

DIVISION 16
SECTION 16000
GENERAL ELECTRICAL CONDITIONS

PART 1 GENERAL

- Note:
1. The word "Owner" when used in the Electrical Specification shall refer to Chabad Lubavitch of Maine, Inc.
 2. The work "Architect" when used in the Electrical Specification shall refer to Richard Abrahams Associates, Architects.
 3. The words "Electrical Engineer" when used in the Electrical Specification shall refer to Electrical Design Consultants.
 4. The word "provide" when used in the Electrical Specification and Electrical Drawing Notes shall mean to furnish and install.
 5. The word "furnish" when used in the Electrical Specification and Electrical Drawing Notes shall mean the Contractor is to purchase equipment but not install the equipment.
 6. The word "install" when used in the Electrical Specification or Electrical Drawing Notes shall mean that the Contractor is to install equipment but not purchase the equipment.

1.01 SCOPE

- A. The phrase "Electrical Work" and the "Scope of Electrical Work" shall mean and is intended to include the providing of all labor, material, and equipment to satisfactorily accomplish the installation and test described or referenced on the Electrical Drawings or in this Electrical Specification.
- B. As a minimum, all Electrical Work will be accomplished in accordance with the most recent edition or revision of the National Electrical Code, NFPA-70. No electrical construction requirements for this project, which are also requirements of the National Electrical Code, will be repeated on the project's Electrical Drawings or in the Electrical Specification. There will be no further reference to specific aspects of the National Electrical Code throughout the Electrical Drawings and Electrical Specification except that:
 1. All requirements on the Electrical Drawing or in the Electrical Specifications, which appear to allow electrical work that is in violation of the National Electrical Code, shall be considered to be errors or omissions on the Electrical Drawings or in the Electrical Specification. The Contractor shall include in the bid for this work all costs to complete the work in accordance with the National Electrical Code regardless of these errors and omissions.
 2. All requirements on the Electrical Drawings or in the Electrical Specification, which are more restrictive than the National electrical Code and/or are in addition to the minimum requirements of the National Electrical Code are intended to be requirements over and above those of the National Electrical Code and are to be accomplished as described.
 3. Utility requirements, which are more restrictive than the National Electrical Code and/or more restrictive than the Electrical Drawings and Specifications, are considered to be project requirements in addition to the National Electrical Code and the Electrical Drawings and Specifications.

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4. Conflicts between the requirements of the National Electrical Code and requirements of any other applicable building code, utility requirements, or local ordinance shall be resolved in favor of the National Electrical Code unless the conflicting code or requirements specifically states that it is to supersede the National Electric Code.
 5. Discrepancies between the Electrical Engineer's drawings and specifications and the drawings and specifications of the Landscape Architect, the Project Architect, the Civil Engineer, The Structural Engineer, and the Mechanical Engineer shall be resolved by the Electrical Engineer. The Electrical Engineer's resolution shall take the form of a review of the project documents and a determination of details of the Electrical Work to be provided that is most appropriate for the project without regard to the relative construction cost associated with the Electrical Engineer's determination, then a credit will be due from the Contractor to the owner for the difference between the most expensive possible determination and the Electrical Engineer's determination.
- C. In addition to the requirements of the General, Special, and Supplementary conditions of the project's other specification sections and contract documents, the Electrical Specification includes the following sections:

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16020	Shop Drawing Submittals
16030	Fire Rated Penetrations
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16474	Panelboards and Switchboards
16477	Safety Switches and Disconnect Means
16501	Lamps
16502	Ballasts and Accessories
16510	Interior Building Lighting
16520	Exterior Building Lighting
16580	Emergency Lighting
16622	Emergency Power Generator
16625	Overhead Door Wiring
16721	Fire Alarm System
16741	Voice/Data Wiring System
16775	Cable Television System
16913	Mechanical Equipment Controls
16921	Misc. Mechanical Equipment

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1.02 ELECTRICAL SAFETY

- A. The Contractor shall enforce industry standard safe electrical practices and procedures including contained in the listed referenced in Paragraph 1.07.

1.03 EXAMINATION OF SITE AND CONTRACTUAL DOCUMENTS

- A. Before submitting bid and beginning any work, it is understood and agreed that the Contractor is competent to provide the type of Electrical Work shown on the Electrical Drawings and Specifications and has become aware if all Electrical Work required for the satisfactory completion of this project by careful examination of all the project's drawings and specifications, the work site and related contract documents.

1.04 CONTRACTOR'S WARRANTIES

- A. The Contractor warrants that all Electrical Work shall be free from defects.
- B. Any defective Electrical Work shall be repaired by the Contractor without cost to the Owner, Architect, or the Electrical Engineer. This repair cost shall include any direct or indirect damages resulting from the failure or the repair of the Electrical Work.
- C. The Contractor agrees to indemnify, defend, and hold harmless the Owner, Architect, and the Electrical Engineer from and against all loss or expense (including costs and Attorney's fees) by reason of liability imposed by law upon the Owner, Architect, or the Electrical Engineer for damages because of bodily injury, including death at anytime arising there from, sustained by any person or persons or on account of damage to property, including loss of user thereof, arising out of or in consequence of the performance of the contract, provided such injury to persons or damage to property is due or claimed to be due to the negligence of the Contractor, his employees or agents.
- D. The Contractor warrants that there has been no collusion with the Electrical Engineer or anyone from the office of the Electrical Engineer.
- E. The Contractor warrants that he has not been influenced by any oral statement or promise of the Electrical Engineer; but only by these Contract Documents.
- F. The Contractor warrants that he is qualified and authorized to do work in the State of Maine and is familiar with all general and special laws, ordinances, and regulations that may affect the work, its performance, or those persons employed therein.

1.05 CLEAN-UP

- A. At the completion of each workday, the area shall be left "broom" clean. At the completion of the project there shall be no Electrical Work debris left at the site.

1.06 DRAWINGS AND SPECIFICATIONS

- A. The Drawings and Specifications are complementary each to the other and the work required by either shall be included in the Contract as if called for by both. All conflicting directions between Drawings and Specifications shall be resolved by requiring the more restrictive direction be followed.

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- B. All work shown on the Drawings is intended to be approximately correct to the scale of the Drawings, but figured dimensions and detailed Drawings are in all cases to assume precedence over them. Where differences exist between two or more descriptions of work to be accomplished, the more detailed description shall be followed.
- C. The Electrical Drawings are diagrammatic and are not intended to show every detail of construction or the exact location of equipment. Where building construction makes it advisable or necessary to change the location of equipment, the Contractor shall perform such work without additional cost to the Owner, Architect, or the Electrical Engineer for the project. Any doubt as to the intended location of equipment shall be resolved by the Electrical Engineer before proceeding with the installation.
- D. Details and information not customarily shown on electrical Drawings or described in Electrical Specifications, which are, however, necessary for the proper installation and operation of the project's systems and equipment or required to meet applicable codes shall be included in the Contractor's price the same as if herein specified and shown.
- E. The intent of Drawings and Specifications is to obtain an electrical installation of all systems, complete in every detail and with all electrical systems properly interconnected. The Electrical Contractor Shall provide all such parts as may be necessary to complete the systems in accordance with the highest quality of industry standards and to the satisfaction of the Electrical Engineer. Upon completion, the electrical systems and all equipment throughout the project shall operate safely, satisfactorily and function as intended.
- F. If any discrepancy between requirements of the Drawings and Specifications, the Electrical Engineer shall resolve the discrepancy.
- G. If the Contractor discovers any error or omission in the Drawings or Specifications or in the work undertaken and preformed by him, he shall immediately notify the Electrical Engineer and the latter shall promptly investigate the matter and provide instruction for the correction thereof.
- H. The locations of existing and proposed underground utilities, if shown, are shown in an approximate way only. The Contractor shall determine the exact locations of all existing underground utilities before commencing work. The Contractor agrees to be fully responsible for any and all damages, which might be occasioned by his failure to locate and preserve existing underground utilities exactly.

1.07 CODES, STANDARDS, INSPECTIONS AND FEES

- A. All electrical Work shall be in accordance with the most recent edition or revision of the following documents. (Note: See paragraph 1.01 b in addition to requirements below.)
 - 1. NFPA 101 (Life Safety Code).
 - 2. NFPA-72 (National Fire Alarm Code).
 - 3. NFPA-70 (National Electrical Code).
 - 4. Underwriters Laboratory detailed requirements for installation of listed material and equipment published in their documents titled:
 - a. Electrical Construction Materials Directory.

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- b. General Information for Electrical Construction, Hazardous Location, and Electrical Heating and Air Conditioning Equipment.
 - c. Fire Resistance Directory.
 - d. Electrical Appliance and Utilization Equipment Directory.
 - e. Fire Protection Equipment Directory.
 - 5. OSHA 2079 Vol. III (Construction Industry Standards).
 - 6. OSHA Standards contained in the Code of Federal Regulations # 1926 Subparts "S" and "K".
 - 7. NFPA-241 (safeguarding construction, alteration, and demolition operations).
 - 8. ICBO Uniform Building Code.
 - 9. Local Utility Requirements.
 - 10. Local Building Codes.
 - B. In case of differences between any of the requirements in paragraph A above, as applied to this project, the most restrictive shall govern.
 - C. Where Drawings and Specifications indicate work in addition to the above requirements, the Drawings and Specifications shall be followed.
 - D. All Utility (power, telephone, CATV) installation and connection fees and fees for permits and inspections shall be included in the Contractor's bid.
 - E. The Contractor shall include in his bid all costs to bring utilities into the project that are not paid for by the utility. This includes but is not limited to such utility charges as transformer installation costs, "excess costs" for underground service, new pole locations, and easements.
 - F. The Contractor shall include in his bid all work associated with assisting telephone system installer.
 - G. The Contractor shall be responsible for the timely notification of the Authority Having Jurisdiction in order that required inspection of Electrical Work may be accomplished.
 - H. The Contractor shall submit a letter to the Electrical Engineer stating that the Electrical Work has satisfactorily passed inspection by the Authority Having Jurisdiction.
- 1.08 DIMENSIONS AND COORDINATION
- A. The Contractor is responsible to verify field dimensions and coordinate Electrical Work with that of other trades.
- 1.09 PHASED CONSTRUCTION

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- A. The Construction work is accomplished in phases. The Contractor shall include in his bid all additional costs associated with phased construction, which will require unusual scheduling problems, rework, and extended construction time.

