

PART 1 - GENERAL:

1-1 WORK INCLUDED

- A. The requirements of this section apply to all the sections within Division 16. Applicable requirements of all of these Specifications shall apply to electrical work.

1-2 SYSTEM DESCRIPTION

A. General:

1. Complete Functional and Operable Systems:

- a. All specified parts, materials and functions.
- b. All detailed systems, equipment, power and controls.
- c. Ready for use.
- d. Final sizing is dependent on equipment selected by the Contractor.
- e. Ratings indicated on the electrical drawings are for guidance only and do not limit the equipment size.

2. Electrical Systems to be Installed:

- a. 480 volt, 3-phase, 3-wire, 60 Hz, distribution.
- b. 208/120 volt, 3-phase, 4-wire, 60 Hz, distribution.
- c. 120 volt receptacle system
- d. 208/120 volt lighting system
- e. Grounding system
- f. Conduit system for telephone system
- g. Temporary lighting, power and telephone facilities during construction.

B. Labor, Services and Skilled Supervision:

1. Complete Electrical Construction, Erection, Installation and Connection:

- a. Materials and equipment specified in this section.
- b. Related materials and equipment necessary to complete a system.
- c. Wiring equipment specified in other divisions.

2. Adjustment and Testing:

- a. Simulate system operation.
- b. Proper system operation.
- c. Proper control settings for limit switches, flow and pressure devices, and valve actuators.
- d. System electrical integrity.

(1) Continuity

- (2) Insulation resistance
- (3) Ground
- C. Materials and Equipment
 - 1. Specified in this Division.
 - 2. Necessary to complete the Systems.
 - 3. For equipment specified in other Divisions.
- D. Costs Billed by Private or Public Utilities as Service Charges included in Contract price.
 - 1. To extend or connect, the electric or communications supply system.
 - 2. Temporary power used during construction.
 - 3. Metering installation.
- E. Permits and Inspection Certificates:
 - 1. State electrical.
 - 2. Municipal electrical.

1-3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 13450: Instrumentation and Control
- B. Section 16050: Basic Electrical Materials and Methods
- C. Section 16060: Grounding
- D. Section 16120: Equipment Connections
- E. Section 16130: Feeder and Branch Circuits
- F. Section 16270: Dry Type Transformers
- G. Section 16500: Lighting

1-4 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- A. Submit in accordance with Section 01330: Submittals.
- B. Shop Drawings and Data: Submit complete assembly, foundation, and installation drawings together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of equipment, including, but not limited to:
 - 1. Motor control centers (variable frequency drive motor controllers).
 - 2. PLC controllers, control devices and power supplies.
 - 3. Remote control system.
 - 4. Ground conductors, rods.
 - 5. Conductors, 600 volt.
 - 6. Junction boxes, one cubic foot and larger.
 - 7. Automatic transfer switch (ATS)

8. Standby generator

1-5 WARRANTY

- A. Except lamps.
- B. Free of defects.
- C. Function properly.
- D. Manufacturer's warranty time and coverage shall be included with bid.

PART 2 - PRODUCTS:

2-1 CODES, ORDINANCES, STANDARDS AND PERMITS

- A. Compliance with codes applicable to the Work:
 1. Comply with all local and state codes and regulations.
 2. In case of conflict between Contract documents and governing codes, the most stringent shall take precedence.
 3. Where Contract documents exceed minimum code requirements, Contract documents take precedence.
 4. No extra payment will be allowed for work or changes required by local code enforcement authorities.
- B. Apply for, obtain and pay for all required permits and inspection certificates.
 1. Arrange for all inspection by permit enforcing agencies.
 2. Deliver all permit compliance documents to COR.
- C. Underwriters Laboratories (UL) labels shall apply to:
 1. All materials and devices, etc.
 2. Except specified items not covered by existing UL standards.
- D. Conflicts with applicable regulations
 1. Resolve at Contractor's expense.
 2. Prepare and submit details of alternate construction:
 - a. Acceptable solution of conflict.
 - b. List of substitute materials:
 - (1) For approval of inspecting authorities.
 - (2) For approval of COR.

2-2 IDENTIFICATION

- A. Conductors:
 1. Color code:

- a. Continuous jacket color.
 - b. Colored tape wrap at each end and each intermediate junction box.
 - c. Plastic adhesive tape at each end and each intermediate junction box.
2. Conductor numbers or letters and numbers:
 - a. Laminated composition or plastic disc (floaters) with string loops. Hot stamped sleeves. Identify same at each end in the control panel and the device, and each intermediate junction box.
 - b. Correspond to design drawing. Prepare as-built record drawing identifying conductor numbers as installed.
 3. Phase color code:
 - a. NEC as applicable.
 - b. Each phase separate color or color taped.
 - c. Each circuit voltage separate color.
- B. Terminal Strips:
1. Identify each conductor:
 - a. Conductor number, or,
 - b. Function, or,
 - c. Serial number.
 2. Provide terminal strips in all junction boxes terminating four or more conduits with #10 and smaller wire.
- C. Equipment Without Terminal Strips:
1. Identify each connection point:
 - a. Tape on equipment body beside terminal screw.
 - b. Tape or tag on conductor.
 - c. Correspondence with conductor number.
 - d. Do not cover manufacturer's contact numbers on equipment.
- D. Panelboards and Control Centers, Disconnects and Circuit Breakers:
1. Phenolic Name Plates:
 - a. Black lettering scribed on white background.
 - b. Identify purpose, use, pertinent characteristic (volts, phase, etc.)
 - c. Motor or equipment being controlled.
 2. Breaker Panel Circuit Schedule:
 - a. Remove or furnish directory card.
 - b. Type neatly assigned circuit use.
 - c. Replace in panel.

3. Auxiliary Relays and Components:
 - a. Identify corresponding to drawings.
 - b. Typed data adhesive tape.
 4. Control and Visual Indicating Devices:
 - a. Identify corresponding to drawings.
 - b. Use standard nameplate or engraved legend as required.
- E. Equipment Identification:
1. Name and number if more than one similar unit:
 - a. Phenolic engraved nameplate or etched or engraved anodized aluminum.

