

DIVISION 16

Electrical

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Section 16A

General Technical Requirements
for the Electrical Work

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SECTION 16A

GENERAL TECHNICAL REQUIREMENTS
FOR THE ELECTRICAL WORK

1.0 SCOPE

The intent of this Specification is for Contractor to furnish, install, connect and test the electrical work as specified in Article 2.1 - Work to be Provided.

2.0 GENERAL

Work shall be complete, in accordance with the Specification and best established practice and shall include the procurement of licenses, permits and approvals for all the electrical work.

2.1 Work to be Provided

The Work to be provided shall be as follows:

- Section 16B - Electrical Service
- Section 16C - Conduit System
- Section 16D - Insulated Wire and Cable
- Section 16E - Grounding
- Section 16F - Lighting and Heating Systems
- Section 16G - Panelboards
- Section 16H - Motors
- Section 16I - Motor Control Centers, Motor Controls,
Motor Starters and Motor Disconnect Switches
- Section 16J - Temporary Power and Light

Pennsylvania Electric Company Drawing 15E132 - Pad for 500 KVA, 34.4 KV Transformer is given in Appendix 2 and is part of these specifications.

The following drawings are part of these specifications:

Burns and Roe, Inc. Drawings

<u>Dwg. No.</u>	<u>Title</u>
3051	One Line Diagram
3002	Elementary Wiring Diagram

<u>Dwg. No.</u>	<u>Title</u>
3003	Elementary Wiring Diagram
3100	Power and Grounding Plan
3102	Electrical Site Plan
3103	Pump House Ltg. Cond. & Grounding

2.2 Work by Others

.1 Pennsylvania Electric Company (PENELEC) will furnish electric power to Owner for operation of the facility.

.2 Primary feeder voltage will be 34.5 KV, 3 phase, 60 cycles. Utilization voltage will be 3 phase, 4 wire, 480 Gnd. Y/276 volts.

.3 PENELEC will supply and install the meter and pad mounted three phase transformer for Owner outside the main building as shown on the drawings.

2.3 Codes and Standards

The equipment, material, installation and testing of the electrical work shall conform to the latest edition and latest addenda thereto in force, as of date of award, of the following applicable codes, regulations, specifications and standards:

- .1 American National Standards Institute
- .2 Institute of Electrical and Electronics Engineers
- .3 American Society for Testing and Materials
- .4 National Fire Protection Association
- .5 National Electrical Code
- .6 Insulated Power Cable Engineers Association
- .7 Underwriters' Laboratories Inc.
- .8 Commonwealth of Pennsylvania Codes and Regulations:
 - a. Electric Safety Regulations, Department of Labor and Industry
 - b. Regulations for Protection from Fire and Panic.

- .9 Federal Specification
W-C-581 - Conduit, Electrical, Steel, Rigid,
Zinc Coated
- .10 Military Specification
MIL-C-23571 - Conduit and Conduit Fittings,
Plastic, Rigid
- .11 National Electrical Manufacturer's Association

3.0 DETAILED REQUIREMENTS

Detailed Requirements for the electrical work are given in the specification sections listed above in Article 2.1 - Work to be Provided.

4.0 INSTALLATION

Installation for the electrical work shall be in accordance with the specification sections listed above in Article 2.1 - Work to be Provided.

5.0 TESTING

Testing for the electrical work shall be in accordance with the specifications listed above in Article 2.1 - Work to be Provided.

6.0 INFORMATION TO BE SUBMITTED

Information to be submitted for the electrical work shall be in accordance with the specification sections listed above in Article 2.1 - Work to be Provided.

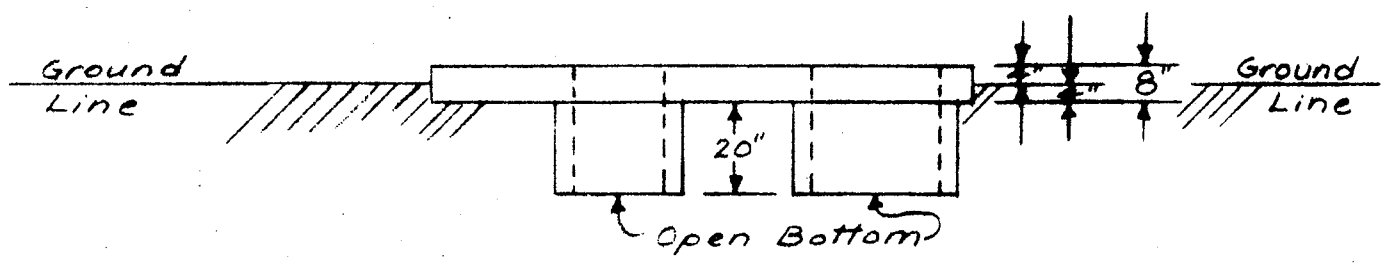
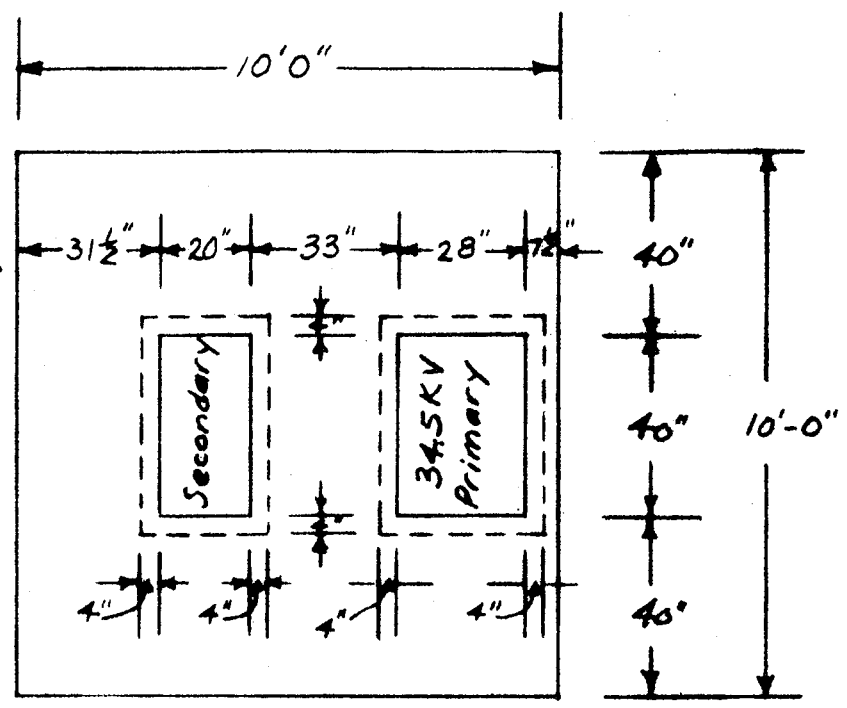
APPENDIX 2

Page No.