1.10 TEMPORARY ELECTRICAL SERVICES

- A. The Contractor shall provide temporary electrical outlet receptacles totaling one every 900 square feet or part thereof of work area. These receptacles shall be GFCI type 20 Ampere, 120 Volt receptacles or they shall be protected by ground fault circuit interrupter circuit breakers.
- B. The Contractor shall provide temporary lighting such that no point in any area where construction is underway shall have less than 20 foot-candles on the floor.
- C. The Contractor shall provide all stairways and means of egress from buildings under demolition, erection, construction, or repair with illumination to at least 3 foot-candles under normal conditions and 1 foot-candle under emergency power conditions. Emergency power provided for illuminating the stairway and means of egress to a minimum of 1 foot-candle shall have the capacity to maintain that level of illumination for 1 hour.
- D. The Contractor shall remove all temporary wiring, lighting, receptacles and other temporary material before the project is substantially complete.
- E. Temporary lights, power wiring, receptacles and heat shall be provided for temporary construction office spaces.
- F. The electric power consumed prior to Substantial Completion of the Project shall be paid for by the Contractor. No temporary electric resistance heaters will be allowed.

1.11 MATERIALS AND EQUIPMENT

- A. All material and equipment provided as part of this project shall be new, undamaged and shall be "listed and labeled" for the use herein intended as defined in the National Electrical Code.
- B. The Contractor shall provide a letter to the Electrical Engineer stating that all the MSDS available for equipment and material used on this project are included in the 3-ring binder.

1.12 MATERIAL SAFETY DATA SHEET (MSDS)

- A. The Contractor shall request the U.S. Department of Labor (OSHA) Material Safety Data Sheet (MSDS) for every component of electrical material provided as part of this project. All MSDS for the project shall be assembled alphabetically in a 3-ring binder and given to the Electrical Engineer prior to substantial completions.
- B. The Contractor shall provide a letter to the Electrical Engineer stating that all the MSDS available for equipment and material used on this Project are included in the 3-ring binder.

1.13 AS-BUILT RECORD DRAWINGS

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- A. The Contractor shall keep on the job at all times, one complete set of Drawings and Specifications of the Electrical Work, on which shall be neatly and accurately noted any of the project's Electrical Work that is provided other than as shown on the Drawings or described in the Specifications. Such deviations from the Drawings and Specifications shall be noted, with explanation.
- B. At the Conclusion of the Project, the Contractor shall prepare Record Drawings based upon as-built conditions. Every deviation from the Project's Drawings and Specifications shall be detailed. These Record Drawings shall be of the same quality as the original Project drawings.
- C. Provide the tie point dimensions from building structural features to the ground rod locations.
- D. Show as-built location of all underground electrical conduits on both the Electrical Site drawings and the project's Civil Engineering drawing.
- E. As-built record drawings shall be submitted to the Electrical Engineer prior to the Electrical Engineer's final "punch list" review of the project.
- F. If accurate record drawings are not provided by the Contractor at the time of substantial completion, the record drawings shall be prepared by the Electrical Engineer and the cost to the Electrical Engineer to prepare these record drawings shall be paid out of the contractor's retainer.

1.14 EQUIPMENT IDENTIFICATION

- A. Provide black and white laminated plastic name plates attached with sheet metal screws and having ¼ inch tall engraved letters identifying each piece of equipment below:
 - 1. Disconnect Switches.
 - 2. Remote Control Switches.
 - 3. Power or Lighting Panels.

1.15 MAINTENANCE INFORMATION

- A. The Contractor shall furnish all necessary assistance and instruction to properly train the Owner's authorized personnel in the operation and care of the electrical systems.
- B. The Contractor shall furnish a complete set of electrical shop drawings and operating and maintenance manuals for all electrical equipment to the Owner.
- C. The Contractor shall submit name, address and telephone number of the Manufacturer's representative and service company for each piece of electrical equipment for service and spare parts.

1.16 DEPARTURE FROM ELECTRICAL DRAWINGS AND SPECIFICATIONS

NOTE: Request for departures from the Electrical Drawing and Specifications will be processed in the same manner as any Design-Build portion of the project. See Section 16050 for details regarding submission of Design-Build material for review by the Electrical Engineer.

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- A. No departure from the Electrical Drawings and Specifications will be allowed without written request and a copy of the revised electrical drawing from the Contractor. A written request for departure from the Electrical Drawings and Specifications shall include all changes in project cost and effect on project completion schedule associated with the request. All decisions will be in writing from the office of the Electrical Engineer within five days after receipt of the written request for departure from the Contractor.
- B. Any Departure from the Electrical Drawings or from these Specifications that does not have the written approval of the Electrical Engineer may, at the discretion of the Electrical Engineer, have to be reworked at the expense of the Contractor.
- C. No payments for work and material in addition to that included in the scope of the Electrical Drawings or these Specifications, “extras”, will be allowed unless the additional work and material is approved in writing by the Electrical Engineer and the cost to the Owner for this “extra” is included in the approval. The amount of the “extra” shall not exceed an estimate based upon the current edition of Means Electrical Cost Data.
- D. Departures from the Electrical Plans and Specifications which result in the Contractor not having to perform work or provide material which was included in the scope of these documents shall be accompanied by a reduction in payments, “credits”, shall be based upon the current edition of Means Electrical Cost Data.
- E. The Contractor shall be responsible to have the Authorities Having Jurisdiction (Electrical Inspector, Fire Prevention Officer, Fire Marshal, etc) review and approve the proposed deviation from the Electrical Drawings and Specifications originally submitted for construction permits. Additional permit fees shall be paid by the Contractor.
- F. The Contractor shall be responsible to update bonding and construction insurance policies to account for the changed conditions associated with the deviation from the original Electrical Drawings and Specifications.

1.17 SUBSTANTIAL COMPLETION

- A. Before a certificate of substantial completion, or its equivalent, is issued for work herein described, the Contractor shall submit a written statement to the Electrical Engineer stating that all Electrical Work and performance tests have been satisfactorily accomplished in accordance with the Drawings and Specifications.

END OF SECTION 16000

SECTION 16010 TEST REQUIREMENTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Testing of project's systems and components.
- B. Test results documentation.
- C. A satisfactory operational test of all electrical systems both individually and interconnected with associated systems is required to prove satisfactory installation before final acceptance by the Electrical Engineer. The Contractor shall address a letter to the Electrical Engineer that states that all operational test were completed and electrical systems functioned satisfactorily.
- D. The right is reserved by the Electrical Engineer to inspect and test any portion of the equipment or material during the progress of construction.
- E. No electrical work shall be concealed by back filling earth, sheet rocking walls, or any other means until the Electrical Engineer has had the opportunity to inspect the electrical work about to be concealed. The Electrical Engineer shall be given a three day notification of impending concealment.

1.02 RELATED WORK

1.03 REFERENCES

PART 2 EQUIPMENT

2.01 TESTING

- A. The Contractor shall provide all necessary instruments and equipment and make all tests, adjustments and trial operation required.

PART 3 EXECUTION

3.01 CONDUCTOR AND BRANCH CIRCUIT TEST

- A. Verify with a continuity tester that phase conductors are not grounded prior to energizing the circuit for the first time.
- B. Verify that no current flows in grounding conductors when branch circuits are energized for the first time.

3.02 RECEPTACLE TESTS

- A. Every 125 Volt duplex type receptacle shall be tested with a receptacle wiring tester that detects error of polarity and grounding.
- B. Every 125 Volt duplex type receptacle shall be tested to detect high resistance connections, excessive (over 5%) full load voltage drop from service entrance to receptacle, and inadequate plug cap blade retention.
- C. Ground fault circuit interrupter type receptacles shall be tested to assure that the trip level is in the range of 0.004 to 0.006 Amperes.

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TEST REQUIREMENTS

- D. Verify that the rejection feature of child-resistant receptacles function properly.
- 3.03 FLUSH WALL PLATE TEST
- A. Cover plates for flush mounted light switches and receptacles shall be firmly mounted against the wall, ceiling or floor surface on all edges and corners. Using a piece of paper as a go no-go gauge, if the paper can be slid behind the cover plate at the corners, the installation is unacceptable and shall be repaired.
- 3.04 GROUNDING
- A. The adequacy of the service entrance grounding system shall be tested by measuring the ground resistance with an earth test megger as described in the National Electrical Code Handbook. The ground resistance shall not exceed 10 Ohms. Provide additional ground rods and conductors as needed.
 - B. The ground rod(s) shall be tested before being covered with soil.
 - C. Ground Rods shall be tested prior to their connection to the grounding electrode conductor from the building's power distribution system.
 - D. Record the weather condition and the soil moisture at the time of the ground rod testing.
 - E. Provide tie points from an easily recognizable building structural feature to the ground rods and show the tie points on the as-built drawings.
- 3.05 EMERGENCY LIGHTING SYSTEM
- A. The emergency lighting system and exit signs shall be operated in the emergency mode for 90-minutes.
 - B. At the end of the 90-minute test period, the Contractor shall measure the output voltage of battery operated systems at the battery. The battery voltage shall not be less than 87-½% of the starting voltage.
 - C. The Contractor shall verify that the emergency light heads are aimed at the floor or stair so as to provide not less than the required illumination level over the means of egress in accordance with the Electrical Specifications.
- 3.06 EMERGENCY POWER GENERATOR
- A. After installation, simulate power failure in such a way as to prove the satisfactory operation of the automatic transfer switch, automatic starting cycle, automatic shutdown and return to normal.
 - B. Test failure alarm and shutdown circuits by simulating failure conditions.
- 3.07 FIRE ALARM SYSTEM
- A. The Contractor shall include in his bid all costs to have the fire alarm system manufacturer's representative make a thorough inspection and operational test of the complete fire alarm system including all system components. The inspection shall be designed to ensure the following criteria have been met:

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1. The complete system and system's individual components shall be tested in accordance with Chapter 7 of the National Fire Alarm Code. The complete system and the system's individual components shall be proven to operate in accordance with the Project's drawings and specifications, the manufacturer's rated characteristics, and the National Fire Alarm Code.
2. Verify that all installation requirements associated with the UL listing for each component have been adhered to.
3. Verify that the system and its individual components have been provided in accordance with the manufacturer's requirements.
4. Verify that the required supervisory features of the system function satisfactorily.

3.08 CATV ANTENNA SYSTEM

- A. The Contractor shall verify that the CATV system was provided in accordance with the Electrical Drawings and Specifications and the manufacturer's detailed installation requirements. The Contractor shall test the installed system to verify that it functions as intended.

3.09 LIGHTING SYSTEMS

- A. The Contractor shall verify that the lighting system was provided in accordance with the Electrical Drawings and Specifications and the manufacturer's detailed installation requirements.
- B. The Contractor shall test the installed system to verify that it functions as intended.

3.10 VOICE/DATA

- A. Installed wiring and connectors shall be tested to demonstrate that the installation meets the minimum performance standards of ANSI/EIA/TIA-569.
- B. The Contractor shall verify that the voice/data wiring system was provided in accordance with the Electrical Drawings and Specifications and manufacturer's detailed installation requirements.

3.11 REWORK

- A. All project systems and system components shall be reworked until test results indicate that the specified criteria have been met and the system functions as intended.