PART 3 - EXECUTION:

3-1 INSPECTION OF SITE

- A. Each bidder shall thoroughly inspect the site and existing conditions affecting the work prior to bidding.

3-2 CONTRACT DRAWINGS ESSENTIALLY DIAGRAMMATIC FOR CLEARNESS AND LEGIBILITY

- A. Equipment shown in desired location.
- B. Size and location shown to scale wherever possible, but is approximate unless dimensioned.
- C. Contractor compare all available data to refine location.
- D. Verify information and dimensions at building site.
- E. Install all work to conform to structure and equipment.
- F. Avoid obstructions.
- G. Preserve headroom and working clearances.
- H. Keep openings and passageways clear.
- I. Make accessible all equipment requiring inspection and maintenance.

3-3 PROTECTION, CARE AND CLEANING

- A. Protect materials before and after installation against moisture, dirt and damage.
- B. At all times, keep the premises clear of undue accumulation of rubbish.
- C. On completion of the work, remove all rubbish and debris resulting from this Contract and dispose of same.
- D. Equipment and fixtures shall be thoroughly cleaned and left in a satisfactory condition for use.
- E. Provide temporary heat in motors and electrical panels, control centers and enclosures to eliminate condensation until installations are placed in normal service.

- F. All electrical equipment and fixtures shall be installed in a manner to meet the requirements of a Seismic Zone 3 area.

3-4 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEM

- A. Contractor to provide assistance for inspection:
1. To COR.
 2. To State or local permit inspectors.
 3. To utility company inspections.
 4. At all times as requested:
 - a. Remove covers.
 - b. Operate machinery.
 - c. Continuity tests.
 - d. As necessary to demonstrate quality and adequacy.
- B. Operate each:
1. Generator and manual transfer switching system.
 2. Feeder and branch circuits.
 3. Panelboard circuits.
 4. Motor controls and motors.
 5. Control systems.
 6. Electric controls on installed mechanical and UV equipment.
 7. Remote and local control and alarm systems.

3-5 TESTS

- A. General:
1. Perform all tests as outlined.
 2. Additional tests as may be necessary to establish:
 - a. Adequacy to perform function.
 - b. Quality of workmanship.
 - c. Safety.
 - d. Completeness.
 - e. Suitability.
 3. Provide test labor materials and tools.
 4. Advance timely notification of test schedules.
 5. Correct promptly any failure or defects revealed by test.
 6. Retest or transient conditions test may be required in critical cases as required by COR.

B. Driven Ground Rod Resistance Test:

1. Immediately after installation.
 - a. Each rod individually.
 - b. Combined resistance when 2 or more in group.
2. Maximum 25 ohms at point of system connection.
3. Report contain:
 - a. Date of test.
 - b. Soil conditions.
 - c. Measured resistance.
 - d. Submit at once.

C. Wiring Tests:

1. Continuity.
2. Proper wire size:
 - a. Insulation resistance measured by DC 2000 volt megger:
 - (1) All circuits including services.
 - b. Circuits 600 volts or less:
 - (1) 1,000,000 ohms to ground minimum.
 - (2) Except circuits over 50 amperes with:
 - (a) All served devices except fluorescent fixtures connected,
 - (b) All incandescent lamps removed, motor terminals disconnected,
 - (c) Panelboards and switchboards with switches closed,
 - (d) 300,000 ohm to ground minimum.
 - (3) Insulation between ungrounded conductors not less than 1.5 times minimum insulation to ground.

D. Equipment Tests:

1. Operating amperes:
 - a. Each motor:
 - (1) Measure and record each phase.
 - (2) Equal or less than name plate rated current at 1.0 service factor.
 - b. Each panel and load center:
 - (1) Measure and record input each phase.
 - (2) Balance phases by reconnection.
 - (3) Maximum variation ± 10 percent between phase current and average.
 - c. Power transformers for each UV system:

- (1) Measure and record each phase at 25, 50, 75, and 100 percent loads.
 - d. Dry type lighting and supply transformers:
 - (1) Measure and record each phase.
- E. System Tests:
1. Service voltage: Measure voltage at the service entrance. Voltage shall be within service range A as defined by ANSI/IEEE C84.1.
 2. Utilization Voltage: Measure voltage at each load of 5 kVA or greater. Other voltage measurements shall be taken as required by the COR. Voltage shall be within utilization range A as defined by ANSI/IEEE C84.1.
 3. Voltage balance:
 - a. Maximum 1 percent unbalance at full load.
 - b. Cooperate with utility to achieve balance within limits.
 - c. Rearrange single phase loads.
 - d. Unbalance definition for 1 percent:
 - (1) 100 times the sum of the deviation of the three voltages from the average voltage divided by the average voltage.
 4. Harmonic Distortion: Transient or Non-linear Conditions: Where there is reason to believe that harmonic distortion transient or non-linear conditions may exist in the UV system or variable frequency drives, causing the system operating parameters to exceed the observed limits specified in the above performance criteria. Perform tests utilizing recording instruments to establish the existence of these conditions and effectiveness of corrective action taken.
- F. Electrical System Test Reports:
1. Indicate all tests performed.
 2. Demonstrate conformance with performance criteria.
 3. Note corrections made to meet performance.
 4. Consult COR on report format.
- G. Motor Test Reports:
1. Consult COR on report format.
 2. Provide information on each motor 1/3 horsepower and larger:
 - a. Motor use.
 - b. Location.
 - c. Duplicate of motor nameplate, or tabulation of complete name plate data.
 - d. Measured full load current phase A, B, C.
 - e. No-load voltage phase AB-BC-CA.
 - f. Full-load voltage phase AB-BC-CA.
 - g. Feeder conductor insulation resistance phase-to-phase and phase-ground.
 - h. Control circuit function.

- i. Rotation direction from drive end.
- j. Variable frequency drive measured voltage for total harmonic distortion as defined by IEEE 519.