Pennsylvania Electric Company, Drawing
No. 15E132, Transformer Pad for 500 KVA,
34.5 KV Transformer

16A-4

Transformer Pad
to be a minimum
of 8" thick
reinforced concrete
All walls to be a
minimum of 4"
thick
Reinforcing
acceptable $\frac{3}{8}$ "
minimum deformed
Rod - #4 - 6" X 6"
paving mesh
Provide 6" depth
of Gravel or Slag
under box for
drainage



The exact size and location of secondary and primary compartments vary with transformer manufacturers. The drawing to be used for construction will be furnished at that time.

REVISIONS			PENNSYLVANIA ELECTRIC COMPANY	SCALE - 1" = 40"	
TE	NAME	REMARKS		NAME	DATE
			Transformer Pad for 500 KVA	DRAWN	G.R.W. 12/30/69
			34.5 KV Transformer	TRACED	
				CHECKED	
				APPROVED	G.R.W. 12/30/69
				NO.	15 E / 32
				DATE	12/30/69

Section 16B

Electrical Service

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SECTION 16B

ELECTRICAL SERVICE

1.0 SCOPE

This Specification Section includes the furnishing, installing, connecting and testing of the 480 volt supply service, all as indicated on the drawings and described in the Specification.

2.0 GENERAL

2.1 Work to be Provided

Contractor shall furnish, install, connect and test the 480 volt supply service as indicated on the drawings and described in the Specification.

2.2 Work by Others

.1 Pennsylvania Electric Company (PENELEC) will furnish electric power to Owner for operation of the facility.

.2 Primary feeder voltage will be 34.5 KV, 3 phase, 60 cycles. Utilization voltage will be 3 phase 4 wire 480 Gnd Y/276 volts.

.3 PENELEC will supply and install the meter and pad mounted three phase transformer for Owner outside the main building as shown on the drawings.

2.3 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of date of award, of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Design Conditions

Utilization voltage will be 480 Gnd. Y/276 volt, 4 wire, 3 phase service. Primary feeder voltage will be 34.5 KV, 3 phase 60 cycle service. Conduits and cable shall be sized as indicated on the drawings.

3.2 Materials

Conduit shall be in accordance with Section 16C - Conduit. Cable shall be in accordance with Section 16D - Insulated Wire and Cable.

4.0 INSTALLATION

4.1 Transformer Pad

Contractor shall furnish the concrete pad for PENELEC transformer in accordance with PENELEC drawing #15E132 and Section 3A - Concrete.

4.2 Low Voltage Feeder

Contractor shall provide a low voltage feeder between the outdoor transformer secondary terminals and the incoming line breaker in the main building motor control center as shown on the drawings including wiring for the PENELEC instrument, transformers and recording meters.

5.0 TESTING

No additional tests beyond those normally employed either in manufacturing, installation or construction processes or as called for by the specified codes and standards are required under this Article.

6.0 INFORMATION TO BE SUBMITTED

There will be no technical information required in Bid Form.

Section 16C

Conduit System

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DIVISION 16

SECTION 16C

CONDUIT SYSTEM

1.0 SCOPE

This Specification Section includes furnishing and installing the conduit system complete, all as indicated on the drawings and described in the specification.

2.0 GENERAL

The routing and location of conduit runs are generally not dimensioned on the drawings, but shall be determined in the field to suit the actual locations of equipment, to conform to structural features and to avoid interferences with other systems and equipment.

2.1 Work to be Provided

The Work to be provided under this specification shall include furnishing and installing the conduit system complete as indicated on the drawings and described in this specification.

2.2 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of date of award, of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Material

All materials shall be new. Materials not otherwise specified shall be in conformance with the Electrical Materials List of the Underwriters' Laboratories, Inc., and the Codes and Standards herein specified.

3.2.1 Rigid Conduit

All electrical conduit, except underground conduit but including imbedded conduit, shall be full weight rigid steel hot-dipped galvanized inside and out. Underground conduit shall be of polyvinyl chloride of a type approved by Engineer. All conduit shall be furnished in manufactured lengths, threaded at both ends. Minimum conduit size shall be 3/4 inch unless otherwise shown specifically on the drawings or otherwise specified.

Approved couplers shall be used for connecting PVC conduit to galvanized conduit. Unless otherwise shown on the drawings, underground conduit shall be 2'-6" below grade.

3.2.2 Flexible Conduit

Flexible conduit shall be of the best grade interlocking spiral steel strip. The steel strips used in the construction of flexible conduit shall be thoroughly annealed and fully coated with metallic zinc or shall be protected with other approved rust-resisting coating. The interlocking spiral strip construction shall be such as to permit bending the conduit to a radius of 4 times its internal diameter without spreading the strips so that they will open on the outside of the bend or compressing them so that rough surfaces will result on the inside of the bend, or in any other way distorting or reducing the internal diameter of the flexible conduit at the bend. Flexible conduit used in moist locations, or locations subject to dampness shall be protected on the outside with a close-fitting polyethylene or polyvinylchloride jacket.

The interior and exterior of all the installed conduit shall be smooth and free from any burrs, sharp edges or other defects which may injure the wires to be pulled into the conduit.

3.2.3 Conduit Fittings

All conduit fittings shall be of the best grade cast or malleable steel galvanized except approved PVC fittings shall be used on PVC conduit. They shall be complete with gaskets and metal blank or nipple covers. Approved condulets shall be installed for conduits one and one-quarter (1-1/4") inches and larger. Running threads or nipples will not be allowed. Wherever the use of unions are necessary, threaded OZ split couplings or equal shall be used. Outlets shall be of ample size to permit pulling of cables without injury.

3.2.4 Outlet, Pull and Junction Boxes

Conduit boxes and fittings for exposed conduit work shall be unit or multiple gang cast metal, general purpose, indoor or outdoor as required, surface mounted enclosures with threaded conduit hubs and mating metal covers.

All outlet, pull and junction boxes and conduit fittings, except as otherwise indicated on the drawing shall be made of No. 10 gauge sheet steel (minimum) and have gasketed covers held in place by screws. All boxes, covers and fittings shall be protected on the inside and outside by galvanizing.

3.2.5 Cable Trays

The cable tray system for control cable and instrumentation cable shall be furnished and installed complete by Contractor including all fittings, hangers, supporting steel, hardware and bracing as described herein and shown on the drawings.

All cable trays shall be steel, hot-dipped galvanized after fabrication has been completed. Cable trays shall be of the expanded metal bottom type with solid metal side panels. Cable carrying depth shall not be less than three inches. All hangers, cross braces and hardware shall be hot-dipped galvanized steel. All bends, crosses, tees, offsets, takeoffs and risers shall be of the same make as the cable tray.