3.12 DOCUMENTATION

- A. The Contractor shall address a letter to the Electrical Engineer, which states that all specified test have been accomplished, lists the test results, and states that all systems and components meet the specified criteria.
- B. After satisfactory completion of the fire alarm system test specified above, a Fire alarm system Record of Completion shall be completed in accordance with the National Fire Alarm Code and sent to the Electrical Engineer. System documentation shall be provided to the Electrical Engineer by the Contractor.

END OF SECTION 16010

SECTION 16020 SUBMITTALS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Proposed Equipment and Material submittals.
- B. Material Safety Data Sheet

PART 2 SUBSTITUTIONS

- A. No substitution of material or equipment for that specified on the Electrical Drawings or in the Specification shall be allowed unless otherwise noted on the Electrical Drawings or this Specification.
- B. The Contractor shall assume all responsibility for additional expenses resulting from every substitution. For additional details regarding departures from the Electrical Drawings and Specifications, see Section 16000, Paragraph 1.15.
- C. The Electrical Engineer reserves the right to change from the original specification to another specified material equipment or method if the originally specified material's character has been changed by the manufacturer without notice of change to the Electrical Engineer or applicable laws contradict the intent of the Specification

PART 3 SUBMITTALS

- A. No shop drawings shall be submitted unless required by other sections of the Project Specifications.
- B. Where indicated in other sections of the Project Specifications that a submittal is required, the submittal procedure shall be as follows:
 - 1. The Contractor shall provide five sets of submittals.
 - 2. When proposed for review, submittals must bear a Contractor's stamp indicating that the submittal meets the requirements of the Project's drawings and specifications before being proposed for the Electrical Engineer's review. Without the Contractor's stamp, the submittals will be returned for correction.
 - 3. No consideration will be given to brochure or catalog information not specifically marked for and referenced to the Project's drawings and specifications.
 - 4. The submittal shall contain reference to specified manufacturer's catalog numbers which shall be qualified in writing if required to meet the product performance or characteristics described in the Project's drawings or specifications.
 - 5. In the event that any specified manufacturer's part number has been superseded by a new number since the preparation of the Project's drawings and specifications, the new number shall be provided with the old catalog number noted on the submittal.
 - 6. In any case where a written description or notes on the Project's drawings or specifications, pertain to performance or the characteristics of equipment or hardware and these descriptions or notes conflict with the manufacturer's

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catalog number, the written description or notes on the Project's drawings or specifications shall take precedence. If the manufacturer is unable to modify the product, as described by the catalog number, to include the written description on the Project's drawings or specifications, then the product described by catalog number shall be considered unsatisfactory for use on this project.

7. All equipment and material submittals shall have a letter included with the submittal that lists the delivery lead time requirements for each item in the submittal. The delivery lead time is the number of CALENDAR days between the time the order for an item is placed with the distributor and the time the item can be delivered to the work site. No proposed item will be reviewed without its delivery lead time indicated.
8. Equipment and material proposals shall indicate all UL listings related to this project's intended application.
9. Equipment and material proposals shall include the Material Safety Data Sheet (MSDS).
10. The Contractor shall submit a letter from the "disposal firm" that will accept the demolition materials from this project. For non-hazardous waste, the "disposal firm" shall be the next custodian of the demolition material even if this custodian is only a transportation firm. For hazardous waste, the "disposal firm" will include the transportation firm and final recipient of the hazardous waste. The letter required by this section will state that the firm in custody of demolition material is duly qualified. See Section 16040.

PART 4 EXECUTION

- A. No equipment or material associated with a required shop drawing shall be purchased or installed prior to written approval of that shop drawing from the project Electrical Engineer.
- B. All MSDS for this Project shall be assembled in a 3-ring binder. See General Conditions Section 16000, Paragraph 1.12.

END OF SECTION 16020

**SECTION 16030
FIRE RATED PENETRATIONS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Sealing electrical penetrations of fire rated walls, floors and ceiling.
- B. Preserving ceiling fire ratings at recessed light fixtures.

1.02 RELATED WORK

- A. Conduits.
- B. Cables.
- C. Boxes.
- D. Wireways.
- E. Lighting.

1.03 REFERENCES

Note: Electrical work shall be in accordance with the most recent edition or revision of the following documents.

- A. UL publication: "Electrical Construction Materials Directory".
- B. UL publication: "Electrical Appliance and Utilization Equipment Directory".
- C. UL publication: "General Information for Electrical Construction, Hazardous Location, and Electric Heating and Air Conditioning Equipment.
- D. UL publication: "Building Materials Directory".
- E. UL publication: "Fire Resistance Directory".
- F. NFPA 10-1: Life Safety Code.

PART 2 MATERIAL

2.01 ACCEPTABLE MANUFACTURERS (For UL Listed Fire Rated Sealing Material Only)

- A. 3M Company: "Fire Barrier" caulking, putty and systems.
- B. Dow Corning: "RTV Silicone Foam: sealants.

PART 3 EXECUTION

3.01 GENERAL

- A. The Contractor shall be responsible to determine the fire rating of every wall, ceiling and floor penetrated in the course of the project's electrical work.
- B. The Contractor shall be responsible to preserve the fire rating of every wall, ceiling and floor with regard to penetrations associated with the project's electrical work.

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FIRE RATED PENETRATIONS

3.02 INSTALLATION

- A. All cables penetrating floors, ceilings, or walls shall be provided in accordance with the UL listed fabrication details furnished by the manufacturer of the fire sealing material to maintain the fire rating.
- B. Alternate fire stopping methods are acceptable if they are in accordance with a method shown in the UL Fire Resistance Directory and UL Building Materials Directory.

END OF SECTION 16030

SECTION 16040
ELECTRICAL CONSTRUCTION WASTE DISPOSAL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Electrical construction waste.

1.02 REGULATORY REQUIREMENTS

- A. The disposal of electrical construction waste and material shall be in accordance with all applicable Federal, State, and local community laws and ordinances.

1.03 SUBMITTALS

- A. The Contractor shall submit a letter detailing the disposal of and the recipient of non-hazardous electrical construction waste generated as part of this project.
- B. The Contractor shall submit a letter from the transportation company and the final recipient of disposed electrical construction waste, and electrical equipment, components, and material which is considered hazardous waste stating that all persons and companies involved with this disposal are qualified to do this work.
- C. See Section 16020 for additional details.

PART 2 PRODUCTS

2.01 The following list of electrical systems, equipment, components, and material is for guidance, only, and is not complete.

- A. Electric lighting lamps containing more than 0.2 ppm of mercury or 5 mg/1 of lead are subject to all the laws pertaining to hazardous waste disposal. Some types of lamps included are fluorescent lamps, high pressure sodium lamps and mercury vapor lamps. (Note: Hazardous waste determination is not necessary if waste lamps are kept whole and intact and are delivered to a qualified lamp recycling facility.)
- B. Smoke detectors contain radio active material shall be considered hazardous waste. These smoke detectors shall be returned to the manufacturer located inside the detector. If that instruction is missing, the Contractor shall be responsible to contact the Department of Environmental Protection and dispose of these smoke detectors in accordance with all applicable state and federal requirements. Regardless of the disposal method, the contractor shall provide a letter to the owner with a copy to the Electrical Engineer that details the disposal method. See Section 16020 for additional requirements.
- C. Copper and aluminum wiring release by the owner to the contractor for disposal shall be recycled. The Contractor shall deliver this wiring to a facility for recycling. The salvage value of these materials shall be retained by the Contractor. The Contractor shall provide a letter to the owner, with a copy to the Electrical Engineer that details the disposition of copper and aluminum wiring removed from this project.

PART 3 EXECUTION

- A. All electric demolition materials shall remain the property of the owner until the owner or a representative of the owner releases the material to the Contractor. When the

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ELECTRICAL CONSTRUCTION WASTE DISPOSAL

demolition material is released to the Contractor, it shall be removed from the site immediately and disposed in accordance with this specification.

- B. Electrical construction waste shall be removed from the site in accordance with this section of the Electrical Specification.

END OF SECTION 16040

SECTION 16111 CONDUIT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Rigid Metal Conduit and Fittings.
- B. Electrical Metallic Tubing and Fittings
- C. Flexible Metal Conduit and Fittings.
- D. Liquidtight Flexible Metal Conduit and Fittings.
- E. Rigid Non-Metallic Conduit and Fittings.

1.02 RELATED WORK

- A. Fire Rated Penetrations: See Section 16030.
- B. As-built conduit location drawings.

1.03 REFERENCES

- A. Applicable UL listing requirements.
- B. Applicable NEMA standards.

1.04 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020.

PART 2 PRODUCTS

Note: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this product.

PART 3 EXECUTION

3.01 ELECTROLYSIS

- A. Do not bring dissimilar metals into contact with each other to prevent electrolysis. Where dissimilar metal contacts cannot be avoided, coat surfaces with corrosion inhibiting compound before assembling.

3.02 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for type THW insulated conductors, unless conduit size is otherwise specified on the Electrical Drawings
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

SECTION 16111 CONDUIT

- D. Maintain minimum six inch clearance between conduit and heat sources such as flues, steam pipes and heating appliances.
- E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations.
- F. Group conduit in parallel runs using conduit racks constructed of steel framing channel, threaded rods, and conduit straps or clamps. Provide space for 25% additional conduit.
- G. Do not fasten conduit with wire or perforated pipe straps. Remove all temporary conduit supports before conductors are pulled.

3.03 CONDUIT INSTALLATION

- A. Cut conduit square and de-burr cut ends.
- B. Use hydraulic one-shot conduit bender or elbows for bends in conduit larger than two-inch trade size.
- C. Do not construct moisture traps in conduit runs. All conduits shall slope to drainage points.
- D. Use suitable conduit caps to protect empty conduit against entrance of dirt and moisture.
- E. Provide suitable pull wire in every empty conduit.
- F. Make connections to motors and vibrating equipment with a minimum of 24 inches of flexible conduit. Minimum size ½ inch for motor connections. Use 3/8 inch flexible conduit only for fixture and control wiring.
- G. All Service Entrance conduits will have grounding bushings with plastic throats.
- H. All penetrations of building's exterior envelope shall be made weatherproof.
- I. Maximum size conduit in concrete slabs in ¾ inch. Do not allow conduits to cross each other in slabs.
- J. Wipe plastic conduit clean and dry before joining. Use conduit cleaning solvent before cementing joints. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20-minutes minimum before moving conduit or pulling in conductors.
- K. All metal conduits shall be grounded but shall not be used as the grounding conductor.
- L. All conduit entering concentric knockouts shall be terminated in bonding bushings with bonding conductor.

3.04 CONDUIT INSTALLATION SCHEDULE

- A. Underground Installations More than Five Feet From Foundation Wall shall be Schedule 40 plastic conduit.
- B. Installations Under Concrete Slab shall be Schedule 40 plastic conduit.
- C. Exposed Outdoor Locations shall be Rigid Metal Conduit (RMC).