3-6 RECORD DRAWINGS

- A. One Complete Set Blue Line Prints Provided:
 1. Keep separate and clean.
 2. Reserve for complete picture of work actually installed.
 3. Serve as work progress report sheets.
 4. Notations made neat and legible.
 5. Available all times at job site.
- B. Record Layout Actual Routing
- C. Completion of Work and Record:
 1. Signed by Contractor.
 2. Dated.
 3. Delivered to COR.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment System or Pump Station Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16010

PART 1 - GENERAL:

1-1 SUMMARY

- A. This section covers basic electric materials and methods.

1-2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01330: Submittals.
B. Section 13450: Instrumentation and Control.
C. Section 16010: Basic Electrical Requirements.
D. Section 16060: Grounding.
E. Section 16500: Lighting.

1-3 SUBMITTALS

- A. Submit in accordance with Section 01330: Submittals.
B. Shop Drawings and Data: Submit pictorial, assembly and installation drawings together with detailed specifications and data for the material and equipment listed in Section 16010: Basic Electrical Requirements, Paragraph 1.4
C. In addition to the requirements above, submit two copies of Operation and Maintenance manuals for the following:
1. Motor and water treatment controls
2. Motor control centers and variable frequency drives
3. Motors
4. Remote control interface equipment
5. Panelboard circuit breakers
6. Programmable logic controller (PLC)
D. Operation and maintenance manuals shall be in addition to any instructions or parts lists shipped with the equipment.
E. Wiring and Connection Diagrams: Submit wiring and connection diagrams for motor controllers and motor control centers. Extent and detail of wiring diagrams shall comply with NEMA standards for the equipment.

1-4 QUALITY ASSURANCE

- A. General Requirements:
1. New, free from defects, quality as specified.
2. Standard product of known manufacturer.
3. Same manufacturer:
4. Material of the same type or classification.

5. Used for the same purpose.
 6. Labeled or listed by approved testing laboratories.
 7. Suitable for the intended application.
 8. Approved by inspection authorities.
- B. Applicable Codes and Standards: Shall be the latest revisions, supplements and amendments to the following:
1. ANSI/NFPA 70: National Electrical Code (NEC).
 2. NEMA Standard ICS-2: Industrial Control Devices, Controllers and Assemblies.
 3. NEMA Standard KS-1: Enclosed and Miscellaneous Distribution Equipment Switches.
 4. NEMA Standard MG-1: Motors and Generators.
 5. MENA Standard PB-1: Panelboards.
 6. NEMA Standard WD-1: General Requirements for Wiring Devices.
 7. UL Standard 98: Enclosed and Dead-Front Switches.
 8. UL Standard 845: Motor Control Centers.
 9. UL Standard 1004: Electric Motors.
 10. IEEE 519: Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
 11. Flathead Electric Coop Standards and Requirements.

PART 2 - PRODUCTS:

2-1 RACEWAYS

- A. Rigid steel threaded galvanized. (EMT acceptable for lighting branch circuits).
- B. PVC Schedule 40 for all underground runs.
- C. Long radius bends for underground runs shall be rigid steel.
- D. Locknuts and insulating bushing on terminations.
- E. Flexible metallic conduit shall be used in short runs for ease of installation and to prevent vibration from equipment.
 1. Liquidtight flexible conduit.
 2. Zinc-coated steel core.
 3. Extruded gray PVC cover.
 4. Sealtite Type "UA".
 5. Minimum size conduit shall be 3/4-inch.

2-2 CONDUCTORS

- A. Copper Conductor:

1. 600 volt minimum insulation.
2. Type THHW or higher temperature rating. (All wire shall be sized per 75oC rating)
3. Minimum Wire Size:
 - a. Power carrying conductors, No. 12 AWG.
 - b. Control wiring to PB sta., pressure sensors, limit SW. etc., No. 14 AWG stranded.
 - c. Fixture wire, No. 16 AWG stranded.
4. Insulation colors consistent each phase.
5. Stranded power conductors No. 8 AWG and larger sizes.
6. Terminal lugs and connectors for power and lighting circuits shall be copper alloy pressure type.

2-3 CONDUIT FITTINGS

- A. Cast malleable iron condulets or unilets.
- B. Threaded with watertight gasket.
- C. Watertight seals on conduit entering underground structures, Type EYS, located inside structure wall.
- D. Non-metallic, compatible with PVC Schedule 40 raceway.

2-4 JUNCTION BOXES

- A. Size as required by code or as shown on the plans. Allow extra space when splicing.
- B. Full access screwed covers mounted with corrosion resistant machine screws.
- C. Fabricated from code gauge galvanized sheet steel:
 1. Interior and dry locations shown on drawings.
 2. Paint with rust-inhibiting primer.
- D. Cast metal with threaded hubs FS or FD or type RS with cast plates with threaded hubs:
 1. Exterior, damp or underground locations unless otherwise shown on the drawing.
 2. Fully gasketed.
 3. Size for outlets including gang requirements.
 4. Size for conduits, conductors and volume fill by Code.
 5. Stainless machine screws for covers and side plates.

2-5 WIRING DEVICES

- A. General:
 1. Specification grade, NEMA standard.
- B. Switches:
 1. 20 ampere, 125 volts.

2. Totally enclosed in a molded phenolic case.
 3. Flush tumbler type.
 4. Group under a gang plate where two or more switches in same location.
 5. Motor horsepower rated trip-free with overload device for use with fractional HP or more motor loads.
- C. Receptacles:
1. 20 amperes, 125 volts, 2 pole, 3 wire NEMA 5-20R unless otherwise noted:
 - a. Totally enclosed GFI protected, grounding type.
- D. Cover Plates:
1. Appropriate size and type.
 2. Gasketed weatherproof type of corrosion resistant or galvanized steel or galvanized malleable iron for exterior or damp locations.
 3. Gang plates for multiple switches or multiple outlets at one location.
 4. Fastening screws corrosion resistant or stainless.

2-6 LOCAL CONTROL STATIONS

- A. Type and functions as shown on the plans.
- B. Heavy duty, fully gasketed.
- C. NEMA 12 for indoor locations.
- D. NEMA 4 stainless steel or fiberglass for outdoor or damp locations.
- E. Heavy duty contact blocks and operators.
- F. Lock out stop provisions.