4.0 INSTALLATION

4.1 Preparation

Before installation, the interior of all conduits, conduit, bends and fittings shall be inspected and cleaned of all dirt, cuttings and other foreign material. Cut ends of conduit shall be reamed to remove burrs and sharp edges. No running threads will be allowed. All cut threads shall be thoroughly painted with a coating of red lead or other approved sealant.

4.2 Embedded Conduit

Embedded conduit shall be run as directly as possible from point to point, with a minimum of crossing and bending. No portion of conduit placed in concrete floor or slabs shall be less than two inches from the finished surface, except where the steel floor construction makes less cover unavoidable. In the latter case a minimum cover of one and one-half

(1-1/2) inches will be permitted. However, in specific cases where conduit locations are detailed and dimensioned in floors or walls, the drawings shall be followed. Conduits shall be firmly fixed in place by wiring to reinforcing steel or by other approved means to avoid being displaced during pouring of concrete. Under no circumstances shall reinforcing bars be tack welded, cut or drilled. Reinforcing bars shall not be bent to accommodate conduit except on prior approval of the Engineer.

Changes in direction of embedded conduit runs shall be made with sweep bends. Standard radius bends may be used for (a) turning out of thin slabs and (b) in other specific locations only on prior approval of Engineer.

Conduit boxes and enclosures embedded in concrete shall be securely attached to the forms to preclude movement during pouring, and shall be firmly anchored in the concrete. Conduit boxes and enclosures shall be complete with all connecting conduits, locknuts and external bonding jumpers, and shall be properly set in place before pouring concrete. All openings in conduit boxes through which concrete may leak shall be carefully plugged.

4.3 Exposed Conduit

Exposed conduit directions shall be horizontal, vertical and parallel or perpendicular to building column lines or walls, avoiding diagonal runs where possible. Conduits shall not be run closer than 18 inches from hot surfaces or pipes unless otherwise dimensioned on the drawings or approved by Engineer.

Conduits carried along walls, in or above ceilings or on steelwork shall be supported by galvanized steel clips or hooks, expansion bolts and hangers spaced not more than seven (7) feet apart when fastened to steel structures and not more than 5 feet apart when fastened to masonry.

Hangers for conduit banks shall be galvanized and of the type shown on the drawings or approved by Engineer.

Sleeves and openings for passage of conduit through walls and floors shall be provided in the course of building construction, where possible to foresee requirements. Contractor shall perform such additional cutting as found necessary, and shall patch the openings to match the original condition.

Contractor shall seal all conduit or duct sleeves or openings with concrete or other approved means indicated on the drawings. Unused openings or sleeves shall be similarly sealed.

Flexible conduit shall be used for all connections to motors or other equipment subject to vibration or wherever relative movement may occur. The length of the flexible connection between the rigid conduit and the equipment shall be sufficient to eliminate transmission of noticeable vibration to the rigid conduit system.

4.4 Bends

Ninety degree bends for conduits 1-1/4 inch size and larger shall be factory made. Other bends may be field fabricated by Contractor using approved bending tools. All bends shall be of radius permitted by the drawings and the National Electrical Code and construction conditions.

Conduit bends shall be of uniform radius and free from cracks, crimps, or other damage to the pipe or its coating, and shall not have the pipe sections reduced by more than 10 percent of the nominal cross-sectional area.

Changes in direction of a bank of exposed conduits shall maintain the uniformity and neat appearance of the group, allowing for the minimum acceptable bending radius of any one conduit in the bank.

4.5 Joints

Unless otherwise indicated on the drawings, all metal conduit joints shall be threaded, using standard couplings. Joints shall be made up tight to assure maintaining grounding continuity in service. Running threads and slip joints other than those on approved fittings shall not be used. Conduit runs which cannot be completed with standard joints shall be made up with threaded type conduit unions.

4.6 Capping

Ends of conduits shall be capped during construction.

4.7 Drainage

All conduits shall be installed in such a manner as to avoid entrapment of moisture. Where moisture or condensation in the conduit run will occur in exposed conduit above grade, Contractor shall drill a weep-hole on the bottom of the conduit at the lowest point in the run. Drilling shall be accomplished before the installation of cables.

4.8 Entrances to Enclosures

Enclosures for equipment ordinarily have provisions for conduit and cable entrance. Where required, however, Contractor shall perform additional drilling, tapping, cutting or welding for conduit and cable entrances as part of the normal work of installation. Unused openings in boxes shall be effectively closed.

Exposed or surface mounted boxes and enclosures shall be securely fastened to building structure, masonry or supporting steel. Where condensation is likely to occur, the surface mounted box or enclosure shall clear the mounting surface by at least one-half inch.

Conduit connections to general purpose enclosures shall be made with double locknut and bushing. The conduit bushings 1-1/4 inch trade size and larger shall be the insulating type.

4.9 Inspection

Contractor shall make certain that each conduit run is full round at bends, has no obstructions sharp edges or burrs and that its interior is clear. Contractor shall be responsible for any damage to cable pulled because of such defects and for replacement of damaged cable.

In case of any doubt as to the internal condition of the conduit, Contractor shall run a test mandrel, and if necessary a cutting mandrel which has the approval of Engineer through the conduit line.

4.10 Installation of Trays

The cable trays shall be installed as shown on the drawings. Alternate routes for cable trays must have prior approval of Engineer. The requirements listed under conduit installation herein covering hangers, inserts, sleeves, racks, supporting steel, drilling and anchors shall apply to the installation of cable trays. Cable trays shall be supported by cantilevered wall brackets sufficiently braced to prevent horizontal movement when ladders etc. are placed against trays. Maximum longitudinal spacing of supports shall be eight feet. Trays shall be supported at all bends, tees, crosses, dropouts, offsets, risers etc.

5.0 TESTING

No additional tests beyond those normally employed either in manufacturing, installation or construction processes or as called for by the specified codes and standards are required under this Article.

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted within 30 days after award of contract.

6.1 Drawings and Data

Contractor shall submit to Engineer for approval three (3) copies of drawings or lists showing size material and coating of pull boxes, junction and terminal boxes. Whenever Contractor desires to substitute a different but equivalent box, conduit fitting or hanger from that specified he shall likewise submit three (3) copies of drawings or lists displaying the same information to Engineer for approval.

SECTION 16D

INSULATED WIRE AND CABLE

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DIVISION 16

SECTION 16D

INSULATED WIRE AND CABLE

1.0 SCOPE

This Specification Section includes the furnishing, installing, connecting and testing of insulated wire and cable all as indicated on the drawings and described in the specification.

2.0 GENERAL

2.1 Work to be Provided

The Work to be provided includes the furnishing, installing, connecting and testing of insulated wire and cable as indicated on the drawings and described in the specification.

2.2 Work by Others

.1 Pennsylvania Electric Company (PENELEC) will furnish electric power to Owner for operation of the facility.

