and pay all costs including fuel for the sufficient number of approved portable heaters so the progress of the work is not impeded.

After the pump pit building or portions thereof are enclosed and the outside temperature falls below 50° F during normal working hours or below 35° F at any other time, the General Contractor shall provide for temporary heat. A tank shall be considered "enclosed" when (a) the exterior walls have been completed; and (b) when openings are closed with either temporary or permanent closures.

The General Contractor shall operate portable heaters or maintain a temporary heating system. The General Contractor shall pay all costs including fuel for the operation and maintenance of the equipment, either temporary or permanent, to provide adequate heat. The tank or tanks shall be maintained at a minimum temperature of 50° F except when a lower temperature is authorized by the Engineer. The General Contractor shall remove all soot, smudges and other deposits from walls and all exposed surfaces which are the result of the use of any temporary heating equipment including the use of the permanent heating system for temporary heat purposes. He shall not do any finish work until all such surfaces are properly cleaned. The General Contractor shall be responsible for the dismantling and/or removal of portable heaters and other temporary heating apparatus and equipment.

K. COORDINATION OF WORK – ALL CONTRACTS

It is essential that the Contractors communicate on this job. A list of Contractors will be supplied by the Engineer prior to the start of work. The Contractors are directed to check on the progress of each contract to maintain a smooth flow of trades throughout the duration of the project. The Owner and Engineer will not be responsible for changes or rework necessary due to lack of coordination between Contractors.

END OF SECTION

SECTION 2 WORK RESTRICTIONS

A. GENERAL

1. Related Documents

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

2. Summary

This Section includes work restrictions for the Project.

3. Use of Premises

a. During the construction period each Prime Contractor shall coordinate its use of the premises for construction operations, including use of the site, compliance with state and local procedures and regulations regarding the use of site and surrounding public ways.

b. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1) Limits: Confine construction operations to areas of new construction.

2) Clean wheels of construction vehicles before leaving construction site. Keep Owner's access roads and public roads free of construction dirt.

3) The Contractor shall coordinate with the Owner or his representative for the purpose of defining and regulating temporary lay-down and storage areas, temporary utility hookups, and any other items which may require the use of various portions of the site.

c. Working Hours

Working hours and times for delivery of material and removal of debris and trash shall be as follows:

1) 6:00 a.m. – 8:00 p.m.

2) No Work shall be performed on weekends or holidays without Owner's approval.

END OF SECTION

SECTION 3 SUBMITTAL AND TESTING PROCEDURES

A. GENERAL

1. Related Documents

- a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- b. Certain specification sections contain additional submittal procedures for specified items. The requirements stated therein shall be primary for those items.

2. Summary

- a. This Section includes administrative and procedural requirements for submittals, including the following:
 - 1) Shop Drawings.
 - 2) Product Data.
 - 3) Samples.
 - 4) Informational Submittals: Miscellaneous submittals
 - 5) Requests for Information (RFI); requests for clarification and interpretation.

3. Definitions

- a. Action Submittals: Written and graphic information that requires Architect/Engineer's responsive action.
- b. Informational Submittals: Written information that does not require Architect/Engineer's approval. Submittals may be rejected for not complying with requirements.

4. Submittal Procedures

- a. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1) Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2) Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

- a) Architect/Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

b. Processing Time

Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect/Engineer's receipt of submittal.

- 1) Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect/Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
- 2) Concurrent Review: Where concurrent review of submittals by Architect/Engineer's consultants, Owner, or other parties is required, allow 14 days for initial review of each submittal.
- 3) If intermediate submittal is necessary, process it in same manner as initial submittal.
- 4) Allow 10 days for processing each resubmittal.
- 5) No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

c. Identification

Place a permanent label or title block on each submittal for identification.