2-7 MOTOR CONTROLS

- A. NEMA Standard:
 1. Individual wall mounted units.
 2. Control center group mounted units.
- B. Combination circuit breaker and magnetic starter unless otherwise specified.
- C. Switch and fuse units:
 1. Heavy duty loadbreak with quick make, quick break operation.
 2. Common operator for 3 phases.
 3. High pressure switch contacts.
 4. Current limiting fuses rated as shown on the drawings.
- D. Circuit breaker units.
 1. Thermal magnetic circuit breakers.

2. Interchangeable trip type.
 3. Adjustable magnetic trip elements.
 4. Magnetic-only (MCP) type acceptable only if shown on the drawings and if part of an UL listed assembly.
- E. Type, size and functions as indicated on the drawings.
1. Variable frequency drives.
 2. Across-the-line start.
 3. Contacts self cleaning type designed for easy inspection and replacement.
 4. Manual toggle switch, quick make, quick break trip-free type.
 - a. Single phase less than one horsepower.
- F. Modular construction suitable for motor control center installations unless otherwise indicated on the plans.
- G. Pilot devices on controller door unless otherwise indicated on the Plans.
1. Start-stop buttons or selector switch (see schematic diagrams).
 2. Reset buttons.
 3. Running time meter, hours and tenths, non-resettable.
- H. Pilot lights shall be transformer push-to-test type with color and functions shown below unless otherwise noted on the drawings.
1. Motor running - green light.
 2. Motor stopped - red light.
 3. Circuit energized - white light.
- I. Overload trips in each phase.
1. Sized for actual motor running current.
- J. All disconnect or circuit breaker operators shall have padlocking provisions in open position with field knockout or drill position for closed position.
- K. 120 volts control power through an integral control transformer with 125 VA spare capacity unless otherwise indicated on the drawings.
- L. Protective fuse for each control circuit.
- M. Terminal strip for all external connections.
- 2-8 MOTOR CONTROL CENTERS
- A. NEMA, AIEE and ANSI Standards. NEMA enclosure type 1 gasketed.
1. Sections 20-inches, 24-inches, or 35-inches wide by 20-inches and 90-inches high.
 2. Short circuit bracing to 65,000 RMS amperes or as otherwise shown on the drawings.
 3. Back access prohibited.
- B. Completely wired NEMA Class I, Type B wiring.

- C. 480 volts, three phase, 60 hertz alternating current, ampere ratings as indicated on the plan drawings.
- D. Motor controllers as described in Para. 2.7 of this section variable frequency drive motor controllers in Section 16220.
- E. Comprised of individual vertical units of same depth and height.
- F. Common power bus arranged for easy section additions.
- G. Six size 1 starters per vertical section.
- H. Main horizontal bus (800 amp) with vertical busses (400 amp) to feed each section.
- I. Busses shall be tin plated aluminum or copper.
- J. Ground bus across the bottom or manufacturer's standard.
- K. Top and bottom wiring space for each vertical section wiring.
- L. Vertical wiring space for unit wiring.
- M. All wiring neatly grouped, tied and supported to hold in place.
- N. All units to be modular construction of interchangeable type, front accessible held by machine screws.
- O. Each unit completely isolated and barriered from other units.
- P. Unit door hinged on the left side when facing the panel.
 - 1. Three hinges for doors over 1/3 height.
 - 2. Four hinges for full height doors.
- Q. Spare sections to be complete with all facilities except interior unit.
- R. Hinged door for spare sections to be furnished with covered cutouts.
- S. Blank area shall be covered.
- T. Zinc phosphate treated inside and out or rust preventive treatment.
- U. Tough epoxy resin primer, durable baked enamel, light gray finish.
- V. Auxiliary controls mounted in MCC:
 - 1. Auxiliary pan for equipment mounting.
 - 2. Relays, timers, meters, metering transformers, auxiliary power transformers mounted in separate compartments from starter.
 - 3. Limit two auxiliary relays in starter compartment:
 - a. Locking provision in extended position.
 - b. Roller or ball bearing slide.
- W. Acceptable Manufacturers
 - 1. Allen-Bradley 2100 Centerline
 - 2. Square-D
 - 3. Cutler-Hammer
 - 4. Siemens

2-9 PANELBOARD

- A. Type, size and functions as indicated on the drawings.
- B. Dead front, flush, surface or motor control center mounting.
- C. Tin plated aluminum busses, or copper busses, full panel height, rigidly supported with bus supports.
- D. Minimum bus rating not to be smaller than feeder protective device setting.
- E. Complete with main breaker or main lugs and sub-breakers as shown on the drawings.
- F. Circuit breakers:
 - 1. Molded case thermal magnetic trip units.
 - 2. Common trip bar for two or three pole breakers.
 - 3. Trip-free and trip-indicating plug-in type.
 - 4. Quick-make, quick-break contacts.
 - 5. Single, two or three pole breaker interchangeability.
 - 6. Ground fault circuit interrupter (GFCI) where indicated.
- G. Zinc-coated sheet steel cabinets, Underwriters' Laboratories, Inc. label. Heavy gauge for embedded installation.
- H. NEMA Type 1 enclosures for indoor locations unless otherwise noted.
- I. NEMA Type 3R enclosures for outdoor locations.
- J. Typewritten directory properly identifying each circuit under the clear plastic cover.
- K. Panel bus arrangement:
 - 1. Three phase, 4 wire, 208/120 volts with solid neutral and ground bars with lugs.
- L. Gutter space:
 - 1. 5-inch minimum at top and bottom in addition to ground and bus space.
 - 2. 4-inch minimum on sides.
 - 3. Meet NEC requirements.
- M. Transient-voltage surge suppressor shall be sized for each panelboard voltage rating and connected per manufacturer's requirements.
- N. Breaker interrupting rating not less than the following unless shown otherwise on the Drawings:

<u>Breaker Ampere Rating</u>	<u>Interrupting Capacity 208 V AC</u>	<u>RMS Symmetrical Amperes 480 V AC</u>
20 - 60	10,000	14,000
70 - 125	10,000	14,000
150 - 400	40,000	30,000

2-10 OVERLOAD PROTECTION

- A. Size to fit motors.