.2 PENELEC will supply and install the meter and pad mounted three-phase transformer for Owner outside the main building as shown on the drawings.

.3 Wiring and tests for the lighting and heating systems are specified in Section 16F - Lighting and Heating Systems.

2.3 Codes and Standards

The Work shall conform to the latest editions and latest addenda thereto, as of date of award, of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Material

Contractor shall furnish all wire and cable, and all

labor, material and tools for installing and terminating cables and wires such as pulling lines, swivels, winches, guide pulleys, connectors, insulating, fire proofing and copper tapes, solder, clamps, braces, supports, hardware, bushings, pulling compounds, identification tags, terminal blocks (other than provided on fabricated equipment) ground straps, ground copper serving material, and other material which may be required for the complete installation of cable and wire in accordance with the best modern practice.

3.1.1 Wire and Cable

Wire and cable of the following types, all in accordance with IPCEA Specifications shall be furnished:

Item G - 600 volt, single standard conductor, thermosetting chemically cross-linked polyethylene insulation or oil base rubber insulation such as Kerite, with PVC jacket. Current carrying capacity based on 75 C copper temperature. For use on 277/480 volt a-c, 120/208 volt a-c and 125 volt d-c grounded and ungrounded circuits.

Item H - 600 volt, multi-conductor, individual conductors, concentric round stranded copper, 75 C copper temperature chemically cross-linked polyethylene insulation or such as Kerite, individually color-coded polyvinyl chloride jacket overall for use on 120 volt a-c and 125 volt d-c grounded and ungrounded control circuits.

Wire for lighting branch circuits shall be single copper conductor, solid No. 10 or No. 12 AWG. All wire No. 8 AWG and larger shall be stranded. Control wire shall be 19/25 unless otherwise specified or shown on specification drawings. Control wire in cable trays shall be single conductor with PVC jacket. Wire for branch lighting circuits shall be 600 volt type RHW or THW.

3.1.1.1 Wire Sizes

Wire sizes shall conform to the National Electrical Code as a minimum requirement and no wire smaller than No. 12 AWG will be permitted for use unless specially shown on the drawings or used as a fixture wire. No. 14 AWG fixture wire is acceptable. Wire sizes indicated on the drawings represent the minimum size which will be accepted. The actual cable size of any

circuit as required under the applicable codes or ordinances shall also determine the minimum size of the conductor to be used.

3.1.2 Connectors

All connectors for wire and cable shall be solderless type. Connectors for wire sizes up to and including No. 6 AWG shall be the compression type, equivalent to Thomas & Betts Sta-Kon or Burndy Hylug, having an additional collar for clamping the conductor insulation. Wire nuts will not be permitted. For cable sizes No. 4 AWG and larger above, connectors shall be of either the compression or the bolted type with silver plated contact surfaces.

3.1.3 Tools

Tools for making compression connections shall be of a type which once an indent has been started cannot be opened until the indent has been properly completed.

3.1.4 Splices and Termination Materials

Cable splicing and terminating materials, such as tapes, fillers, adhesives, varnishes and the like, shall be of the type and grade recommended by the cable manufacturer for each class of cable.

4.0 INSTALLATION

4.1 Handling During Construction

Contractor shall store all cables in areas on buildings designated by Owner. Cables shall be protected from deterioration and damage both while being handled and while in storage.

Contractor shall prevent the entrance of water into the cables by keeping the ends sealed and shall seal ends cut during installation as soon thereafter as possible.

Cables shall be carefully handled when unreeling to avoid damage due to kinking or bending. Kinked cable shall be discarded.

4.2 Installing Cables in Raceways

Raceways shall be complete before wiring is installed. Cables shall be pulled into the raceways assigned on the drawings. No change in assignment shall be made without the written approval of Engineer.

Pulling of cables into conduits or other raceways shall be done with care to avoid damaging the cables. The reels shall be set up as close as practicable to the raceway entrance, and the cable shall be trained as directly as possible with a minimum amount of bending. A protector shall be provided at the raceway entrance to protect the cable jacket. Where several cables are to occupy one conduit they shall be pulled together.

Attachment of cable to the pulling line shall be by means of woven basket grips or by attachment directly to the conductors. Rope hitches shall not be used. A swivel connection shall be used with conductors of 250 MCM size and larger. Where moisture may enter the cable during pulling, the cable ends shall be sealed.

Where considered necessary a lubricant approved by the cable manufacturer may be applied.

Cable pulling tension shall not exceed the lower value of either that recommended by the cable manufacturer or the following:

<u>Conductor Size</u>	<u>Maximum Allowable Tension lbs.</u>
500 MCM	4,000
350 MCM	2,800
250 MCM	2,000
4/0 AWG	1,690
2/0 AWG	1,060
No. 1 AWG	670
" 2 "	530
" 4 "	330
" 6 "	210
" 8 "	130
" 10 "	82
" 12 "	52

When requested by Engineer, contractor shall furnish and use a calibrated dynamometer for observation of pulling loads. Observed tensions shall be recorded and reported to Engineer. Cables stressed beyond values recommended as safe by the manufacturer will be rejected and must be replaced as part of the work specified herein.

4.3 Installing Cables in Boxes, Trays and Cabinets

Open wiring in boxes, trays and cabinets, shall be arranged in a neat, orderly, manner. Single conductors which form one circuit shall be cabled together with waxed linen cord, T & B "Ty-Wraps", or approved equal.

4.4 Cable Bends

Cables shall not be bent either temporarily during installation or permanently to a radius less than the cable manufacturer's recommended minimum radius.

4.5 Cable Splices

Cables shall be continuous between circuit terminations or junction boxes and shall not be spliced except where indicated on the drawings. Where other splices are found necessary during installation, the approval of Engineer shall first be obtained before incorporating such splices. Splices shall be located only in large boxes, or where sufficient space is otherwise provided for the purpose.

The methods of splicing conductors, and the materials used shall be as recommended by the cable manufacturer for each class of cable.

4.6 Cable Terminations

Methods of making terminations shall generally be the same as prescribed for splices.

Control cables entering control boards and switchgear shall be formed out in a neat arrangement and secured with nylon cord or T & B "Ty-Wrap", into position at the terminal blocks. Attachment of wires to terminals shall be by means

of solderless connectors furnished by contractor for this purpose. Mere wrapping of wire around screw terminals will not be permitted.

4.7 Tags and Tagging

Cable identification tags shall be of strong non-conducting fiber, approximately one inch in size. The cable tag shall be provided with a hole for attaching it to the cable with cord. Cable numbers shall be stamped on one side of the tag. Tags shall be applied at each pull box and at each terminal having no identifying terminal block. No tags are required for branch circuits for lighting and heating.

All wiring shall be identified in accordance with the designations on the drawings. Individual conductors of a-c or d-c circuits shall also be identified as to phase or polarity.