- 1) Indicate name of firm or entity that prepared each submittal on label or title block.
- 2) Provide a space on label or beside title block to record review and approval markings and action taken by Architect/Engineer.
- 3) Include the following information on label for processing and recording action taken:
 - a) Project name.
 - b) Date.
 - c) Name and address of Architect/Engineer.
 - d) Name and address of Contractor.
 - e) Name and address of subcontractor.
 - f) Name and address of supplier.
 - g) Name of manufacturer.
 - h) Unique identifier, including revision number.
 - i) Number and title of appropriate Specification Section.
 - j) Drawing number and detail references, as appropriate.

k) Other necessary identification.

d. Deviations

Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

e. Additional Copies

Unless additional copies are required for final submittal, and unless Architect/Engineer observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

f. Transmittal

Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect/Engineer return submittals, without review, received from sources other than Contractor.

- 1) Paper or Electronic submittals may be provided, except for color and texture approvals. Send to or Email to Borough Engineer for distribution.
- 2) On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect/Engineer on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
- 3) Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- 4) Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Submittal and transmittal distribution record.
 - i. Remarks.
 - j. Signature of transmitter.

g. Distribution

Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

h. Use for Construction

Use only final submittals with mark indicating action taken by Architect/Engineer in connection with construction.

- i. Requests for clarification or interpretation including Request for Information (RFI) shall be in writing (mailed or emailed) to the Engineer – copy Architect.

B. PRODUCTS

1. Action Submittals

a. Shop Drawings

Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1) Preparation: Include the following information, as applicable:

- a) Dimensions.
- b) Identification of products.
- c) Fabrication and installation drawings.
- d) Roughing-in and setting diagrams.
- e) Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
- f) Shopwork manufacturing instructions.
- g) Templates and patterns.
- h) Schedules.
- i) Design calculations.
- j) Compliance with specified standards.
- k) Notation of coordination requirements.
- l) Notation of dimensions established by field measurement.

2) Wiring Diagrams

Differentiate between manufacturer-installed and field-installed wiring.

5) Sheet Size

Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

4) Number of Copies

Submit 5 prints for the Architect/Engineer's review.

- a) The Architect/Engineer will stamp each submittal with a uniform action stamp; refer to Article 3.02
- b) Distribution: Contractor is responsible for distributing required prints of shop drawings to his subcontractors and material suppliers after review by the Architect/Engineer.
- c) One copy of each shop drawing shall be kept at the project site.
- d) Contractor shall submit one copy of each shop drawing to the Owner at the end of the project as a "Record Document."

b. Samples

Prepare physical units of materials or products, including the following:

1) Samples for Initial Selection

Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

2) Samples for Verification

Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

3) Preparation

Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect/Engineer's sample where so indicated. Attach label on unexposed side that includes the following:

- a) Generic description of Sample.

- b) Product name or name of manufacturer.
- c) Sample source.

4) Additional Information

On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

- a) Size limitations.
 - b) Compliance with recognized standards.
 - c) Availability.
 - d) Delivery time.
- 5) Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
- a) If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least 3 sets of paired units that show approximate limits of the variations.
 - b) Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

6) Number of Samples for Initial Selection

Submit 1 full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect/Engineer will return submittal with options selected.

7) Number of Samples for Verification

Submit 3 sets of Samples. Architect/Engineer will retain 1 Sample set; remainder will be returned.

- a) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

8) Disposition

Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

- a) Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

- c. Product Schedule or List

Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

- 1) Type of product. Include unique identifier for each product.
- 2) Number and name of room or space.
- 3) Location within room or space.

- 2. Architecture/Engineer's Action

- a. General

Architect/Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- b. Action Submittals

Architect/Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect/Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

- 1) Architect/Engineer's action on shop drawings will result in making one of five notations on them; namely "SATISFACTORY," "UNSATISFACTORY," "SATISFACTORY AS NOTED," "SATISFACTORY AS NOTED, REVISIONS REQUIRED," or "UNSATISFACTORY, REVISE AND RESUBMIT."
- 2) Final Unrestricted Release: When the Architect/Engineer marks a submittal "SATISFACTORY," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
- 3) Final-But-Restricted Release: When the Architect/Engineer marks a submittal "SATISFACTORY AS NOTED" the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 - a) Resubmit to Architect/Engineer a file copy of submittal stamped by Architect/Engineer as "SATISFACTORY AS NOTED," after the corrections have been made.
- 4) Returned for Re-submittal: When the Architect/Engineer marks a submittal "SATISFACTORY AS NOTED, REVISIONS REQUIRED," or

"UNSATISFACTORY, REVISE AND RESUBMIT," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

a) Do not use, or allow others to use, submittals marked "UNSATISFACTORY," "SATISFACTORY AS NOTED, REVISIONS REQUIRED," or "UNSATISFACTORY, REVISE AND RESUBMIT," at the Project Site or elsewhere where Work is in progress.

3. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect/Engineer will return the submittal marked "Action Not Required."

c. Informational Submittals

Architect/Engineer will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect/Engineer will forward each submittal to appropriate party.

d. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

C. TESTING

As required by applicable specification sections.

END OF SECTION

SECTION 4 GENERAL ELECTRICAL (26000)

A. GENERAL

1.1 RELATED DOCUMENTS

All Contract Drawings, Specification Sections, Drawings, Addendums, and general provisions of the Contract, including, but not limited to, General Conditions of the Construction Contract and Instructions to Bidders, apply to the Work outlined in this Section.

1.2 WORK INCLUDED

A. Provide labor, materials, equipment, and services to perform operations required for the complete installation.

B. Scope of Work – Work shall include, but shall not be limited to, the following:

1. Provide all underground public utility and Borough and private service line location prior to any excavation.
2. Provide all excavation, shoring, protection, backfill, and restoration for all underground Work. Refer to Division 2 specification Sections for details regarding methods for the Work.
3. Provide all drilling, sawing, cutting, chases, patching, forming, sleeves, patching, etc. for all Work as required. Refer to Division 1 specification Sections for details regarding methods for the Work.
4. Provide and install complete support systems for all Work. Support systems shall be in accordance with OSHA requirements, the National Electrical Code, requirements of the Structural Engineering Consultant, the Architect, and in accordance with all equipment manufacturer's recommendations, and consistent with accepted industry practice.
5. Provide and install a complete underground conduit system for power and telecommunications. Work to include, but not be limited to, conduits, nylon pull ropes, and warning tape.
6. Provide and install a conduit system at the present Shiremanstown Borough Municipal Building for telecommunications use. Provide and install conduits, supports, nylon pull ropes, drilling, patching, as required for a complete raceway system.
7. Provide and install a complete underground electric service entrance system. Work to include, but not be limited to, trenching, compacted backfill, restoration, grade beam sleeves, conduits, nylon pull ropes, warning tape, wire, support devices, wireway, tap blocks, main disconnects, fuses, main distribution

panelboard, support devices, painted plywood backboard, grounding, phase failure warning, and surge protection system.

8. Provide and install a complete underground raceway system ready for use by Owner's telecommunications vendors. Work to include, but not be limited to, conduits, nylon pull ropes, tagging, warning tape, support devices, painted plywood backboard, and grounding. Trench by General Contractor.
9. Provide and install a complete power distribution system. Work to include, but not be limited to, conduit, support devices, wire, fusible switches, fuses, panelboards, circuit breakers, boost transformers, feeders, junction boxes, pull boxes, and surge protection devices.
10. Provide and install a complete branch circuit wiring system. Work to include, but not be limited to, conduit, support devices, wire, fusible switches, fuses, manual motor starter switches, wireways, junction boxes, pull boxes, and outlet boxes.
11. Provide and install a complete grounding system. System shall be in accordance with, but not limited to, these specifications, the National Electrical Code, requirements of Underwriters Laboratories (UL), and all applicable codes, regulations and accepted standards.
12. Provide and install a complete interior and exterior lighting system. Work to include, but not be limited to, luminaires, lamps, mounting devices, photoelectric cell(s), conduit, support devices, wire, and all control devices.
13. Provide and install a complete emergency lighting system. System shall be in accordance with, but not limited to, these specifications, the Pennsylvania Code, Title 34, Chapters 49 through 60 of the Department of Labor and Industry, National Electrical Code, UL, NFPA, Americans with Disabilities Act (ADA), and all applicable codes, regulations and accepted standards.
14. Provide and install a complete telecommunications raceway system for voice and network wiring. System shall include, but not be limited to, conduit homeruns, outlet boxes, blank cover plates, junction boxes, pull boxes, etc. Provide tagged pull lines in each conduit run. All work shall be in strict accordance with the Owner's telecommunications vendor's requirements.
15. Provide and install all wiring to all Hvac and plumbing equipment. Work shall include, but not limited to, all power wiring to electric hot water heater, air handling and conditioning units, Hi Bay heating and ventilating unit, automatic temperature control equipment, exhaust fans, motor operated dampers, gas fired equipment, starters, controllers, contactors, etc.
16. Provide and install a complete complement of wiring devices. Work to include, but not be limited to, convenience receptacles, special purpose power receptacles, ground fault interrupter receptacles, switches, occupancy sensors, and cover plates.
17. Provide and install a complete low voltage lighting switching system. System shall include, but not limited to, relay and control cabinet(s), all low voltage control and