- B. Verify from motor nameplate and measure amp load.
- C. Special consideration for submersible motors. Check manufacturer's recommendations.

2-11 MOTORS

- A. All motors shall be of the horsepower and speed appropriate for the equipment drive, of squirrel cage design, 40°C ambient, and shall be of nationally known manufacturer, and shall conform to the applicable standards of the National Electrical Manufacturer's Association.
- B. Motors 1 horsepower and over shall be 3-phase unless required by manufacturer. Fractional horsepower motors may be single phase.
- C. Insulation shall be not less than Class B and an epoxy dip coating for protection against accidental submergence. Ambient temperature will be approximately 32°C and under these conditions the service factor shall be 1.0 minimum.
- D. The totally enclosed fan cooled (TEFC) motor frame shall be suitably protected against corrosion inside and out considering operation in an outdoor or moist corrosive atmosphere. Open drip proof (ODP) motors operating in a clean, dry indoor environment shall be provided with bug screens on all ventilation openings. Grease fittings shall be provided on all thrust and radial ball bearings.
- E. Inverter duty AC induction motors to be used with variable speed drives shall be compatible for operations with the drives chosen from a maximum full load speed down to zero without exceeding design temperature limits. They shall be rated for continuous duty with the service factor of 1.15. Maximum full load speed is defined as the highest speed the motor may attain at maximum output of its power supply.
- F. Motors in hazardous locations shall be approved for such areas as indicated on the drawings.

PART 3 - EXECUTION:

3-1 ERECTION

- A. The wiring and materials shall be installed by the Contractor by tradesmen skilled in the installation of this type of work and in accordance with the manufacturer's instructions. All electrical work shall be in accordance with applicable electrical codes.

3-2 RACEWAYS AND CONDUIT

- A. Rigid conduit support intervals not greater than:
 - 1. 1-1/2-inches and smaller - 6 foot intervals
 - 2. 2-inch to 6-inch - 10-foot intervals
- B. Flexible conduit support intervals not greater than 4-1/2 foot intervals.
- C. Conduit runs on the interior walls and ceilings:
 - 1. Support on U-channel.
 - 2. Attach to concrete walls.
 - 3. If not practical to attach to concrete walls, attach to a structural member through the covering materials.

- a. Seal covering to prevent sound transmission.

3-3 CONDUCTORS

- A. Pulling lubricant soapstone or NEC approved materials.
- B. No splices between outlet boxes or fittings.
- C. Color identify or tag as specified in Section 16010: Basic Electrical Requirements.
- D. Conductor ends stripped of insulation without nicking metal.
- E. Assure high conductive permanent connections.

3-4 JUNCTION BOXES

- A. Mount and support per good standard practice using brackets, rod hangers, bolts, expansion bolts.
- B. Support independent of attached conduit.
- C. Replace covers and screws when wiring is complete.

3-5 WIRING DEVICES

- A. Wall switch outlet 4 feet 0 inches above finish floor.
- B. Receptacle outlet 4 feet 0 inches above finish floor in pump room, 1 foot 6 inches in all other areas.
- C. Height as noted on drawings.
- D. Lighting switch on lock side of entrance door.

3-6 LOCAL CONTROL STATIONS

- A. Secure to adjacent wall.
- B. Secure to controlled equipment in convenient location.

3-7 MOTOR CONTROLS

- A. Separately enclosed starter units:
 1. Fasten securely to supporting structure:
 - a. Wood screws or lag screws to wood boards or timbers.
 - b. Machine bolts to metal framing or plates.
 - c. Expansion anchors to concrete walls.
 - d. Expansion toggle wing bolts or sleeve anchors to hollow block.
 - e. Provide 1-inch spaces to set panel out from concrete or block wall.
 2. Arrange for driven equipment use or function.
 - a. Similar units adjacent.
 - b. Multiple units:
 - (1) In horizontal line uniform to top height.

- (2) In groups symmetrical arrangement. Top of highest enclosure not exceeding 6-feet-9-inches above floor and bottom lowest enclosure not less than 1-foot-3-inch above floor.

B. Motor control centers:

1. Provide 2-inch mounting curb under cabinet.
2. Fasten brace from adjacent wall or support structure to enclosure frame.
 - a. Support enclosure as required for Seismic Zone 3.
3. Fasten securely at base.
 - a. Anchor bolts in concrete.
 - b. Lag bolts or through bolts in timber.
4. Assemble units and make-up field connections.
 - a. Follow manufacturer's instructions.
 - b. Special care for joints in electrical busses.
5. Connect all wiring to power source, loads and controls.

3-8 PANELBOARDS AND CABINETS

A. Fasten securely to wall:

1. Wood screws or lag screws to wood boards or timbers.
2. Machine bolts to metal framing or plates.
3. Expansion anchors to concrete walls.
4. Expansion toggle wing bolts or sleeve anchors to hollow block.
5. Provide 1-inch space to set panel out from concrete or block wall.

B. Outdoor post mounted:

1. Provide wood or galvanized angle brackets.
 - a. Galvanized 1/2 inch lag screw or through bolt fastening to pole.
 - b. Galvanized lag screw or through bolt fastening box to bracket.
2. Brackets top and bottom if enclosure more than 15 inches high.
3. Support post not less than 6-inch x 6-inch treated timber or 4-inch Schedule 40 galvanized pipe set in concrete.