4.8 Cable Sealing

Where cable raceways pass from heated to non-heated areas, interiors of raceways shall be sealed to prevent condensation. Sealing may be accomplished by applying rubber filler or other approved compound around the conductors at the termination or other accessible point in the run.

5.0 TESTING

5.1 Insulation Measurement Test Procedures

Electrical wiring and cables shall be meggered. Megger voltages shall be applied for one (1) minute at stable voltage, in accordance with procedure recommended in James G. Biddle Company, Manual No. 21-J and shall be as follows:

<u>Rated Circuit Voltage</u>	<u>Megger Voltage (DC)</u>	<u>Minimum Resistance in Megohms</u>
Up to 250 volts	500	10
251 to 600 volts	1,000	20

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted:

6.1 Data Sheets

Contractor shall submit to Engineer for approval three (3) copies of data sheets showing make, type and all standard technical information of wire and cables proposed for use.

SECTION 16E

GROUNDING

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DIVISION 16

SECTION 16E

GROUNDING

1.0 SCOPE

This Specification Section includes the furnishing, installing and testing of the electrical and equipment grounding system, all as indicated on the drawings and described in Specification.

2.0 GENERAL

2.1 Work to be Provided

The Work to be provided includes the furnishing, installing and testing of the electrical and equipment grounding system, all as indicated on the drawings and described in Specification.

2.2 Work by Others

.1 Pennsylvania Electric Company (PENELEC) will furnish electric power to Owner for operation of the facility.

.2 PENELEC will supply and install meter and pad mounted three-phase transformer for owner outside the main building as shown on the drawings.

2.3 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of date of award, of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 - Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 General

The outdoor grounding system shall consist of bare cable loops two (2) feet, minimum below grade, ground rods and ties.

3.2 Materials

All materials shall be new and in conformance with the Codes and Standards hereinbefore specified.

3.2.1 Ground Cables

Ground Cables shall be 4/0 annealed bare stranded lead covered copper wire conforming to ASTM Specification B189.

3.2.2 Ground Rods

Ground rods shall be sectional type 3/4-inch diameter copper-clad lead covered steel furnished in 10-foot lengths, as listed in the Electrical Materials List of the Underwriters' Laboratories, Inc. Ground rods shall be equipped with means for adding to their length by coupling.

4.0 INSTALLATION

4.1 Ground Rods and Ground Cable

Ground Rods shall be driven with a cap and driving stud, to refusal. The ground conductors shall be carefully laid with slack and buried to a minimum depth of two feet below finished grade.

All ground cable shall be carefully handled when installed to avoid kinking or cutting the conductors. All parts of the Grounding System shall be protected against damage during construction.

4.2 Concrete Embedded Grounding Conductors

Concrete embedded grounding conductors shall be installed with 1-1/2-inch minimum concrete cover. The exposed continuation shall be located for convenience in making the final connection and so as to provide maximum protection against damage. Sufficient length of conductor shall be provided to permit continuation without splicing. The length extending out of masonry shall be protected by boxing or an equivalent means. Conductors passing through foundation walls shall be sealed against water seepage.

4.3 Exposed Grounding Conductors

Exposed grounding conductors shall be run to conform to the surface over which they pass. Diagonal runs shall be avoided, the runs being horizontal, vertical and parallel to building walls or columns. Conductors shall be neatly and

securely fastened to the mounting surface without slack using galvanized malleable iron straps.

4.4 Splices and Taps

Conductors shall contain a minimum number of splices throughout each run. Grounding conductor splices and taps shall be made by the thermit weld process. The instructions of manufacturer shall be obtained and followed in welding connections. Contractor's employees who are to splice grounding conductors shall make three (3) welds per employee, prior to start of work. These welds will be inspected by Engineer for good joint fusion and that the joint cross-sectional area has not been reduced. Where an X connection is required, it shall be made with two (2) T connections spaced not less than 18 inches apart. Connections of cable to ground rod shall also be thermit welded. All welded joints shall be checked and inspected by Engineer for good fusion of joints and that the joint cross-sectional area has not been reduced, before being covered.

All splices and taps shall be coated with lead so that no copper shall be left exposed on splices, taps or cables.

4.5 Terminal Connectors

Connections of ground conductors to conduit shall be made with copper clamps or straps or by grounding bushings. Ground connections to piping shall generally be welded or brazed. Non-conductive protective coatings such as paint or enamel on the conduits or fittings shall be removed from the threads or contact surfaces before attaching grounding connection. After ground connection is attached, any exposed bare metal shall be covered again with a coating matching the original coating.

The ground loop shall be connected to a separate ground bus bar in the motor control centers.

Building columns (as shown on the drawings) shall be connected to the ground loop by means of a No. 4/0 AWG bare stranded lead covered copper cable.

All thermit welded ground connections shall be made by the use of exothermic-type welding processes such as Cadweld process, or equal. All other grounding connections shall be made with cast copper alloy clamp-type lugs.

4.6 Equipment Grounding

All motor frames, panelboard housing, metallic conduit, cable trays, tanks, conveyors or elevators and other equipment shall be connected to the grounding system in accordance with the National Electrical Code and as indicated on the specification drawings.

5.0 TESTING

Contractor shall measure the ground resistance of the first completely driven ground rod before connecting it to the ground grid. Contractor shall inform Engineer for acceptance of the results of this measurement right after the measurement is made. Upon completion of the entire grounding system at the site, including all necessary connections and backfilling, Contractor shall measure the ground resistance at locations designated by Engineer. Such resistance measurements shall not exceed 5.0 ohms. If this value is exceeded, Contractor shall drive additional ground rods up to a maximum of three (3) rods for each location. If, however, a ground resistance of 5.0 ohms cannot be achieved by this method, Engineer shall be notified immediately. Ground rods shall not be installed less than ten feet apart.

Measurements shall be made with the J. B. Biddle Company, ground tester, or approved equal. All measurements and tests shall be witnessed by Engineer.

6.0 INFORMATION TO BE SUBMITTED

6.1 Drawings and Data

.1 Contractor shall submit to Engineer for approval a definitive list of the material and devices he proposes to use within 30 days after award of contract.

.2 Contractor shall furnish Engineer with six (6) copies of drawings showing location of cable runs, junctions and ground rods as installed within 5 days after award of contract.

Section 16F

Lighting and Heating Systems

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DIVISION 16

SECTION 16F

LIGHTING AND HEATING SYSTEMS

1.0 SCOPE

This Specification Section includes the furnishing, installing and wiring of the lighting and heating systems complete, all as indicated on the drawings and as described in this Specification. This work includes the initial lamping of the lighting system.

2.0 GENERAL

2.1 Work to be Provided

Contractor shall furnish all materials and labor and shall install a complete lighting system and electric heating system in accordance with this Specification and its drawings.