SECTION 16111 CONDUIT

- D. Only Wet Interior Locations shall be Schedule 40 plastic conduit. Wet locations are as defined by the National Electrical Code or as noted on the Electrical Drawings.
 - E. Exposed Interior Locations shall be Electrical Metallic Tubing (EMT) unless otherwise noted on the Electrical Drawings or in more detailed parts of the Specification.
 - F. Surface mounted raceways such as Walkermold and Wiremold shall be used only where detailed on the drawings.
 - G. Plastic Conduit shall be converted to Rigid Metal Conduit before entering building through foundation wall or slab.
 - H. No Plastic Conduit shall be used within the building.
 - I. All electrical wiring to boxes in masonry shall be in concealed Electrical Metallic Conduit.
 - J. All under slab and underground conduits shall have a minimum slope of 1% down toward the source end.
 - K. All under slab and underground conduits shall have a drain hole at the lowest point.
 - L. Metallic conduit over 2" trade size shall be RMC unless otherwise noted on the Electrical Drawings
 - M. Metallic conduit 2" trade size or smaller may be EMT unless otherwise noted on the Electrical Drawings
- 3.05 CONDUIT COLOR CODE
- A. Coat metallic conduits, prior to installation, with chip resistant enamel paint or 1/2" wide self-sticking marker tape at 3' intervals of the following colors:
 - 1. Red: Conduits containing fire alarm system conductors.
 - 2. Yellow: Conduits containing circuits powered from the generator.
 - 3. Blue: Conduits containing telephone, computer data cables, or other low voltage signal circuits other than fire alarm.
 - 4. Natural: (no paint) Conduits containing 120/240 volt circuits except those on generator power.
- 3.06 PULL WIRES
- A. Provide pull wires in all empty conduits. Provide tags on each end of all pull wires giving location of other end.
- 3.07 Show as-built location of all electrical conduits installed underground outside the building and below the slab inside the building. The underground conduits outside the building shall be shown on both the Electrical Site drawing and the Civil Engineering site drawing. The conduits provided under the slab, inside the building, shall be shown on the Electrical Power Distribution Drawing.

END OF SECTION 16111

**SECTION 16120
CONDUCTORS, CABLES, AND CONNECTORS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Conductors and Cables
- B. Connector Hardware

1.02 RELATED WORK

- A. Identification.
- B. Supports and Fasteners.
- C. Conduit Requirements: See Section 16111.
- D. Fire Rated Penetrations: See Section 16030.
- E. Test Requirements: See Section 16010.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended uses for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Firms regularly engaged in manufacture of electrical conductors, cables, and connectors of types and ratings required, whose products have been in satisfactory use in similar service for not less than three years.

2.02 MATERIALS

- A. Conductor material (COPPER): Electrical conductors of 98% conductivity, annealed Copper shall be used throughout the project. Individual conductor insulation shall be type THWN, 600 Volts, and shall be UL listed and labeled for the use herein intended. Note: Conduits are sized based on THW insulation.
- B. Conductor material (ALUMINUM): NO ALUMINUM CONDUCTORS SHALL BE ALLOWED IN ANY APPLICATION ON THIS PROJECT, UNLESS SPECIFICALLY IDENTIFIED ON ELECTRICAL DRAWINGS.
- C. Individual branch circuit conductors shall not be smaller than AWG #12. Conductors shall have insulation rated at 600 Volts. The ampacity shall be sized at 60 degrees Centigrade.
- D. Fixture conductors shall not be smaller than AWG #12 with heat resistant thermoplastic rated for 600 VAC and with a minimum operating temperature rating of 90 degrees Centigrade. See Section 16502 for ballast compartment wiring.

SECTION 16120
CONDUCTORS, CABLES, AND CONNECTORS

- E. Conductors sized AWG #10 and smaller shall be connected by either color-coded twist-on spring loaded or color-coded die compression type connectors.
- F. Conductors sized AWG #8 and larger shall be connected by either color coded die compression or bolted connectors.
- G. Connectors which pierce insulation as means of making contact with conductor SHALL NOT BE ALLOWED on conductors sized AWG #10 or smaller.
- H. Connectors, which pierce insulation as means of making contact with conductor, shall have the contact pressure maintained by steel nut and bolt.
- I. Exterior exposed wiring shall be in metallic conduit. Where the conduit is exposed to direct sun, the conductor insulation shall be type THHN.
- J. Individual THWN insulated conductors ampacity shall be sized at 60 degrees Centigrade through AWG #1 and at 75 degrees Centigrade where larger than AWG #1.
- K. All conductors and cables used on this project shall have an overall insulation rating of at least 600 VAC.
- L. Type MC cable shall be used for size AWG #10 and 12 branch circuits except where flexible metal conduit is specified.
- M. Branch circuits larger than AWG #10 shall be type MC or individual conductors in electrical metallic tubing (EMT).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide only copper grounding electrode conductors, and straps. Provide copper clad steel grounding electrodes.
- B. Identify circuits in panelboards and load centers with permanent tags attached to conductors as the leave breaker or fuse lugs. This requirement is in addition to panel directory requirements of Section 16474.
- C. Use wire pulling lubricant for pulling AWG #4 and larger wire. Lubricant shall be UL listed and labeled for the conductor insulation used.
- D. Pull wire into conduit only after nearby construction work is complete and after moisture and debris is removed from conduits.
- E. Color code conductors to designate ground conductor, neutral conductor and phase conductors as follows:

120/240 Phase-A	Black
Phase-B	Red
Neutral	White
Ground	Green

- F. Pull conductors together where more than one is being pulled in a raceway.

END OF SECTION 16120

SECTION 16131 PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pullboxes.
- B. Junction Boxes.

1.02 RELATED WORK

- A. Section 16190: Supporting Devices.
- B. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project

2.01 MATERIALS

- A. Pullboxes and Junction Boxes
 - 1. Shall be of metal construction.
 - 2. Shall have screw on or hinged cover unless otherwise noted on the Electrical Drawings.
 - 3. Waterproof boxes shall have bolted or hinged, and gasket covers.
- B. Flush Mounted Pullboxes:
 - 1. Shall be of metal construction.
 - 2. Shall be provided with overlapping covers with flush-head cover retaining screws.

2.02 ACCEPTABLE MANUFACTURERS

- A. Junction and pull boxes used on this project shall be supplied only by Companies regularly employed in the manufacture of types and size required, whose products have been in satisfactory use in similar service for not less than three years.

PART 3 EXECUTION

3.01 INSTALLATION

SECTION 16131
PULL AND JUNCTION BOXES

- A. Pullboxes and junction boxes exposed to the weather or in damp locations shall be weatherproof and have neoprene or silicon rubber gaskets. Silicon rubber gaskets shall be used with heat producing equipment.
- B. All box connectors and wire and cable clamping connectors shall be made of metal. No "push-in" nylon or rubber cable clamps are allowed.
- C. All enclosures exposed to the weather shall have a weep-hole at the lowest point to prevent the build up of condensation. This does not apply to explosion proof equipment.
- D. Where boxes are not sized on the Electrical Drawings, it shall be the Electrical Contractor's responsibility to provide a box sized in accordance with the associated wiring.

END OF SECTION 16131

**SECTION 16133
ENCLOSURES AND WIREWAYS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Electrical Enclosures

1.02 RELATED WORK

- A. Communications.
- B. Lighting Control Equipment.
- C. Power Control Equipment.
- D. Fire Rated Penetrations: See Section 16030

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURES

- A. Manufacturer and Type: Use metal enclosure of the type and size shown or as required by Code it not sized on the drawing.

2.02 MATERIALS

- A. Cabinets: Metal construction, conforming to National Electric Code prime coated and equipped with door, flush hinges, latch and lock assembly.
- B. Backboard: All electrical enclosures and wireways shall be mounted on $\frac{3}{4}$ inch fir plywood, size to leave a minimum of 12 inch clear all around. Provide matte black painted finish on both sides.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Terminate conduit in enclosures and wireways with lock nut and bushing.
- B. Vacuum clean all cabinets at completion of project.
- C. All surface mounted cabinets shall be mounted on plywood backboards.
- D. Where boxes are not sized on the Electrical Drawings, it shall be the Electrical Contractor's responsibility to provide a box sized in accordance with the associated wiring.

SECTION 16133
ENCLOSURES AND WIREWAYS

- E. All enclosures and wireways containing 480 Volt wiring shall have a red enamel painted warning sign, "Danger – 480 Volt" stenciled on the cover.

END OF SECTION 16133

SECTION 16134 OUTLET AND DEVICE BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Outlet Boxes (wiring device attached to cover).
- B. Device Box (wiring device attached to box).

1.02 RELATED WORK

- A. Fire Rated Penetrations: See Section 16030

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 MATERIALS

- A. Boxes
 - 1. For use on all interior walls in dry locations, boxes shall be code conforming galvanized steel.
 - 2. For use on interior sides of all exterior walls in dry locations, boxes shall be code conforming galvanized steel.
 - 3. Boxes mounted on ceiling or in conjunction with light fixtures shall be galvanized steel.
 - 4. Do not use sectional boxes for multi-gang outlets.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Where interior boxes are mounted in exterior walls the Electrical Contractor shall provide insulation behind outlet boxes to prevent condensation in boxes.
- B. In all junction boxes exposed to weather, drill 1/8 inch diameter drain hole into box cavity at lowest point. This does not apply to explosion proof boxes.
- C. Wall plates for flush outlet boxes shall be against the wall on all edges and corners. See Test Requirements and Criteria, Section 16010.
- D. Where outlet boxes are installed by doors, windows, or any other wall opening, the outlet box shall be mounted at least four inches away from the frame and any moldings around the opening.

SECTION 16134
OUTLET AND DEVICE BOXES

- E. Where enclosures are not sized on the Electrical Drawings, it shall be the Electrical Contractor's responsibility to provide a box sized in accordance with the associated wiring.
- F. Do not mount recessed boxes back to back in any partition, wall, floor or ceiling.
- G. Do not mount recessed boxes back to back in same stud or framing bay in walls.
- H. Verify that not more than 100 square inches in 100 square feet is being used for penetrations in fire rated walls by outlet and device boxes. Verify that all other UL listing requirements are followed for installation of outlet and device boxes in fire rated walls.

END OF SECTION 1634

SECTION 16141 LIGHT SWITCHES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Wall Switches.

1.02 RELATED WORK

- A. Outlet Boxes.
- B. Cover Plates.
- C. Grounding.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide switches in accordance with the material and symbol lists, notes on the drawing, and this specification.

2.02 MATERIALS

- A. Light switches (ALL TYPES).
 - 1. Shall be rated 20 Amperes.
 - 2. Provide matching two pole, 3-way and 4-way switches.
 - 3. Switches shall be rated 120/277 VAC
 - 4. Color shall be gray

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount top of switch outlet box 48" above finished floor unless otherwise noted on Drawing.
- B. Coordinate mounting location with architectural details.
- C. Light switches by doorways shall be mounted on the latch side of the door openings. Verify door swings with Architectural Plans.
- D. Light switches by doorway shall be mounted at least 4" away from door frame.