C. Mounting height:

1. Single unit - 5 feet centerline above floor or ground.
2. Multiple units - uniform top height.

D. Mounting Supports

1. Fasten brace from adjacent wall or support structure to enclosure frame.

- a. Support enclosure as required for Seismic Zone 3.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment System or Pump Station Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16050

PART 1 - GENERAL:

1-1 SUMMARY

- A. Furnish all labor, material, equipment, instruments, supervision, and accessories as required to install the grounding system required. Equipment grounds, including conduits, shall have separate grounding conductors above grade. Grounds at various equipment locations may be combined into single conductors connecting to below grade grids.
- B. Provide grounding of all electrical equipment per code rules and established safety practices.
- C. Provide grounding stations for system neutrals.
- D. Provide grounding system as indicated on the Drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16010: Basic Electrical Requirements
- B. Section 16050: Basic Electrical Materials and Methods

1-3 SUBMITTALS

- A. Submit in accordance with Section 01330: Submittals.
- B. Includes, but not limited to, catalog cuts for the following:
 - 1. Ground Rods
 - 2. Connectors

1-4 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. ANSI C2: National Electrical Safety Code (NESC).
 - 2. ANSI/NFPA 70: National Electrical Code (NEC).
 - 3. UL Standard 467: Grounding and Bonding Equipment.
- B. Acceptable Manufacturers:
 - 1. Ground Rods:
 - a. A.B. Chance Co.
 - b. Copperweld Corporation
 - c. Porcelain Products
 - d. Willard Industries
 - e. American Electric
 - 2. Cable-to-Equipment Ground Lugs:
 - a. Burndy Corporation (Burndy)
 - b. Erico Products

- c. O.Z. Gedney Company
- 3. Coatings:
 - a. Kop-Coat, Carboline Company

PART 2 - PRODUCTS:

2-1 MATERIALS

- A. All materials shall be in accordance with the requirements as specified on the drawings and the referenced specification details.
- B. Wire and Cable:
 - 1. In general, ground cables shall be bare, or insulated soft or medium hard drawn, Class A or Class B stranded copper, of sizes shown on the drawings.
 - 2. Ground cables that are direct buried and part of an electrode system shall be bare.
 - 3. Conductor Sizes:
 - a. As indicated for specific connections or as required by NEC.
 - b. For required connections not indicated, use conductor size not less than No. 2/0 AWG if buried in earth or cast in concrete, or No. 6 AWG at other locations.
- C. Ground Rods:
 - 1. Copper-clad steel or copper-alloy sectional-type rods. Copperweld 9400 Series or equivalent.
 - 2. One end pointed to facilitate driving.
 - 3. 3/4-inch diameter and 10-feet long with diameter and length stamped near top of rod.
- D. Connection Materials:
 - 1. Below Ground
 - a. Cable-to-cable, cable-to-rod, and cable-to-connector connections of exothermic-welding-type process.
 - 2. Above Ground
 - a. Compression type unless otherwise indicated on the drawings.
 - b. Bolted to equipment housing with silicon bronze bolts and lock washers.
 - 3. Cable to building column connections by exothermic-welding type process.
 - 4. Ground Rod Clamps: One piece cast bronze with safety set screw. Copperweld 6500 Series or equivalent.
- E. Coatings
 - 1. Kop-Coat Bitumastic No. 50 asphaltic coating.

PART 3 - EXECUTION:

3-1 INSPECTION

- A. Do not cover connections before they are inspected by the COR.

3-2 INSTALLATION

A. General

1. Copper ground wire shall be used on interior and exterior installations and in conduit runs for equipment grounding.
2. All electrical equipment and conduit installed under this contract shall be grounded as required by NEC, indicated on the contract drawings and as specified herein.

B. Wire and Cable

1. Install using as few joints as possible.
2. Suitably protect cable against damage during construction.
3. Replace or suitably repair cable if damaged by anyone before final acceptance.
4. Route runs as indicated or required by NEC.
5. Route where possible for maximum physical protection.

C. Ground Rods

1. Install rods as indicated by driving and not by drilling or jetting.
2. Drive rods into unexcavated portion of the earth where possible.
3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
4. Drive to a depth such that top of rods will be approximately 24 inches below final grade, or subgrade, and connect main grid ground cable thereto.

D. Connections

1. Conform to manufacturer's instructions.
2. Chemically degrease and dry completely before welding connections.
3. Apply one coat of asphaltic coating to all exothermic-welded connections to be buried.
4. Make connections to equipment as follows:
 - a. Make up clean and tight to assure a low-resistance connection with resistance drop not exceeding 1 ohm.
 - b. Install so as not to be susceptible to mechanical damage during operation or maintenance of equipment.

E. Metallic Conduit Ground

1. Adequately and properly ground at all terminal points and wherever isolated from equipment or grounded steel.
2. Where extending into floor-mounted equipment from below, connect to equipment ground bus or frame.
3. All conduit shall be grounded directly or through equipment frames and ground busses to the ground system conductor which shall be minimum of No. 6 bare copper.

F. Box Grounds

1. Unless grounded by conduit system, ground all boxes by direct copper connection.

3-3 FIELD TESTING

- A. Measure resistance of ground system to each ground riser.
- B. Record results and notify COR if any reading exceeds 25 ohms. If the resistance exceeds 25 ohms, then ground rod(s) shall be added. Additional rods shall be driven at least 6 feet away from any existing rods and shall be tied to the existing ground system.
- C. Test at least three of each type of ground connections and not less than 25 percent of all ground connections.
- D. Test by one of the following methods for resistance measurement:
 1. Three-point method, using an ammeter and voltmeter and a-c- or d-c power supply.
 2. Commercial instrument method approved for such type testing.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment System or Pump Station Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16060

PART 1 - GENERAL:

1-1 SUMMARY

- A. Connect to all equipment noted or as scheduled on the Drawings, and provide all cords, cord caps, circuit protection, disconnect switches and necessary devices required for proper connection of equipment.
- B. All control devices furnished by subcontractor are to be set in place by him unless otherwise noted. Control wiring between starters, hydraulic or pneumatic electric switches, electrically operated control components, etc. provided by electrical contractor unless indicated otherwise.

1-2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01330: Submittals.
- B. Section 16010: Basic Electrical Requirements

PART 2 - PRODUCTS:

2-1 MATERIALS

- A. Disconnect switches: Heavy duty unfused unless otherwise noted. Disconnect switches for fractional horsepower, single phase motors may be motor rated toggle switches. Enclosures for disconnect switches as shown or required for conditions encountered.
- B. Contractor shall provide and install all disconnect switches for HVAC systems, fans and mechanical equipment. Rated sizes shall be provided by the equipment Vendors before final installation.