2.2 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of date of award of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 - Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Materials

All materials supplied for the lighting and heating systems shall be new and of the types specified on the drawings, except where substitutions are specifically approved by Engineer. Materials shall be in conformance with the Electrical Materials List of the Underwriters' Laboratories Inc., and the codes and standards hereinbefore specified.

3.1.1 Conduit

All conduit for the lighting and heating systems shall be furnished and installed in accordance with Section 16C of this Specification.

2.2.2 Ballasts

Ballasts shall be of the high power factor type and shall be provided with built-in thermal overload protection. Ballast fill material shall be of the thermo-setting type not subject to softening or liquifying under any condition of operation or failure of ballast.

2.2.3 Fixtures

Fixtures shall be furnished in accordance with the details and types indicated on the drawings.

2.2.4 Lamps

Fluorescent fixtures shall be lamped with cool white rapid start lamps. Incandescent fixtures shall have standard bulbs.

2.2.5 Receptacles

Receptacles for 120 volt circuits shall be rated for a continuous current capacity of 15 amperes.

Receptacles for 480 volt, 3 phase, loads shall be rated for 60 amperes, 3 wire, 4 pole with fourth pole for ground, in weathertight construction with flap covers, equal to Crouse-Hinds AREA 6425.

In wet areas and outdoors convenience outlets shall be watertight or weatherproof as shown on the specification drawings.

2.2.6 Safety Switches

Safety switches, both fused and non-fused types, shall be General Electric's premium heavy duty, Style A or approved equal, with 600 volt rating for 277/480 volt service, and 240 volt rating for 120/208 volt service. Switches shall be equipped with quick make-quick break mechanisms. Switch enclosures for outdoor service shall be NEMA Type 3R.

2.2.7 Outlet Boxes

Indoor lighting fixture outlet boxes shall be galvanized, 4 inches in diameter and 1-5/8 inches deep. Other boxes shall be as specified in Section 16C herein.

2.2.8 Lighting and Small Power Transformers

Contractor shall furnish, install and connect, as shown on the Specification drawings, three (3) dry-type transformers rated at 45 kva, 480 volt delta primary, 120/208 volt wye secondary, 4 wire, with at least two 5 percent FCBN taps on the primary. The transformers shall be for indoor use and shall be for wall mounting. Transformers shall be manufactured by Westinghouse, General Electric, Sorgel Electric Company or approved equal.

The transformers shall be provided with Class B or Class H insulation. Transformers shall be factory tested for conformance with the NEMA and ANSI Standards and shall have a maximum noise level of 45 decibels above a standard 24 decibel noise level of an anechoic test chamber as determined by NEMA Standards.

The transformers when fully loaded at rated voltage shall have a maximum allowable temperature rise, as measured by resistance of 80C over an ambient of 40C for Class B, or 125C over 40C for Class H insulation.

To ensure vibration free operation, the transformer shall be isolated from the wall by an external vibration-absorbing device. This device shall incorporate a leveling adjustment and shall be "Elasto-Nib Damper" as manufactured by the Korfund Company or approved equal.

2.2.9 Clocks

Contractor shall furnish and install three (3) clocks one each in the Chemical Laboratory, Office, and Machine Shop as shown on the drawings.

The clocks shall be of the self-starting, synchronous motor type with convenient external setting devices. They shall have black Arabic numerals and hands over a white face with convex glass covers. The dials shall be 12 inches in diameter.

The clock receptacles shall be Hubbell Catalog No. 7707 or approved equal.

2.2.10 Wall Switches

Wall switches shall be of the tumbler type, rated at 15 amperes, 250 volts, single pole or multi-way.

4.0 INSTALLATION

4.1 Lighting System

Installation of lighting system conduit, wire, lighting fixtures, switches and related materials shall comply respectively with the applicable requirements specified elsewhere in the specification.

Fixtures shall be installed complete with outlet box or conduit fitting, stems and all necessary mounting hardware. Fixtures shall be located as shown on the drawings, except where changes in location are necessary or desirable. Such changes shall be made subject to the prior approval of Engineer.

Boxes shall be fastened consistent with the type of building construction used in a particular area. Only those knockouts which are to be used shall be opened.

Unless otherwise shown on the drawings, convenience outlet boxes shall be mounted 18 inches above the floor or grade; power receptacle boxes shall be mounted three (3) feet above the floor or grade; and switch boxes and lighting panels shall be mounted 4 feet 6 inches above the floor or grade.

4.1.1 Lighting System in Hung Ceilings

Holes for lighting fixtures in hung ceilings are provided in Division 9 herein. Conduit above hung ceilings shall be supported from building steel.

4.2 Heating System Installation

Installation of heating system shall be in accordance with the applicable requirements of Specifications 16D and 16E of the Specification covering conduits and wiring and shall be in accordance with heating equipment manufacturer's instructions and recommendations.

4.3 Lamping

A full compliment of new lamps shall be installed and their operation checked after completion of field testing.

5.0 TESTING

5.1 Factory Tests

Contractor shall forward to Engineer six (6) certified copies of the results of factory testing of transformers 20 days prior to installation.

5.2 Field Tests

Lighting and heating system including their accessory equipment shall be subjected to a "Megger" test of insulation resistance in accordance with the applicable requirements of Article 5.0 Testing, of Specification Section 16D - Insulated Wire and Cable.

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted.

6.1 Drawings and Data

.1 Contractor shall furnish 3 copies of drawings or lists showing type dimensions and make of lighting fixtures and heating equipment offered for Engineer's approval 30 days within award of contract.

.2 Contractor shall furnish Engineer with six (6) certified copies of transformer data within 20 days prior to installation including.

- a. Complete nameplate
- b. Overall dimensions and mounting details

.3 Contractor shall furnish Engineer with six (6) copies of test data requested in Article 5.1 Factory Tests above.

Section 16G

Panelboards

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DIVISION 16

SECTION 16G

PANELBOARDS

1.0 SCOPE

This Specification Section includes the furnishing, installing, connecting and testing of the panelboards as indicated on the drawings and described in the specification.

2.0 GENERAL

2.1 Work to be Provided

The Work to be provided includes the furnishing, installing, connecting and testing of the panelboards, all as indicated on the drawings and described in the specification.

2.2 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of date of award, of the codes and standards as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 - Codes and Standards.

3.0 DETAILED REQUIREMENTS

Panelboards

Power panelboards and lighting panelboards shall be equipped with the number and current rating of branch circuits as shown on the drawings. An uninsulated ground bus shall be provided in power panelboards. Panelboards shall include all hardware, accessories, and mounting steel.

Panelboard bus work shall be of copper, mounted on insulation having high dielectric strength and low moisture absorbing properties. The incoming supply shall have a 3 - pole circuit breaker on the panel board.

A typewritten directory of the branch circuits shall be installed inside each panelboard door. The directory shall be mounted in a brass frame under glass.