master switches, conduit, support devices, low and line voltage wire, outlet boxes, etc.

18. Provide power and control wiring for all electric garage door operators.
19. Procure and pay for all permanent power company charges. There will be no telephone or cable tv company involvement with this project. Contact power company to verify all charges during the bid period. **EC shall be fully responsible to include these costs in the base bid Proposal.**
20. Provide and pay for all electrical rough-in and final inspections. Inspections shall be performed by the Borough selected UCC Code inspection services for all aspects of the wiring system. Furnish certificates to the Owner upon completion.
21. Provide testing of all systems and equipment upon completion per instructions given in the applicable portions of these specifications.
22. Provide labeling and identification for all equipment as indicated in the applicable portions of these specifications. Typewrite all panelboard circuit directories. Label all panels, disconnects, transformers, etc. Tag all wire and pull line runs.
23. Provide coordination drawings to the General Contractor for all Work where interference with other trades can potentially occur. EC shall be fully responsible for all coordination and no extra compensation shall be provided due to lack of coordination.
24. Provide and install all temporary power and lighting in accordance with the Division 1 Sections of the General Specifications. Work shall be in accordance with, but not limited to, the National Electrical Code, UL, OSHA, and all applicable codes, regulations and accepted standards. Provide portable on-site generators and fuel as required. Temporary power service may be available as prescribed in Special Conditions from the Borough.
25. Coordinate all penetrations through grade beams with Structural Engineers.

1.3 GENERAL REQUIREMENTS

- A. Division 26 Electrical Specifications are strictly technical in nature. Refer to General Conditions, Instructions to Bidders, and Division 1 Sections for general requirements of the Contract.
- B. All Site/Civil/Structural drawings and specifications as prepared by Gibson-Thomas Engineering Company, Inc., and all Architectural drawings and specifications as prepared by KD3 Design Studio, Inc., along with issued addendums, accompany this Division 26 technical specification, and are hereby a part thereof.
- C. Use Architectural, Civil, and Structural drawings for all building and foundation dimensions, structural materials, and for all pertinent details. Do not scale electrical plans for this information.