PART 3 - EXECUTION:

3-1 INSPECTION

- A. Verify exact location and method of connection to each piece of equipment prior to roughing-in. Where roughing-in requirements are different from that shown on the Drawings, verify with the COR before proceeding.
- B. Determine voltage and phase of each item before connecting, and if characteristics are not proper for energy available immediately notify the COR.
- C. Verify location of all control devices with subcontractor.
- D. Examine location of all equipment to assure adequate clearance for operation and connection.
- E. Obtain drawings from subcontractor and equipment suppliers to insure proper connections.

3-2 INSTALLATION

- A. Connect motors to provide proper direction of rotation.
- B. Make connections to equipment in accordance with manufacturer's instructions and NEC requirements.

- C. Install raceway entrances to roof mounted equipment inside equipment bases wherever possible to eliminate penetrating roofs.
- D. Test all circuits for fusing, continuity and control.
- E. Coordinate work with other subcontractors.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment System or Pump Station Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16120

PART 1 - GENERAL:

1-1 SUMMARY

- A. Provide all feeders shown on the Drawings.
- B. Provide branch circuits to all outlets, devices, motors, appliances and electrical equipment unless otherwise noted.

1-2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01330: Submittals.
- B. Section 16010: Basic Electrical Requirements

PART 2 - PRODUCTS: - Not Used

PART 3 - EXECUTION:

3-1 INSTALLATION

- A. All feeder conductors to be continuous from origin to panel or equipment without splice in intermediate pull or splice box. Unless otherwise indicated each feeder raceway to contain only those conductors constituting a single feeder.
- B. Feeder raceways to enter directly opposite terminal lugs where possible.
- C. Provide feeder conductor identification in accordance with Section 16010: Basic Electrical Requirements.
- D. Install branch circuit wiring in raceways throughout project unless otherwise indicated.
- E. Verify roughing-in requirements prior to installation of branch circuits. See equipment schedules, architectural, mechanical and structural Drawings for equipment locations.
- F. See Section 16050: Basic Electrical Materials and Methods, for general installation requirements.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment System or Pump Station Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16130

PART 1 - GENERAL:

1-1 SUMMARY

- A. This section covers lighting requirements for the Treatment System Building.

1-2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 16010: Basic Electrical Requirements
B. Section 16050: Basic Electrical Materials and Methods

1-3 SUBMITTALS

- A. Shop Drawings and Data: In accordance with procedures set forth in Section 01340, submit picture, complete assembly, and installation drawings together with detailed specifications and data covering materials used, parts, devices, and other accessories forming part of the lighting equipment, including, but not limited to:
1. Foot candle distribution pattern, each axis if unsymmetrical.
 2. Maintenance factors.
 3. Coefficient of utilization.
 4. Lamp rated lumens and wattage.
 5. Ballast type and protection.
- B. Consideration of fixtures submitted will be based on:
1. Comparison with the catalogue data for the fixtures specified.
 2. Must be UL listed and approved for locations indicated.
 3. All fixtures submitted at one time.
 4. Sample fixture when specifically requested by the COR.
- C. Operation and Maintenance Manuals:
1. Supply operation and maintenance manuals prepared by the equipment supplier and covering:
 - a. Assembly, installation, adjustment and checking instructions.
 - b. Parts list.
 - c. Outline, cross sections, and assembly drawings, illuminating engineering data; and wiring diagrams.
 2. Operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1-4 ADAPTATION OF EQUIPMENT

- A. Furnish equipment readily adaptable for installation and operation in the structure in the manner shown on the drawings.
- B. Assume full responsibility for alterations of planned structure to accommodate actual equipment

furnished.

- C. Make and coordinate all required changes, including structural redesign if required to accommodate actual equipment furnished.
- D. Provide all such alterations free of extra cost to the Government.
- E. Provide fixtures complete with lamps, ballasts, reflectors, diffuser, lenses, louvers, shielding, hangers, accessories and fittings.

1-5 PROTECTION

- A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling, and storage.
- B. Protect equipment from exposure to elements and keep thoroughly dry at all times.
- C. Painted Surfaces:
 - 1. Protect against impact, abrasion, discoloration, and other damage.
 - 2. Repaint, to satisfaction of the COR, all painted surfaces which are damaged prior to final acceptance.
 - 3. Protect electrical equipment, controls, insulation, etc. against moisture and water damage.

1-6 EQUIPMENT GUARANTEE

- A. Guarantee all equipment against:
 - 1. Faulty or inadequate design.
 - 2. Improper assembly, erection, or handling.
 - 3. Defective workmanship or materials.
 - 4. Leakage, breakage, or other failure.
- B. Provide manufacturers guarantee.

1-7 QUALITY ASSURANCE

- A. Applicable Standards: Shall be the latest revisions, supplements and amendments to the following:
 - 1. Certified Ballast Manufacturers (CBM) - Ballasts
 - 2. Illuminating Engineering Society (IES)
 - 3. Reflector and Lamp Manufacturers (RLM) Standards Institute
 - 4. Underwriters' Laboratories, Inc. (UL)
 - a. UL Standard 935: Fluorescent Lamp Ballasts
 - b. UL Standard 1029: High Intensity Discharge Lamp Ballasts
 - c. UL Standard 1570: Fluorescent Lighting Fixtures
 - d. UL Standard 1571: Incandescent Lighting Fixtures
 - e. UL Standard 1572: High Intensity Discharge Lighting Fixtures
 - 5. American National Standards Institute (ANSI):

- a. Applicable codes under C78 (Electric Lamps) for:
 - (1) High Intensity Discharge
 - (2) Incandescent
 - (3) Fluorescent
- b. Applicable codes under C81: Electric Lamp Bases and Holders
- c. Applicable codes under C82: Lamp Ballasts and Transformers
- 6. ANSI/NFPA 70: National Electrical Code (NEC)
- 7. ASTM D523: Standard Test Method for Specular Gloss
- 8. Federal Specification W-L-101: Incandescent Lamps
- 9. Federal Specification W-L-00116: Fluorescent Lamps
- B. Acceptable Manufacturers:
 - 1. Lighting Fixtures: As listed on the Lighting Schedule or approved equivalent.
 - 2. High Intensity Discharge and Fluorescent Ballasts:
 - a. Jefferson Electric
 - b. Advance Transformer
 - c. Magnetek Lighting Products
 - 3. High Intensity Discharge and Fluorescent Lamps:
 - a. General Electric Co.
 - b. Philips Lighting
 - c. Sylvania (GTE Products)