Panelboards shall be those manufactured by General Electric ITE, Square D Co. or Westinghouse Electric Corp.

3.2 Boxes, Trim and Doors

Boxes shall be fabricated of No. 16 gauge (minimum) sheet steel, hot dipped galvanized after forming.

Boxes shall have at least a four inch wiring gutter all around.

Doors and trim shall be made of at least No. 12 gauge sheet steel, suitably stiffened.

Trim and gutter covers shall be attached to the box by means of machine screws.

Doors shall be flush with the trim.

Doors shall have paracentric lock.

3.3 Branch Circuit Protective Devices

Panelboards for 277/480 volt, 3 phase service shall be equipped with Westinghouse type HFB or approved equal, molded case circuit breakers having 1, 2 or 3 poles, as required. Interrupting ratings at 277 and 480 volts shall be at least 25,000 amperes symmetrical and 30,000 amperes asymmetrical.

Panelboards for 120/208 volt, 3 phase service shall be equipped with molded case circuit breakers having 1,2 or 3 poles, as required. Interrupting ratings at 120 and 208 volts shall be at least 7,500 amperes asymmetrical.

Panelboards for temporary light and power service can be of the fusible switch type equipped with current limiting fuses.

4.0 INSTALLATION

Contractor shall mount panelboard boxes, install the panelboards including doors and trim and complete the external connections. External connections shall be in accordance with the requirements specified in Specification Section 16C and 16D of this specification.

5.0 TESTING

Contractor shall demonstrate that each panelboard shall have all of its branch circuits, other than the spare circuits, in an operable condition. Circuit breakers for spare circuits shall be tested for satisfactory operation.

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted within 30 days after award of contract.

6.1 Drawings

Contractor shall furnish Engineers with prints of drawings showing overall dimensions, gutter width, voltage, designation and trip setting of circuit breakers.

Section 16H

Motors

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DIVISION 16

SECTION 16H

MOTORS

1.0 SCOPE

This Specification Section includes the furnishing, installing, connecting and testing of the motors all as indicated on the drawings and described in the Specification.

2.0 GENERAL

2.1 Work to be Provided

This Specification Section includes the furnishing, installing, connecting and testing of the motors all as indicated on the drawings and described in the Specifications.

2.2 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of the date of award, of the codes and specifications as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 - Codes and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Service Conditions

Motors shall be full voltage starting type and shall have torque characteristics suitable for the driven load. All motors shall be able to start fully loaded and accelerate promptly to rated speed with only 80% of motor rated voltage at the motor terminals.

In sizing motors, no portion of a motor's service factor above 1.0 shall be used in continuous operation of the motor.

3.2 Type

Alternating current, 3 phase motors shall be full voltage start, and of the squirrel-cage induction type unless otherwise specified or shown on the specification drawings. Single phase motors shall be capacitor start, induction run type.

3.3 Enclosures

Unless otherwise specified herein or shown on the drawings of this Specification indoor motors shall have open drip-proof enclosures, all outdoor or agitator or pump motors shall have totally enclosed, fan cooled enclosures.

3.4 Insulation

Motors shall have Class B insulation and have a continuous temperature rise of 50 C for drip-proof motors and 55 C for TIFC motors.

3.5 Voltage Ratings

Alternating current motors sized from 1/2 to 200 horsepower shall be rated at 460 volts, 3 phase, 60 Hz and motors sized 1/3 horsepower and smaller shall be rated 115 volts, single phase, 60 Hz unless otherwise shown on the Specification Drawings.

3.6 Stator Winding Temperature Switches

Three phase alternating current motors of 5 horsepower and smaller shall be equipped with a thermal switch built into the motor. The switch shall have contacts which open on high winding temperature. The device shall be similar to General Electric's "Thermotector" or Westinghouse's "Thermoguard."

3.7 Terminal Boxes

Connection boxes of the split type shall be furnished for each motor. Separate connection boxes shall be furnished for power connections, space heaters and temperature detectors.

3.8 Heaters

Space heaters shall be provided in drip-proof motors 5 hp and larger. Outdoor motors 5 hp and larger and indoor TIFC motors 20 hp and larger shall be provided with space heaters. The space heaters shall be rated at 115 volts single phase. Space heater leads shall be brought out to a connection box that is separate from the one for the motor leads.

3.9 Finish

Motor finish and paint shall be of the rust inhibiting type, and in accordance with manufacturer's standard.

3.10 Manufacturers

Motors shall be those manufactured by Allis-Chalmers, Electric Machinery, Electro Dynamics Division of General Dynamics, General Electric, Westinghouse or approved equal.

4.0 INSTALLATION

Contractor shall align motors on dead center within the tolerances specified by the driven equipment manufacturer, and with uniform air gap and correct magnetic centering.

5.0 TESTING

5.1 Preparation

Rotating parts shall be turned over by hand to make sure they are free, and the operating clearances checked. All ventilating openings and other parts shall be free from obstructions, dirt and other foreign substances. Contact surfaces shall be thoroughly cleaned. Lubrication shall be provided and checked.

5.2 Insulation Resistance

Motors shall be meggered in accordance with method detailed in Specification Section 16D INSULATED WIRE AND CABLE. For three phase induction motors, the insulation resistance shall be measured between the three stator phases connected together and ground, and phase to phase among the three phases. All readings of insulation resistance and corresponding temperatures shall be recorded and promptly given to Engineer. Normal voltage shall not be applied to any machine before it has been meggered and clearance given by Engineer for application of line voltage.

5.3 Direction of Rotation

Contractor shall test check that direction of rotation of all motors is correct. Contractor shall make changes to obtain the correct rotation.

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted within 30 days after award of contract.

6.1 Motor List

Contractor shall furnish Engineer with three copies of motor list showing make and type of motors to be furnished by Contractor, for Engineer's approval.

6.2 Drawings

Contractor shall furnish Engineer with six (6) certified copies of motor dimension sheets showing mounting details and outline dimensions for all motors furnished by Contractor.

Section 16I

Motor Control Centers, Motor Controls

Motor Starters and Motor Disconnect Switches

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DIVISION 16

SECTION 16I

MOTOR CONTROL CENTERS, MOTOR CONTROLS

MOTOR STARTERS, AND MOTOR DISCONNECT SWITCHES

1.0 SCOPE

This Specification Section includes the furnishing, installing, connecting and checkout of the motor control centers, motor controls, starters, disconnect switches and other switching and control equipment, all as indicated on the drawings and described in the Specification.

2.0 GENERAL

2.1 Work to be provided

The Work to be provided includes the furnishing, installing, connecting, and testing of the motor control centers, motor controls, starters, disconnect switches and other switching and control equipment, all as indicated on the drawings and described in the specifications.

2.2 Codes and Standards

The Work shall conform to the latest edition and latest addenda thereto, as of the date of award, of the codes and specifications as specified in Section 16A - General Technical Requirements for the Electrical Work, Article 2.3 - Code and Standards.