**SECTION 16141
LIGHT SWITCHES**

- E. When more than one light switch (multi-gang) is provided by a door, the lights closest to the door shall be controlled by the light switch closest to the door opening.

END OF SECTION 16141

SECTION 16142 INCANDESCENT DIMMERS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Incandescent Dimmers.

1.02 RELATED WORK

- A. Outlet Boxes.
- B. Plate Covers.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Lutron.
- B. Leviton.
- C. General Electric (not push on-off type).

2.02 DEVICES

- A. Solid state, semi-conductor type capable of controlling lighting intensity over the complete range from off to full brightness with integral On/Off switch.
- B. Suitable for mounting in multi-gang outlet box without de-rating.
- C. Dimmer capacity shall be based on the connected load shown on the electrical drawings unless otherwise noted on the drawing.
- D. Shall have radio and television interference filter.
- E. Shall operate with 3-way switches where shown on Drawing.
- F. Dimmer shall be line voltage compensated to prevent flicker.
- G. Dimmers in the Assembly space shall have lamp debuzzing coils at the load.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount at switch height.

SECTION 16142
INCANDESCENT DIMMERS

- B. Do not use common neutrals on dimmer circuits.
- C. Do not mount in manner to require de-rating.
- D. Use multi-gang one piece face plates on multi-gang installations.

END OF SECTION 16142

SECTION 16143 FLUORESCENT DIMMERS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Fluorescent dimmers.
- B. Dimming Ballast.

1.02 RELATED WORK

- A. Outlet Boxes
- B. Wall Plate Box Covers.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURES.

- A. Lutron
- B. General Electric
- C. Leviton

2.02 DEVICES

- A. Solid state, semi-conductor type capable of controlling lighting intensity over the complete range from off to full brightness with integral On/Off switch.
- B. Dimmer capacity shall be based on the connected load shown on the electrical drawings unless otherwise noted on the drawing.
- C. Shall have radio and television interference filter.
- D. Shall operate with 3-way switches where shown on Drawing.
- E. Dimmer shall be recommended by the manufacturer of the ballasts used in the lighting load being controlled. The dimmer/on/off switch shall prevent the fluorescent lamps from flickering when turning ON.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount at switch height.
- B. Do not use common neutrals on dimmer circuits.

SECTION 16143
FLUORESCENT DIMMERS

- C. Do not mount in manner to require de-rating.
- D. Use multi-gang one piece face plates on multi-gang installations.

END OF SECTION 16143

SECTION 16145 RECEPTACLES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Receptacles

1.02 RELATED WORK

- A. Outlet Boxes.
- B. Plate Covers.
- C. Grounding.
- D. Identification.
- E. Testing: See Section 16010.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Receptacles shall be by Manufacturers specified on Drawings.

2.02 DEVICES

- A. Standard Duplex Receptacles: (Not Childproof)
 - 1. Shall be rated 20 Amp, 125 VAC, 2-pole, 3-wire.
 - 2. Shall be polarized, straight blade, with U grounding slot and NEMA 5-20 configuration.
 - 3. Shall be full gang size.
 - 4. Color shall be gray.
 - 5. Wiring terminals:
 - a. Receptacles shall be provided side-wired with screw terminals which when wired must have two full threads of engagement on extruded section in terminal.
- B. Ground Fault Circuit Interrupter Receptacles:
 - 1. Shall be rated 20 Amps, 125 VAC.
 - 2. Color shall be gray.

SECTION 16145 RECEPTACLES

3. Minimum to maximum Earth Leakage Current needed to trip shall be between 0.004 and 0.006 Amperes.
 4. Use feed through GFCI ONLY where specifically called for on Electrical Drawings.
 5. Shall have built-in test circuit.
 6. Where exposed to weather, receptacle shall have a waterproof spring loaded cover for exterior mounting. Wet location receptacles shall be waterproof with attachment plug inserted.
 7. GFCI receptacles shall have an indicator light which shows that the receptacle is energized.
- C. Range outlets shall be rated for 50 Ampere, 125/250 Volt grounding type unless otherwise noted on Drawing
- D. Clothes Dryer Outlet shall be 30 Amperes, 125/250 Volt grounding type unless otherwise noted on drawing.
- E. Where indicated to be childproof, receptacle shall be Hubbell, Catalog Number 5G62HGY, 15 Amps, 125 Volts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount receptacles vertically with bottom of box at 18 inches above finished floor with grounding pole at top unless otherwise noted on Drawing.
- B. In all areas, coordinate receptacle height with benches and counters. Verify equipment and counter layout and details with other trades. Receptacles shall be mounted eight inches above counters and benches unless otherwise noted on Drawings.
- C. Isolated ground receptacle grounding conductor shall not be connected to building ground circuit except as grounding electrode conductor at service entrance.
- D. Provide electrically continuous grounding CONDUCTOR for all receptacles. All conduits shall be grounded but shall not be used as grounding conductor.
- E. Receptacles mounted within six feet of every sink or other wet location shall be GFCI type. All receptacles in the kitchen, garage, and bathroom shall be GFCI type.
- F. Every duplex receptacle shown connected to a switch is intended to mean that the top half of the receptacle is switched and is separated from the bottom half. The bottom half is "on" all the time.

END OF SECTION 16145

SECTION 16147 COVER PLATES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Cover Plates. (Standard and Waterproof)

1.02 RELATED WORK

- A. Testing. See Section 16010

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 MATERIALS

- A. Nylon: Completely smooth, color to match device for all interior flush mounted receptacles and switches.
- B. Cast Metal: Die cast aluminum furnished with four mounting screws and gasket for exterior receptacles and switches.
- C. Gaskets: Silicon Rubber for use with exterior and wet interior outlet boxes.
- D. Steel: Hot dip galvanized or cadmium plated.
- E. All exterior receptacles and switch boxes shall be fitted with corrosion resistant, watertight, weatherproof, self closing cover plates.
- F. All weatherproof cover plates shall be sealed against the box and wall with neoprene gaskets.
- G. Wet location receptacles shall be water tight and weatherproof both when the plug cap is in use and when the plug cap is not in use.
- H. Gray nylon wall plates shall be used on all flush boxes in finished walls.

2.02 PLATES

- A. Flush mounted plates shall be beveled type with smooth rolled outer edge.
- B. Surface mounted box cover plates shall be beveled, pressure formed with smooth edge to fit box. Break all sharp edges with a file.
- C. Waterproof cover shall have a gasket, clear polycarbonate gasketed and spring loaded for exterior use and gray nylon for interior use.
- D. Where two-gang boxes are required for single-gang devices, provide special plates with device opening in center of plate. Do not use two-gang plates with one opening blanket.

SECTION 16147 COVER PLATES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide cover plates on all devices, outlets, and junction boxes.
- B. Inspect each damp or wet location cover plate installation to insure that the gasket is properly sealing the enclosure.
- C. All cover plates on flush mounted boxes shall be firmly mounted against and touch the wall, ceiling or floor surface on all edges and corners. If a piece of paper can be slid behind the cover plate at any point, that installation is unacceptable and shall be repaired.
- D. All cover plates shall be parallel and perpendicular to major building lines.

END OF SECTION 16147

SECTION 16190 SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Conduit Supports.
- B. Cable Supports.
- C. Pull, Outlet, and Junction Box Supports.
- D. Luminaries Support.

1.02 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, and Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 CONDUIT SUPPORTS

- A. Single runs may be supported by beam clamps or ring bolt type hangers with specialty clips. Do not use Plumber's perforated strap.
- B. Horizontal and vertical conduit shall be supported with specifically designed conduit fittings, framing channel, or beam clamps.
- C. Mount conduit as shown in Drawing details when giving.

2.02 ANCHOR METHODS

- A. Hollow Masonry: Toggle Bolts or Spider Expansion Anchors.
- B. Solid Masonry: Lead Expansion Anchors or Preset Inserts.
- C. Metal Surfaces: Machine Screws, Bolt, Clamps made for the specific application or Welded Studs.
- D. Wood Surfaces: Wood Screws and Cable/Conduit Clamps.
- E. Concrete Surfaces: Self Drilling Anchors or Powder – Driven Studs.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Layout to maintain neat mechanical appearance.
- B. Provide supports adequate to carry five times the equipment loads expected.
- C. Follow drawn layouts, when shown, as closely as possible avoiding structural features and equipment of other trades.

SECTION 16190
SUPPORTING DEVICES

- D. Luminaries shall be supported from building structural members.
- E. No conduits shall be supported by pendant wires. All conduit shall be attached directly to the building's structure (except flexible metal conduit), or supported by threaded rod assemblies.

END OF SECTION 16190

SECTION 16402
UNDERGROUND ELECTRIC FEEDERS
AND BRANCH CIRCUITS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Underground Electric Service Entrance Lateral.
- B. Underground Electric Feeders and Branch Circuits.
- C. Underground conduits provided for electric power, CATV, Data, and Telephone on both the "Utility Side" and the "Owner's Side".

1.02 RELATED WORK

- A. Conduit.
- B. Wires and Cables.
- C. Work includes Primary Conduit, Cable, and Riser at Pole.
- D. Fire Rated Penetrations: See Section 16030.

1.03 REGULATORY REQUIREMENTS

- A. All work associated with incoming utility wiring shall be done in accordance with the utility and local and state construction codes.

1.04 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 MATERIALS

- A. Conduit: See Section 16111.
- B. Markers: Every buried conduit shall be marked by warning tape installed 12 inches below grade.
- C. Drainage Assembly: Slope all underground conduit to drain. Provide a drain hole at lowest point in each conduit.

PART 3 EXECUTION

3.01 UNDERGROUND INSTALLATION

- A. Provide adaptation from PVC conduit to steel bends. All bends in service entrance lateral shall be steel.

SECTION 16402
UNDERGROUND ELECTRIC FEEDERS
AND BRANCH CIRCUITS

- B. Slope service to drainage point. (Source end)
- C. Terminate service conduit in main panel with grounding bushing. Make ground connection from bushing to distribution center ground bus.
- D. Terminate service conduit at transformer with grounding bushing. Make ground connection from conduit bushing to ground bus.
- E. Clean and swab ducts before pulling conductors.
- F. Pull all conductors in a conduit at the same time.
- G. Provide weatherhead, conduit, connectors, and conductors as required by the local Utility.
- H. Include in bid all work in support of and payments required by local utilities in connection with underground service.
- I. Place feeder conduit on undisturbed soil where possible. Use pit run gravel and sand, placed in six inch lifts and compact backfill.

3.02 SERVICE INSTALLATION

- A. Provide trench, cable and conduit for the satisfactory installation of the underground wiring.