PART 2 - PRODUCTS:

2-1 DESIGN REQUIREMENTS

- A. Furnish and install a complete and operable lighting system.
- B. Provide interior and exterior lighting systems as indicated:
 - 1. 208 and 120 volt, 1-phase, 60 hertz.
- C. The fixture catalog numbers listed on the "luminaire schedule" indicate manufacturer, fixture design, appearance, etc., desired. These fixtures shall be modified if necessary to comply with the corresponding ceiling systems and application.
- D. All lighting fixtures shall bear the Underwriter's Laboratories, Inc., label and shall be acceptable for installation in the locations indicated.
- E. All fixture component parts shall be manufactured and/or assembled at the manufacturing plant for shipment in one or more packages. The shipment from the fixture manufacturer shall include integrally-mounted ballasts where ballasts are required for the proper operation of the fixture lamps.
- F. If fixtures specified herein are discontinued at the time the work is executed, provide suitable substitute fixtures, without additional cost, as directed by the COR.

- G. Provide accessories such as wire guards, fusing, stem, canopies, cords, toggle bolts, etc., necessary to mount fixtures in a proper and approved method.
- H. Voltage: Provide ballast for operation of fixtures at voltage shown by circuiting on Drawings, or otherwise indicated.

2-2 FLUORESCENT FIXTURES

- A. Construction:
 - 1. Rust-protected highest quality steel
 - 2. Aluminum
- B. Finish on entire Fixture:
 - 1. Baked white enamel of non-modified acrylic on alkyd base type.
 - 2. Gloss 80% minimum measured by ASTM Method D523 (60 degrees).
 - 3. Reflectance on all fixture parts shall be 85 percent of minimum measured with integrating sphere type reflectometer.
 - 4. Trim finish, louver surfaces, nonferrous reflecting surfaces exception to above requirement shall be manufacturer's standard finish.
- C. Design for maximum heat dissipation:
 - 1. Ballast case not exceed 90oC (194°F).
 - 2. Ambient room temperature 24oC (75°F).
- D. Ballast Type:
 - 1. Ballast for high output lamps shall be high power factor type, CBM and UL labels.
 - 2. Ballast for T-8 lamps or lamps indicated on the drawings shall be energy efficient solid state electronic type. They shall comply with CBM and UL labels.
- E. Ballast Thermal Protection:
 - 1. Automatic resetting protection per UL requirements.
- F. Ballast Mounting:
 - 1. Eliminate vibration and noise.
 - 2. Adequate heat transfer.
 - 3. Captive bolts and nuts for easy replacement.
- G. Sound rating Class B or better.

2-3 INCANDESCENT FIXTURES

- A. Maximum temperature 90oC (194oF) at point of contact with ceiling or wall.
- B. Light pattern similar to specified unit.

2-4 HIGH INTENSITY DISCHARGE (HID) FIXTURES

- A. As listed or indicated on the drawing.

B. High Intensity Discharge Lamp Ballasts shall conform to UL-1029 and bear the CBM and UL labels.

2-5 LAMPS

A. Provide lamps manufactured by General Electric, Philips, or Sylvania unless otherwise indicated.

B. Fluorescent:

1. Standard and cool white per Fed. Spec. W-L-00116.
2. 32 watt, T-8 rapid start energy efficient, 48 inches. Initial rating not less than 2,900 lumens.
3. Lamp as required by fixture and indicated on the "luminaire schedule".

C. High Intensity Discharge (HID):

1. Provide lamps as indicated and as recommended by the fixture manufacturer.

2-6 SPECIAL ACCESSORIES

A. Provide as necessary to mount fixture:

1. Suspended ceiling frames
2. Stems
3. Canopies
4. Toggle bolts
5. Cords, etc.

PART 3 - EXECUTION:

3-1 INSPECTION

- A. Verify location and mounting requirements for each fixture.
- B. Verify voltage at each fixture outlet prior to installation.
- C. Examine fixtures for damage or broken parts and replace prior to installation.

3-2 INSTALLATION

A. General:

1. Install lighting fixtures at locations indicated on contract drawings.
2. Coordinate installation of fixtures with other subcontractors, and verify methods of hanging and supporting required.
3. Install after pipe, duct, conduit, etc., that will be installed above light fixtures have been installed unless otherwise directed by the COR.
4. Fixtures to be coordinated with ductwork, piping and structural members. Adjust stems as required for proper illumination of the area.
5. Properly support and align fixtures and provide all necessary accessories and steel shapes for support of the fixtures. Coordinate complete fixture installation with the facility construction.

6. All fixtures to be illuminated at time of acceptance.
7. All fixtures to be supported in a manner to meet the requirements in a Seismic Zone 3 area.

3-3 SUPPORTS AND ALIGNMENT

- A. Provide proper supports for all fixtures:
 1. Rods, hangers, swivel plates to suit conditions and slopes.
 2. Steel angles and shapes, unistrut, spacers as required by conditions.
 3. Fixture supports independent from conduit.
- B. Alignment:
 1. Parallel to building lines.
 2. Uniform and symmetrical spacing within rooms.
- C. Uniform level when suspended from sloping surfaces.

3-4 CLEANING AND TOUCH-UP

- A. All lighting fixtures shall be cleaned prior to final inspection.
- B. Touch-up scratched or marred surfaces to match original finish.

3-5 TESTING

- A. Refer to Section 16010, this Division, for general testing criteria.
- B. Test all systems for proper operation and correct phasing.
- C. Test all lighting circuits and systems upon completion of installation to assure that the lighting loads operate satisfactorily and conform to Contract Documents.
- D. Perform all tests as recommended by the system manufacturers or requested by the COR.

PART 4 - MEASUREMENT AND PAYMENT:

4-1 MEASUREMENT

- A. All work required in this section shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for the Treatment Building Electrical Work. No separate payment to the Contractor shall be made for the work required in this section.

END OF SECTION 16500