3.0 DETAILED REQUIREMENTS

3.1 Motor Control Centers

Contractor shall provide and install in the Electrical Equipment Room a central control center of a self-supporting, dead-front, back to back type, totally enclosed and having standard modular dimension units.

In addition to the above, Contractor shall provide and install in the Pump House a central control center of a self-supporting, dead-front, totally enclosed type having standard modular dimension units.

Enclosures for both above items shall be NEMA Type I.

The complete motor control centers shall each contain a main incoming line circuit breaker, combination type motor starters and other components of size, type and rating as shown on the drawings. Where required or as shown on the drawings, start-stop push buttons, indicating lights and/or selector switches shall be provided in the cover of the respective motor starter sections.

Motor control center interior wiring shall be NEMA Class 1, type B. Control centers shall be furnished factory wired and complete with wiring gutters, copper bus and a copper ground bus and other control devices as shown on the drawings.

All motor starters and circuit breakers shall be front mounted and shall be easily accessible for maintenance, repair or replacement.

Each circuit breaker handle shall have features for padlocking the breaker in the open position.

3.2 Circuit Breakers

Circuit breakers shall be of the molded-case type, manually operated. Breakers shall be of the sizes shown on the drawings and shall have a minimum of 25,000 amperes symmetrical and 30,000 amperes asymmetrical interrupting capacity at 480 volts. The breakers shall have bimetallic thermal trip elements. They shall be easily removeable as complete units for repair or replacement. The circuit breakers shall have positive trip-free operation. Automatic tripping shall be indicated by handle assuming a midway position between the "ON" and "OFF" position on a target.

3.3 Motor Starters

All 3-phase motors shall be controlled by non-reversing, across-the-line circuit breaker combination-type magnetic starters except as otherwise specified herein. Reversing type controllers shall be supplied where indicated on the specification drawings. No starter shall be smaller than NEMA Size 1 without written approval of the Engineer.

Each starter shall have overload trips in each phase with manual reset and cutout contacts wired into the hot leg of the starter operating coil. A 440/110-volt single-phase control transformer of sufficient capacity to hold the starter in the closed position at 75 percent of rated voltage shall be provided for each starter. Operating coils shall be suitable for continuous service on 110 volts 60 Hz. Each starter shall be equipped with auxiliary contacts of the convertible type as called for on the drawings. Each starter shall be an integral component of a motor control center as specified hereinbefore except where indicated otherwise on the drawings.

All single-phase 120 volt motors shall be controlled by manually operated starters. Starters shall be mounted locally where indicated on the drawings. Single or double-pole tumbler switches specifically designed for alternating current operation and with thermal overload cutout elements may be used as controllers if the current rating is at least 125 percent of motor full load current rating.

3.4 Pilot Devices

Devices such as, push buttons, selector switches, etc. shall be of the heavy-duty, oiltight type with convertible contacts. Indicating lights shall be of the heavy-duty, transformer type.

3.5 Motor Disconnecting Means

Contractor shall provide each motor with a disconnecting means as required by the National Electrical Code even though not indicated on the drawings. For single-phase motors, a toggle switch will be acceptable provided the ampere rating of the switch is at least 125 percent of the motor rating. Enclosed safety switches shall be horsepower rated. Switches shall disconnect all ungrounded conductors.

4.0 INSTALLATION

Starters, motor disconnect switches and control devices except those located in the motor control centers, shall be fastened to adjacent walls or columns. Where no such support is available, Contractor shall fabricate a stand using galvanized steel angles or Unistart. The angles or Unistart members forming the stand shall be of sufficient cross-sectional area to result in a rigid structure.

5.0 TESTING

On completion of wiring of each starter and its associated motor, Contractor shall check the correctness of the wiring, control and operation.

6.0 INFORMATION TO BE SUBMITTED

The following information and data shall be submitted within 30 days after award of contract.

Drawings

Contractor shall submit to Engineer for approval, drawings showing outline and mounting dimensions, compartment and instrument locations and internal wiring diagrams of each motor control center, starter and motor disconnecting switch.

Section 16J

Temporary Power and Light

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DIVISION 16

SECTION 16J

TEMPORARY POWER AND LIGHT

1.0 SCOPE

This Specification Section includes furnishing and installing the temporary construction power and lighting system.

2.0 GENERAL

2.1 Work to be Provided

The work to be provided shall be to furnish equipment, material and installation of temporary power and lighting for construction services.

2.2 CODES AND STANDARDS

The equipment, material, and installation of the temporary power and lighting system shall conform to the latest edition and latest addenda thereto, as of date of award, of the following applicable codes, regulations specifications and standards:

- .1 National Electrical Code
- .2 Commonwealth of Pennsylvania Codes and Regulations:
 - a. Electric Safety Regulations Department of Labor and Industry
 - b. Regulations for Protection from Fire and Panic
- .3 Underwriters Laboratories Inc.

3.0 DETAILED REQUIREMENTS

3.1 General

Contractor shall provide and install the temporary facilities including grounding and light bulbs for construction power and lighting and shall furnish all electric energy used for temporary construction power and lighting, all as required under paragraphs 0-1e, page 1C - GC21 of the GENERAL CONDITIONS of this Specification.

Pennsylvania Electric Co. (PENELEC) presently has a 4,160 volt pole line running past the site which probably will be the most convenient source of temporary power.

3.2 Temporary Indoor Lighting

Contractor shall provide temporary indoor lighting in the Pump House and Main Building for construction purposes.

3.3 Lighting Coverage

Construction indoor lighting shall be as directed by Engineer and shall be arranged generally on 20' centers in the buildings, with one 100 watt incandescent bulb for every 20 square feet of floor area. Mounting height shall not exceed 10 feet.

3.4 Lighting Control

Lights shall be switched from a central location, preferably at the power distribution point.

3.5 Circuit Protection

Entrance circuit to panelboards shall be fused. Each branch circuit shall be fused or have circuit breaker protection.

3.6 Required Circuits

Contractor shall furnish a distribution panelboard having as a minimum the following circuits:

- .1 Four (4) - 460 volt 3 \emptyset , 5 hp to 30 hp circuits as directed by Engineer and as necessary for checkout and testing of motors, pipe welding, stress relieving, etc.
- .2 Sixteen (16) - 115 volt, 1 \emptyset branch circuits for lighting, small tools and construction trailers.

4.0 INSTALLATION

Clearance of overhead or underground lines of the temporary power and lighting system shall be in accordance with the above codes and regulations for temporary electric facilities.

5.0 TESTING

No additional tests beyond those normally employed either in manufacturing, installation or construction processes or as called for by the specified codes and standards are required under this Article.

6.0 INFORMATION TO BE SUBMITTED

There will be no technical information required with the Bid.