END OF SECTION 16402

SECTION 16430 METERING

GENERAL

1.01 WORK INCLUDED

- A. Provide Metal Housing, Meter Socket, and Service Enclosure for Meter.
- B. Provide Instrument Transformers and Cabinets if required.
- C. Provide all equipment, connectors, and conductors not furnished and installed by the local electric power utility.

1.02 RELATED WORK

- A. Panelboard.
- B. Electric Service.
- C. Service Entrance.
- D. Grounding.
- E. Conduit.
- F. Meter Transformers, Transformer Enclosures and Sockets.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15, and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide metering enclosures and associated conduits and wiring.
- B. All metering equipment and enclosures not furnished and installed by local electric power utility shall be provided by the Electrical Contractor.
- C. If allowed by CMP, the current transformers shall be located at the weatherhead with a separate conduit provided down to the meter.

END OF SECTION 16430

SECTION 16450 GROUNDING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Power System Grounding.
- B. Telephone System Grounding.
- C. Data System Grounding.
- D. CATV System Grounding.

1.02 RELATED WORK

- A. Section 16111 – Conduit.
- B. Section 16120 – Wire and Cable.
- C. Testing: See Section 16010
- D. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15, and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 GROUNDING RODS

- A. Provide copper, clad steel grounding rods.

2.02 GROUNDING ELECTRODE CONDUCTOR

- A. Connect slab reinforcing mesh to grounding electrode conductor at three points.
- B. Connect Building's structural steel to grounding electrode conductor.
- C. Provide at least two grounding electrodes at least six feet apart, exterior to the building at more than 5' from the building foundation. Provide as many more than two as needed to achieve a 10 Ohm ground resistance. Test ground rod resistance prior to covering with soil and prior to connection to the building's power distribution system grounding electrode conductor.
- D. Bond and ground domestic water system.

PART 3 EXECUTION

3.01 POWER SYSTEM GROUNDING

SECTION 16450 GROUNDING

- A. Circuit Grounding: Provide grounding bushings, studs, jumpers, and bonding conductors as required at service entrance, panelboards, and distribution system User's equipment.
- B. Provide as many ground rods as necessary to achieve a safe and adequate system ground. See Paragraph 2.02 C above.
- C. Ground rods shall be tested prior to connection to the building power distribution system grounding electrode conductor.

3.02 COMMUNICATION SYSTEM GROUND

- A. Telephone: Provide one AWG #2 with green THWN insulation from ground bus at telephone service entrance to the electrical system grounding electrode.

3.03 GROUNDING CONDUCTORS

- A. All metallic conduit shall be grounded but shall not be used as the grounding conductor.
- B. A separate green insulated grounding conductor shall be provided for every feeder, sub-feeder and branch circuit in conduit.
- C. Multi-wire branch circuits will not be allowed on this project.

3.04 TIE POINTS

- A. Measure exact location of ground rods and tie to easily recognized building structural feature. Add these measurements and the location of the ground rods to the As-Build Drawings.

END OF SECTION 16450

SECTION 16474 PANELBOARDS AND SWITCHBOARDS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide circuit breaker panelboards as indicated in the panelboard schedules and on the drawings. Panelboards shall be equipped with bolt-on thermal-magnetic molded case circuit breakers with frame and trip ratings as shown on the panel schedule.

1.02 RELATED WORK

- A. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Provide shop drawing submittals.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

NOTE: See Material Schedule and Panel Directories on Drawings.

2.02 CIRCUIT BREAKERS

- A. Interrupting ratings shall be at least 22,000 rms symmetrical amperes unless otherwise noted on the Electrical Drawings. Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads shall carry the SWD marking.

2.03 BUSSING ASSEMBLY AND TEMPERATURE RISE

- A. All current carrying parts of the bus structure shall be copper.

2.04 CABINETS AND FRONTS

- A. Each front shall include a door and have a flush cylinder tumbler-type lock with catch and spring-loaded door pull. All panelboards locks shall be keyed alike. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Panel trim shall be surface or flush as indicated on the Electrical Drawings

2.05 EQUIPMENT SHORT CIRCUIT RATING

- A. Each panelboard and installed circuit breakers shall have short circuit current ratings equal to or greater than the AIC rating shown on the Panelboard Schedule on the Electrical Plans, or given in this Specification. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage. Unless otherwise noted on panel directories or riser diagrams, the minimum AIC rating shall be 22,000 Amps. AIC ratings are not to be based upon series ratings.

PART 3 EXECUTION

3.01 INSTALLATION

SECTION 16474
PANELBOARDS AND SWITCHBOARDS

- A. Provide filler pieces for unused spaces.
- B. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit.
- C. The word “spare” on panel directories means to provide a spare circuit breaker for the size shown.
- D. The word “space” on panel directories means to provide a blank location where a future circuit breaker could be located.
- E. Label branch circuit wiring inside panelboard with descriptive tags.

END OF SECTION 16474

SECTION 16477
SAFETY SWITCHES AND DISCONNECT MEANS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide Motor Disconnects.
- B. Provide Circuit and Equipment Disconnects consisting of fused switches and enclosed circuit breakers as shown on the Electrical Drawings.
- C. Pad Locks for Enclosures.

1.02 RELATED WORK (includes but is not limited to)

- A. Pumps.
- B. Compressors.
- C. Heat Generation Equipment.
- D. Air Distribution.
- E. Motors.
- F. HVAC Equipment.
- G. Water Heater.
- H. Fixed Electrical Equipment.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 FUSED SAFETY SWITCHES

- A. Fuses: All fusible switches shall accept Class R fuses and have installation of a UL listed rejection feature to reject all, except Class R fuses.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Where fusible Disconnect Switches are specified, they shall be fused in accordance with the load installed unless the Drawing specifically states that the switch is non-fusible.
- B. In cases where the fuse size is left blank on the Electrical Drawings, the Electrical Contractor shall provide fuses sized in accordance with the label plate on the equipment served.

SECTION 16477
SAFETY SWITCHES AND DISCONNECT MEANS

- C. Provide UL Class RK-5 time delay, dual element cartridge fuses sized as shown on Drawing. Verify equipment load with label plate. If equipment label plate requires a minimum circuit ampacity larger than 80% of the fuse size required by the Electrical Drawings, notify the Electrical Engineer immediately.
- D. Where enclosed circuit breakers are specified, they shall have the frame and trip size indicated on the Electrical Drawings. The AIC rating of the circuit breaker shall be based upon the available fault current unless otherwise indicated on the Electrical Drawings.
- E. The contractor shall provide pad locks for all electrical disconnect switches installed exterior to the building that are accessible at grade level. All pad locks shall be weatherproof and shall be operated by the same key.

END OF SECTION 16477

SECTION 16501 LAMPS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide lamps listed in Luminaire Schedule on Drawing or specified herein.

1.02 RELATED WORK

- A. Interior Building Lighting.
- B. Ballasts and Accessories.
- C. Exterior Lighting.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. If lamp manufacturer is not specified on the project drawings, firms regularly engaged in manufacture of lamps of types and ratings required, whose products have been in satisfactory use in similar service for not less than one year may be provided.

2.02 INCANDESCENT LAMPS

- A. Incandescent lamps shall have a minimum rated life of 2500 hours at the wattage and line voltage listed in the Luminaire Schedule

2.03 FLUORESCENT LAMPS

- A. Fluorescent lamps shall be the wattage, size, lumen output and life given in the Luminaire Schedule or attributed to the particular Manufacturer listed. The color of all fluorescent lamps shall be 3500 degrees Kelvin unless noted otherwise on the drawings.

2.04 HIGH INTENSITY DISCHARGE LAMPS

- A. High Intensity Discharge lamps shall be wattage, lumen output, rated life, bulb and base type, phosphor coating, and contain safety features given in the Luminaire Schedule or attributed to the particular Manufacturer listed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide lamps in accordance with the combined instructions of both the lamp Manufacturer and the Luminaire Manufacturer.

END OF SECTION 16501

**SECTION 16502
BALLASTS AND ACCESSORIES**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide required Ballast.

1.02 RELATED WORK

- A. Interior Building Lighting.
- B. Lamps.
- C. Exterior Lighting.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Firms regularly engaged in Manufacture of Ballasts of types and ratings required and whose products have been in satisfactory use in similar service for not less than one year.
- B. Provide Ballast that meet the standards of UL, Certified Ballast Manufacturer's Association, and requirements stated on the Luminaires Schedule and as specified herein.
- C. Ballast shall be specifically listed for use with the lamp type given in the Luminaires Schedule.

2.02 FLUORESCENT BALLASTS

- A. Ballast shall operate at the line voltage of the installation, shall be thermally protected, have 95% or higher Power Factor, be Group "A" noise rated and, if given on the Luminaires Schedule, be by the Manufacturer listed.
- B. Utilize Two-Lamp Ballasts wherever possible.
- C. Equip Ballasts with non-PCB capacitors and pressure relief devices to prevent rupturing.
- D. All interior fluorescent lamp Ballasts shall have a Class "A" sound rating.
- E. Exterior Ballasts shall have low temperature rating for reliable starting -20 degrees Fahrenheit.

2.03 HIGH INTENSITY DISCHARGE BALLASTS

- A. Ballasts shall be rated for the voltage shown on the Drawings in the Luminaires Schedule or in the Specification.

SECTION 16502
BALLASTS AND ACCESSORIES

- B. Non-PCB capacitor shall be installed by Manufacturer with Ballasts to correct the Power Factor of the incoming supply line to 95% or greater.
- C. Exterior Ballast shall be rated for satisfactory starting at -20 degrees Fahrenheit.
- D. All interior ballasts assemblies shall be remote mounted to achieve a Class "A" sound rating.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide ballasts specifically designed and listed for lamps specified in the Luminaires Schedule.
- B. Interconnecting wiring in Fluorescent Ballast Compartments shall be rated for operating at a temperature of not less than 90 degrees Centigrade.
- C. Wires shall be connected with spring loaded wire nuts temperature rated for the wires being connected.
- D. Interconnecting wiring in HID Ballasts compartments shall be rated for operating at a temperature of not less than 105 degrees Centigrade.

END OF SECTION 16502

SECTION 16510 INTERIOR BUILDING LIGHTING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section includes Supply and Installation of Luminaires, Supports and Accessories.

1.02 RELATED WORK

- A. Wires and Cables.
- B. Supporting Devices.
- C. Lamps.
- D. Ballasts and Accessories.
- E. Testing: See Section 16010.
- F. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

1.04 COORDINATION

- A. Provide compatibility for interface of other materials with Luminaires and Support Systems.
- B. Coordinate with field conditions to avoid conflicts between Luminaires, Supports, Fittings, and Mechanical Equipment.

1.05 REQUIREMENTS

- A. All recessed Luminaires shall be thermally protected except emergency lighting equipment.
- B. The completely assembled and installed luminaries shall have a Group or Class "A" sound rating.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. See Drawing Luminaires Schedule for Equipment Manufacturer and part number.