- D. The Electrical Contractor shall review site/civil, architectural, structural, plumbing, heating, ventilation, and air conditioning plans and shall adjust the Work to conform to all conditions shown thereon. Discrepancies shown on different plans and specifications shall be promptly brought to the attention of the Professional. This Contractor shall conform to all reasonable changes without extra cost to the Owner or General Contractor.
- E. Use the Sections of the Division 26 specifications as a guide for quality of workmanship and materials. They are intended to cover all parts of the system. Failure of drawings or specifications to mention all items which are necessary for the proper functioning of the system shall not relieve the Electrical Contractor from the responsibility to furnish and install the same.
- F. The electrical drawings indicate: the general arrangement of circuits and outlets, location of switches, panelboards, conduit, and other work. The Contractor shall obtain exact locations in the field prior to installation and arrange the Work accordingly. The drawings are schematic in nature.
- G. It is the intent of the Contract Documents (CD's) to result in a complete electrical installation in full accordance with all requirements of State, Federal, Local and other applicable codes, regulations, and ordinances. In the event any portions of the installation shown, or specified, fail to meet these requirements, it shall be the Contractor's responsibility to alter the layout to meet the requirements of the governing Code, and to notify the Professional of such changes. Where the provisions of the Contract Documents shown or described, exceed the requirements of the applicable codes, regulations, or ordinances, the standards set forth in the Contract Documents shall govern.
- H. The work covered by the Contract Documents shall include furnishing all labor, material, equipment, appliances and services to construct and install the complete electrical system as shown on accompanying drawings, addendums, and as specified herein. Any changes necessitated by Code requirements shall be included in base bid Contract.
- I. No work shall start until Contract Documents and other required documents have been submitted to the Department(s) or Authorities having to issue certificates of approval and have been signed and approved.
- J. Where the words "Electrical Contractor", "Contractor", or "EC" appear in the Contract Documents, it shall mean the ultimate responsibility of the Electrical Prime Contractor.
- K. Where the word "Professional" appears in the Contract Documents, it shall mean the Civil/Structural Engineer, the Architect, or other Consulting Electrical or Mechanical Engineers.
- L. Where the word "Owner" appears in the Contract Documents, it shall mean Shiremanstown Borough.

1.4 CODES AND REGULATIONS

- A. All Work and materials shall conform, but not be limited to, the following general regulatory agencies and codes. Note that individual specification Sections may refer to more specific codes which are also applicable:
 - 1. Shiremanstown Borough regulations and ordinances.
 - 2. Pennsylvania Department of Labor and Industry.
 - 3. National Fire Protection Association (NFPA) Codes.
 - 4. Latest edition, 2002, of the National Electrical Code (NFPA 70) and all current revisions thereto.
 - 5. Americans with Disabilities Act (ADA).
 - 6. Occupational Safety and Health Administration (OSHA).
 - 7. Underwriters Laboratories, Inc. (UL)
 - 8. National Electrical Manufacturer's Association (NEMA).
 - 8. Pennsylvania Act 222 (energy conservation).
 - 9. Pennsylvania Statutes regarding notification of utilities prior to excavation.
 - 10. Pennsylvania Department of Environmental Protection (DEP).
 - 11. Federal Environmental Protection Agency (EPA).
- B. Absolutely no extra claim for compensation shall be allowed for changes necessitated by Code compliance regardless of how shown, or specified, and the bidding Contractor hereby waives all his rights to such extra compensation.

1.5 PERMITS, INSPECTIONS, FEES AND CHARGES

- A. The Borough will pay for all permits. The Contractor shall pay for all inspections.
- B. The Contractor shall give all requisite notice to all authorities having jurisdiction (AHJ), and shall obtain all permits, provide deposits, and inspection fees necessary for the installation of the Work.
- C. Certificates of Inspection: deliver free of charge to the Owner before final payment is made. Inspection shall be performed for all aspects of the wiring system.

1.6 VISITING THE SITE

The Contractor shall visit the site of the work and familiarize himself with all conditions affecting the work, and the submission of his Proposal (Bid) shall presuppose his knowledge of all such conditions and performance of all Work required for a complete and Code complying installation.

1.7 COOPERATION WITH CONTRACTORS

Cooperate with other Contractors. Give and request all necessary information. General Contractor shall locate all walls and partitions for electricians. Electricians shall not set conduit until General Contractor has located the Work.

1.8 RECORD DRAWINGS

- A. The Contractor shall keep an accurate record of all deviations from the Contract Documents.
- B. The Contractor shall correctly and neatly enter in red pencil any deviations to the Contract Documents and shall keep the Contract Documents available at the jobsite for inspection.
- C. "As built" drawings and documents shall be turned over to the Owner upon completion.

1.9 TEMPORARY POWER & LIGHTING

- A. Provide, install and maintain temporary electric service facilities.
- B. Provide grounding and overcurrent protection as required by the NEC.
- C. Provide portable on-site generator(s) and fuel as required. Provide temporary service voltage, capacity, and characteristics as required by the General Contractor and all other Prime Contractors.
- C. Provide circuits and outlets as required for all trades.
- D. Provide ground fault protection for personnel as required by the NEC.
- E. Provide all temporary lighting per OSHA requirements and to satisfy all trades.

1.10 TESTS

At completion of the job and before final acceptance, the electrical system as a whole shall be given a final test with all luminaires lighted and all motors and equipment in operation. Any fuses blown or lamps/ballasts burned out shall be replaced by the Contractor without additional cost to the Owner or General Contractor. The tests shall be made only in the presence of the Owner and the design Professional(s). Full satisfaction shall be guaranteed by the Contractor.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 26000

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated [rigid steel conduit] [IMC].
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; aluminum.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

4. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Nonmetallic Conduit:
- B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 1. ENT: Comply with NEMA TC 13 and UL 1653.
 2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 3. LFNC: Comply with UL 1660.
- C. Nonmetallic Fittings:
 1. Fittings, General: Listed and labeled for type of conduit, location, and use.
 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 3. Fittings for LFNC: Comply with UL 514B.
 4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, [Type 1] [Type 3R] [Type 4] [Type 12] <Insert type> unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Gangable boxes are allowed.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: RNC, Type EPC-40-PVC.
 - 2. Underground Conduit: RNC, Type EPC-40-PVC .
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- M. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for luminaires equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- Y. Locate boxes so that cover or plate will not span different building finishes.
- Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.

- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
- B. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service and feeder conductors.
 - 1. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 2. Color for Neutral: White.
 - 3. Color for Equipment Grounds: Green.
 - 4. Colors for Isolated Grounds: Green two or more yellow stripes.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Write-on, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
 - a. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.5 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- J. Vinyl Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- K. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- L. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- M. Self-Adhesive Labels:
 - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- N. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- O. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- P. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

- R. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- S. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- T. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [**or concrete envelope**] exceeds 16 inches (400 mm) overall.
 2. Limit use of underground-line warning tape to direct-buried cables.
 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- U. Write-on Tags:
1. Place in a location with high visibility and accessibility.
 2. Secure using general-purpose cable ties.
- V. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- W. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- X. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.
- D. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- E. Arc Flash Warning Labeling: Self-adhesive labels.
- F. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.

1.3 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Phase, Neutral, and Ground Buses: Tin-plated aluminum.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- H. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
- K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker.
- C. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Mount panelboard cabinet plumb and rigid without distortion of box.
- C. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- D. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- E. Install filler plates in unused spaces.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Occupancy sensors.
 - 4. Wall plates.

1.2 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
- F. Wall Plate Color: For plastic covers, match device color.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.

2.3 GFCI RECEPTACLES, 125 V, 20 A

- A. Duplex GFCI Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Type: Feed through.
 - 4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.4 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
 - 1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
 - 2. Standards: Comply with UL 20.
 - 3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 4. Adjustable time delay of 20 minutes.
 - 5. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
 - 6. Connections: Provisions for connection to BAS.
 - 7. Connections: RJ-45 communications outlet.
 - 8. Connections: Integral wireless networking.

2.5 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic
 - 3. Material for Unfinished Spaces: Galvanized steel.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, thermoplastic with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Device Installation:
 - 1. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:
- B. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
- C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION

SECTION 262813

FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Enclosed switches.

PART 2 - PRODUCTS

2.1 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 250-V, zero- to 600-A rating, 200 kAIC.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.2 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.

1.2 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- C. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240-V ac.
 - 4. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 5. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.3 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
1. Indoor, Dry and Clean Locations: NEMA 250, [Type 1] <Insert type>.
 2. Outdoor Locations: NEMA 250, [Type 3R] [Type 4X] <Insert type>.
 3. [Kitchen] [Wash-Down] Areas: NEMA 250, [Type 4X] <Insert type>, [stainless steel] <Insert material>.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, [Type 4] <Insert type>.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 6. Hazardous Areas Indicated on Drawings: NEMA 250, [Type 7] [Type 9] <Insert type> [with cover attached by Type 316 stainless steel bolts].

3.2 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - h. Verify correct phase barrier installation.
 - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole.

Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

END OF SECTION