PART 3 EXECUTION

3.01 SUPPORTS

- A. Refer to SUPPORT SECTION of Specification and Drawing details.

SECTION 16510
INTERIOR BUILDING LIGHTING

- B. Fluorescent recessed troffers in the grid ceiling shall be supported at opposite corners of the troffer by AWG #16 or larger steel wire or chain attached to the building structure. Do not support Luminaires from the ceiling grid system.
- C. All other recessed Luminaires shall be supported from the building structure by AWG #16 or larger steel wire or chain from at least one point. Do not support Luminaires from the ceiling tile or grid system.
- D. Supports for pendant Luminaires shall each be tested by the Electrical Contractor to demonstrate that they will hold a weight of 60 pounds before installing the Luminaires.

3.02 INSTALLATION

- A. Provide Luminaires with lamps as shown on the Drawings and described in the Specification.
- B. Provide supporting means described above and referred to in Section 16190.
- C. Recessed light fixtures installed in fire rated ceilings shall be enclosed above the ceiling with materials assembled in accordance with the UL Fire Resistance Directory to preserve the fire rating of the ceiling.

3.03 ALIGNMENT

- A. Align Luminaires and clean diffusers and reflectors prior to final acceptance.

END OF SECTION 16510

SECTION 16520
EXTERIOR BUILDING LIGHTING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Exterior Luminaires.

1.02 RELATED WORK

- A. Outlet Boxes, Weatherproof.
- B. Lamps/Ballasts.
- C. Testing: See Section 16010
- D. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Refer to Luminaires Schedule on Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install weatherproof outlet boxes where shown on Drawings.
- B. Install lighting equipment on building where shown on Drawings.
- C. Aim Luminaires and lock in place to prevent movement.
- D. Provide lamps and clean luminaires' interior prior to final inspection.

END OF SECTION 16520

SECTION 16580 EMERGENCY LIGHTING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Emergency Lighting and Exit Signs.
- B. Provide AC power to all self-contained emergency powered exit signs.

1.02 RELATED WORK

- A. Testing: See Section 16010.
- B. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Refer to Luminaires Schedule on drawing for AC and DC Emergency Lighting System Equipment.

2.02 EMERGENCY BATTERY UNITS

- A. Provide full automatic operation on power failure with minimum operating time of 90 minutes for light heads and exits.
- B. Provide battery, fully automatic chargers with built-in test switch, battery state indicator, and mounting brackets.
- C. Battery output power shall be fused by manufacturer.

2.03 EMERGENCY LIGHT SYSTEM

- A. Battery packs shall be 12VDC with a minimum three-year full warranty with a minimum eight-year life expectancy.
- B. Lamps and lampholders shall be described on the Electrical Drawings.
- C. Aim lamp to provide one footcandle on the floor over the NFPA-101 required means of egress.

2.04 EXIT SIGNS

- A. Directional arrows shall be provided to point out the location of exits when exit is not directly below exit sign.

PART 3 EXECUTION

SECTION 16580
EMERGENCY LIGHTING

3.01 INSTALLATION

- A. Aim light heads at floor or stair to provide illumination as specified in the latest edition of the Life Safety Code (NFPA-101).
- B. In no case shall the voltage drop between battery unit and furthest remote light is greater than 5% of the battery voltage.
- C. Provide unit in accordance with the Manufacturer's Instructions and notes on the Drawing.
- D. Provide wiring to remote light heads for 124VDC emergency power in same circuit configuration and wire size as shown on emergency lighting riser diagrams. Circuits in riser diagrams were designed for maximum 5% voltage drop.
- E. Provide junction box near battery pack for connection of 12VDC multiple circuits to emergency power branch circuit conductors from battery.

END OF SECTION 16580

SECTION 16622 EMERGENCY POWER GENERATOR

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Emergency Power Generating System.

1.02 RELATED WORK

- A. Testing: See Section 16010.
- B. Fire Rated Penetrations: See Section 16030.

1.03 SYSTEM DESCRIPTION

- A. Provide emergency power system for supply of power in event of failure of normal supply, consisting of an engine directly coupled to AC generator complete with fittings, connections, auxiliaries, control panel, safety devices, and meter necessary for complete operating system.
- B. Provide fully automatic operation so that unit takes full load within ten seconds after power failure. On resumption of normal power after time delay in transfer switch, automatically retransfer load to normal power and automatically shuts down generator, returning to starting condition ready for another operating cycle.

1.04 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURES

- A. See project's electrical drawing.
- B. Engine Generator set shall be in a weatherproof enclosure.

2.02 GENERATOR

- A. Generator Capacity shall be 25 KW, 120/240 Volts, 3-Wire, Single Phase, grounded.
- B. Excitor: Directly coupled with plus or minus 2% regulation from no load to full load.

2.03 ENGINE

- A. Capacity.
- B. Governor: Speed regulation three cycles maximum from no load to full load with two second maximum recovery to steady state.

2.04 COOLING EQUIPMENT

SECTION 16622
EMERGENCY POWER GENERATOR

- A. Engine: Self-contained liquid cooling complete with fan maintaining safe operating temperature for unit under full load conditions.
- B. Coolant: Glycol base anti-freeze good to -40 degrees Fahrenheit.

2.05 EXHAUST EQUIPMENT

- A. Muffler and Piping: Critical Silenced, completely sealed, and insulated.
- B. Provide damper to close off exhaust when not in use.

2.06 AUTOMATIC TRANSFER SWITCH

- A. Design: Molded case having two automatic trip free molded case circuit breakers motor operated and mechanically linked to provide interlock between two circuits. Electrically operated, mechanically held and obtaining control and transfer power from the source to which it is being transferred. Provide full phase relay protection operating normal power voltage drop to 70% on any phase.
- B. Circuit Breakers: Interrupting capacity to match service entrance.
- C. Provide the following features in addition to automatic transfer function:
 - 1. Time delay relay to delay retransfer from emergency to normal on restoration of normal power, adjustable from 5 to 180 seconds.
 - 2. Time delay relay to prevent generator start-up on momentary failure of normal power adjustable from one second to five minutes.
 - 3. Remote engine starting contacts.
 - 4. Time delay relay to delay generator shutdown after retransfer to normal, to permit engine cooling off period, adjustable from 20 seconds to 10 minutes
 - 5. Two indicating lights to indicate emergency transfer switch position, red for emergency power, green for normal power.
 - 6. Auxiliary contacts to control motorized dampers in cooling and exhaust equipment.
 - 7. Automatic exerciser time clock.
- D. Enclosure: Mounted in separate NEMA-1 enclosure.

2.07 FABRICATION

- A. Provide vibration isolators between rail base and concrete base.

2.08 TOOLS

- A. Provide tools required for normal maintenance of unit in metal box complete with lock and keys mounted on generator unit.

PART 3 EXECUTION

3.01 PREPARATION

SECTION 16622
EMERGENCY POWER GENERATOR

- A. Coordinate ventilation, fuel supply, and exhaust, to provide an efficient layout.

3.02 INSTALLATION

- A. Provide unit complete and make operational.
- B. Provide engine generator set on a concrete pad with vibration isolation mounting feet.
- C. Provide sound attenuation of exhaust, ventilation ducting, and engine generator set equipment to prevent transfer of vibration into building.

3.03 WIRING AND CONNECTIONS

- A. Provide conduit, wiring and connections required and recommended by unit supplier and in accordance with drawings where shown.
- B. Provide all control and alarm wiring in steel conduit.
- C. Do not connect neutral point of generator and generator frame to ground.

END OF SECTION 16622

SECTION 16625 OVERHEAD DOOR WIRING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Overhead door wiring which includes:
 - 1. Provide Power Wiring and Connections.
 - 2. Provide push-button switches at garage entry door and two remote control stations for each door. The remote control stations shall be able to open and close one of the two doors by a selection feature on the remote control unit.

1.02 RELATED WORK

- A. Overhead Doors.
- B. Conduit.
- C. Wires and Cables.
- D. Outlet Boxes
- E. Motor and Circuit Disconnects.
- F. Testing: See Section 16010.

1.03 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 MATERIALS

- A. Disconnect Switches.
 - 1. Refer to Section 16170.
 - 2. Provide fused disconnect switch for each door.
- B. Outlet Boxes.
 - 1. Refer to Section 16134.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide controller and push-button (inside) stations for each overhead door. Provide conduit, boxes, and wiring material required for electrical connections.

**SECTION 16625
OVERHEAD DOOR WIRING**

- B. Provide wiring, conduit, and connection point between emergency door stop sending device and controller to stop door movement when emergency condition is sensed.

END OF SECTION 16625

**SECTION 16721
FIRE ALARM SYSTEM**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Addressible/programable Fire Alarm Systems. Provide two separate fire alarm systems. One fire alarm system is dedicated to the residence and the other is dedicated to the Synagogue.
- B. Automatic Fire Department notification means.
- C. Residential quality single station detection/alarm functions shall be provided by the residential fire alarm system. (Note there is no available residential single station detection/alarm tandem operating system available for the number of bedrooms and bathrooms in this residence.)

1.02 RELATED WORK

- A. System Demonstration.
- B. Identification system.
- C. Controls and Instrumentation.
- D. Conduit – identified with red tape or paint.
- E. Wires and Cables.
- F. Telephone System.
- G. Testing: See Section 16010.
- H. Fire Rated Penetrations: See Section 16030.

1.03 REFERENCES

- A. The Contractor shall coordinate the Fire Alarm installation and verify that the installation is in accordance with the requirements of the local Fire Department and NFPA 72 Series Documents.
- B. The Contractor shall provide alarm horns and strobes in accordance with the visible notification requirements of the Americans with Disabilities Act.

1.04 SYSTEM DESCRIPTION

- A. Supervised non-coded 24 volt DC, “Class A” system.
- B. Provide manual fire alarm pull stations, thermal detectors, horns, and sprinkler circuits fully supervised.
- C. System shall operate with manual stations, smoke and heat detectors, and sprinkler circuits as follows:
 - 1. Actuate control panel to cause evacuation alarm continuously throughout the building.
 - 2. Indicate alarm origin on annunciator at reception desk and main entrance to building.
 - 3. Transmit signal to Municipal Fire Department.

**SECTION 16721
FIRE ALARM SYSTEM**

1.05 REGULATORY REQUIREMENTS

- A. Installation subject to approval, inspection, and test of applicable regulatory agency, and the authority having jurisdiction.
- B. System design shall be submitted by Contractor to the local Fire Department for final approval prior to system purchase and construction.

1.06 SUBMITTALS

- A. Provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 MANUAL FIRE ALARM STATION

- A. Manual: Non-coded, semi flush mounted, indicating operation physically until reset, double action, key reset, and non break glass.

2.02 PRODUCTS OF COMBUSTION DETECTORS

- A. Provide, where shown, smoke detectors having the following features:
 - 1. Blinking LED for visual supervision of satisfactory operating status (non-alarm).
 - 2. Blinking LED to lock "ON" at full brilliance in alarm.
 - 3. Detector shall be reset from control panel.
 - 4. Complete detector functional test shall be provided where necessary.

2.03 ALARM DEVICES

- A. All alarm devices shall be combined audio-flashing visual strobe units except where otherwise shown on the electrical drawings.
- B. After installation, the whopping sound level output of the horn shall be not less than 87 dBA at 10 feet, omni-directional.
- C. After installation, the visible signaling device shall flash approximately but not less than once in every two seconds and the effective intensity shall be as shown on the electrical drawings. All strobes throughout the project shall be synchronized to flash at the same time.
- D. Minimum rated life for combined audio-visual unit shall be 200 hours of continuous operation.
- E. Every bedroom and outside every bathroom shall have a horn/strobe alarm and smoke detector connected to the residential fire alarm system. This horn/strobe and smoke detector combination is to be programmed to function in the same way as a residential single station smoke detection/alarm system.

**SECTION 16721
FIRE ALARM SYSTEM**

2.04 REMOTE ANNUNCIATOR

- A. Provide remote annunciator at main entrance or other location at the direction of the local Fire Department.
- B. Remote annunciator shall have illuminated individual visual indication of zone in alarm, system trouble, zone in trouble and audible indication of system and zone trouble.
- C. Remote annunciator shall have trouble silence switch.
- D. Provide engraved laminated nameplates beside alarm and trouble lights with word description of zone, not zone number.

2.05 CONTROL PANEL

- A. Steel construction, hinged front cover, key locked.
- B. Provide control panel for connection to master box and local Fire Department.
- C. Equip panel with:
 - 1. Door mounted annunciator panel.
 - 2. Separate trouble light for each zone.
 - 3. Trouble buzzer light and trouble silence switch.
 - 4. Separate trouble light to supervise standby power.
 - 5. System reset switch.
 - 6. Provide zone disconnect switches.
 - 7. See system riser diagram on Electrical Drawings for minimum functional requirements.
- D. Provide supervision of system as follows: A break or a ground on a circuit to a fire alarm station, detector, alarm, annunciator circuited operation of evacuation alarm silence switch causes trouble signal, with trouble lamp illuminated. Trouble signal silence switch silences buzzer but lamp remains illuminated. On restoration of the system, the trouble signal to remain energized until trouble signal silence switch is restored to normal. On loss of normal AC power, the trouble alarm operates and illuminates emergency power supervisory pilot lamp. Operation of the trouble alarm silence switch silences trouble signal but power supervisory lamp remains illuminated. On restoration of normal power, trouble alarm remains energized until the silence switch is restored to normal.
- E. Incorporate relays in control panel to control and activate systems referenced under Relate Work and municipal fire department notification.

2.06 POWER SUPPLY (NORMAL AND STANDBY)

- A. Take normal power supply from independent 120 volt, 20 ampere circuit.
- B. Provide rectifier as part of control panel or as separate unit to automatically maintain standby battery bank fully charged under normal conditions and sized to recharge standby batteries in 12

SECTION 16721 FIRE ALARM SYSTEM

hours maximum, following emergency operation. Rectifier to operate the system when batteries are disconnected.

- C. Provide standby battery bank floating across the line. Provide batteries of sufficient capacity to operate system under standby load conditions without recharging for 60 consecutive hours and have sufficient power left to operate complete system in alarm for 5 minutes. Mount batteries in a steel locked enclosure locate where ambient temperatures will be 40 degrees Fahrenheit (4 degrees Centigrade) minimum.

PART 3 EXECUTON

3.01 INSTALLATION

- A. Provide fire alarm wiring in electrical metallic conduit painted red. Wire system Class "A".
- B. Wire size: All conductors shall be sized so that system components operate as specified.
- C. Fire alarm conductor terminations in control panel and annunciator panels to be made on terminal strips with separate point for each conductor. All such strips to be number identified as shown on wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing.
- D. From fire alarm control panel provide one ¾ inch conduit to nearest telephone backboard or panel location for tie-in to central station.
- E. Mount fire alarm boxes with top of box at 48 inches above finished floor.
- F. Provide power supply circuit breaker with lock "ON" device in a location that is accessible only to authorized personnel.
- G. Every bedroom and outside every bathroom there shall be provided the quality and function of a single station smoke detector/alarm system.
- H. The horn-light units shall be mounted in such a manner as to meet the requirements of NFPA-72, the Americans with Disabilities Act, and State and Local building codes and ordinances. See test requirements under paragraph 3.02 below.

3.02 FIELD QUALITY CONTROL

- A. See Section 16010.

3.03 FIRE ALARM SYSTEM CERTIFICATION

- A. After satisfactory completion of an operational acceptance test (see Section 16010), a Certificate of Compliance (NFPA-72A Figure 2-2.4) shall be completed and delivered to the Electrical Engineer for review and acceptance. After acceptance by the Electrical Engineer, copies of the Certificate of Compliance shall be provide to the Owner, the local Fire Department and authorities have jurisdiction.

END OF SECTION 16721

**SECTION 16741
VOICE/DATA WIRING SYSTEM**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Data/Telephone system wiring system.
- B. Data/Telephone Service Entrance.

1.02 RELATED WORK

- A. Conduits.
- B. Outlet Boxes.
- C. Identification System.
- D. Pull and Junction Boxes.
- E. Cabinets.
- F. Fire Alarm.
- G. Testing: See Section 16010.
- H. Fire Rated Penetrations: See Section 16030.

1.03 SYSTEM DESCRIPTION

- A. Cable and Outlets to form Signal Distribution System.
- B. Provide 4-pair, plenum rated, category 5E cable from each outlet to telephone service entrance. Confirm that this cable will be satisfactory to telephone equipment supplier.
- C. The Contractor shall provide all interior building wiring, outlet boxes, telephone plug receptacles, cables, conductors, and connectors as needed to provide an operating system within the building.
- D. The Contractor is not responsible to provide telephone instruments, switchboards, dialers, servers, or remote control equipment.

1.04 REGULATORY REQUIREMENTS

- A. The telephone cable, customer side, shall be provided by the Contractor in accordance with the requirements of the Telephone Utility.

1.05 SUBMITTALS

- A. Do not provide shop drawings submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

SECTION 16741
VOICE/DATA WIRING SYSTEM

2.01 MATERIALS

- A. Conduit. Refer to Section 16111.
- B. Outlet Boxes: Refer to Section 16134.
- C. Backboards: 3/4-inch fir plywood finished in matte black paint.
- D. Pull and Junction Boxes: Refer to Section 16131.
- E. Inside data/tele cable shall be as specified by the local Utility or private information technology service hired by the Owner.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide telephone signal distribution cables throughout project. Provide a 4-pair, plenum rated, category 5E cable between each telephone outlet and the telephone service entrance backboard. Confirm with telephone equipment supplier that 4-pair cable will be satisfactory.
- B. Provide plywood backboards at service entrance as required. Confirm location on job site prior to installation.
- C. Provide 4"x4" telephone outlet boxes with single gang reduction rings and covers at locations shown on Drawing. Provide 3/4-inch EMT between outlet boxes and a point above an accessible ceiling.
- D. Provide all permanently wired electrical material and equipment needed to provide a satisfactory operating telephone system.
- E. Provide an electrical ground for the telephone system.
- F. Telephone conductors and cables shall be more than 12 inches away from any other wires.

END OF SECTION 16741

**SECTION 16775
CABLE TELEVISION SYSTEM**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. CATV System from pole to building.
- B. Television Distribution System throughout building.

1.02 RELATED WORK

- A. Conduit.
- B. Outlet Boxes.
- C. Plate Covers.
- D. Grounding
- E. Fire Rated Penetrations: See Section 16030.

1.03 SYSTEM DESCRIPTION

- A. System shall provide a satisfactory operating signal level at each outlet location.

1.04 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 EQUIPMENT

- A. Wall Outlets: Provide CATV connector type wall plates.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide a pre-wired CATV system throughout the project in accordance with the CATV Utility's requirements.
- B. Provide outlet boxes, jacks and wall plates at each TV location shown on the electrical drawings.
- C. Provide pullboxes in television conduit runs at not greater than 100 feet on center, and in all runs with more than two right angle bends.
- D. Provide complete television antenna signal distribution system throughout the project.

END OF SECTION 16775

SECTION 16913
MECHANICAL EQUIPMENT CONTROLS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Mechanical Equipment Controls.

1.02 RELATED WORK

- A. Conduits.
- B. Wire and Cable.
- C. Motor Starters.
- D. Testing: See Section 16010.
- E. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. See Electrical Drawing Material List and Material List accompanying electrical equipment of other trades. Use equipment specified by Manufacturers as optimum for performance of their equipment.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Cooperate with other trades in bringing power to mechanical equipment terminals.
- B. All power wiring and disconnect switches, shall be provided by Electrical Contractor.
- C. Provide remote control wiring and connection to remote devices.
- D. Electrical Contractor shall verify in field the location of point of connection to equipment of other trades.

END OF SECTION 16913

**SECTION 16921
MISCELLANEOUS MECHANICAL EQUIPMENT**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Space Heaters.
- B. Pump Motor Disconnect Switches and Connectors.
- C. Miscellaneous Mechanical Equipment.
- D. Thermostat Controls.
- E. Exhaust Fan and Controls.

1.02 RELATED WORK

- A. Testing: See Section 16010.
- B. Fire Rated Penetrations: See Section 16030.

1.03 SUBMITTALS

- A. Do not provide shop drawing submittals. See Section 16000, Paragraph 1.15 and Section 16020, Parts 2 and 3.

PART 2 PRODUCTS

NOTE: All products shall meet NEMA construction and testing standards and UL listing requirements applicable to the intended use for this project.

2.01 ACCEPTABLE MANUFACTURERS

- A. Refer to accessory requirements and recommendations by Manufacturer of mechanical equipment being provided.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Refer to Mechanical Plans for details of Electrical requirements of Mechanical Equipment not shown on Electrical Plans or described in the project's Electrical Specification.
- B. Refer to Mechanical plans for details of electric equipment supplied with mechanical systems.
- C. Provide manual, automatic, and automatic with H-O-A type motor starters in accordance with requirements of the Mechanical and Plumbing Drawings and Specifications if not otherwise noted on the Electrical Drawings or Specification.
- D. Provide UL class RK-5 time delay, dual element cartridge fuses sized as shown on Drawings. Verify equipment load with label plate. If equipment label plate requires a minimum circuit ampacity larger than 80% of the fuse required by the Electrical Drawings, notify the Electrical Engineer immediately.

SECTION 16921
MISCELLANEOUS MECHANICAL EQUIPMENT

- E. Review Mechanical Drawings and Specifications to identify equipment and material to be provided by the Electrical Contractor that is not covered in the Electrical Drawings and Specifications.

END OF SECTION 16921

END OF ELECTRICAL SPECIFICATION