

**CONSTRUCTION STANDARD SPECIFICATION**

**SECTION 16501**

**FLUORESCENT LUMINAIRES**

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**SECTION 16501**

**FLUORESCENT LUMINAIRES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Luminaires: Provide luminaires of sizes, types, and ratings indicated, complete with, but not necessarily limited to, housings, lenses or grids, reflectors, lamps and lamp retainers, ballasts, fuses and fuseholders, mounting provisions, and wiring. Requirements for named luminaire components shall be found herein, or in the Contract Documents. A list of approved and forbidden lamp and ballast types may be found in Parts 1 and 2 of this Section.
- B. Materials, Equipment, and Accessories: Provide materials, equipment, and accessories as specified in Contract Documents. Provide luminaire parts and components which may not be specifically identified in the Documents of materials most appropriate to their use or function, compatible with adjoining materials, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the luminaires in the environment in which they are installed.

**1.02 REFERENCES**

- A. American National Standards Institute (ANSI)
  - C78.1 Fluorescent Lamps - Dimensional and Electrical Characteristics.
  - C81.61 Electrical Lamp Bases.
  - C81.63 Gauges for Electrical Lamp Bases and Lampholders.
  - C82.11 High Frequency Fluorescent Lamp Ballasts.
- B. Illumination Engineering Society of North America (IESNA)
  - LM-41 Photometric Testing of Indoor Fluorescent Luminaires
- C. National Electrical Manufacturers Association (NEMA)
  - LE-4 Recessed Luminaires, Ceiling Compatibility

- D. National Fire Protection Association (NFPA)
  - 70 National Electrical Code
- E. Underwriters Laboratories Inc. (UL)
  - 1570 Lighting Fixtures, Fluorescent.
  - 935 Fluorescent Lamp Ballasts, Standard for.
  - 542 Lampholders, Starters, and Starter Holders for Fluorescent Lamps.
- F. U.S. Department of Defense
  - MIL-STD-461 Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility.

### 1.03 DEFINITIONS

- A. Ballast Efficacy: Ratio of a ballast's light output using a reference lamp to ballast input power in watts, expressed in lumens per watt.
- B. Ballast Efficacy Factor (BEF): Ratio of a ballast's efficacy to that of a reference ballast, expressed as a percentage.
- C. Ballast Factor (BF): Ratio of a ballast's light output using a reference lamp to that of a reference ballast with the same lamp, expressed as a percentage and used to correct rated luminaire light output.
- D. Coefficient of Utilization (CU): Ratio of incident light as measured at the workplane to the light output of a luminaire integrated over a solid viewing angle (usually 180°), expressed as a percentage and highly dependent upon the conditions of the installation.
- E. Color Rendering Index (CRI): Inverse ratio of the degree of perceived chroma shift when an object is illuminated by a test lamp as compared with illumination by a reference source of the same color temperature, expressed as a percentage where zero color shift from the reference is a CRI of 100%.
- F. Correlated Color Temperature (CCT): Absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source, in degrees Kelvin.
- G. Lamp Efficacy: Ratio of the total light output of a lamp using a reference ballast to lamp input power, expressed in lumens per watt.
- H. Luminaire Efficiency: Ratio of the light output of a luminaire integrated over a solid viewing angle (usually 180°) to the total light output of the luminaire's lamp(s), expressed as a percentage.
- I. Lamp Current Crest Factor (LCCF): Ratio of peak lamp current to the root-mean-square (rms) lamp current as delivered by the ballast, expressed as a percentage of the crest factor of a pure sine wave voltage, or  $\sqrt{3}$ . A higher LCCF can reduce lamp life.

- J. Nationally Recognized Testing Laboratory (NRTL): A laboratory officially recognized by OSHA as having met their requirements for a NRTL, such as the Underwriter's Laboratory (UL).
- K. Total Harmonic Distortion (THD): The sum of the ratios of the root-mean-square value of harmonic currents or voltages to the root-mean-square value of the current or voltage at the fundamental line frequency (60Hz), expressed as a percentage with the appropriate subscript (THD<sub>I</sub> or THD<sub>V</sub>).

#### 1.04 SYSTEM DESCRIPTION

##### A. Design Requirements:

1. The SNL standard fluorescent luminaire for building general and interior lighting shall be of the enclosed, surface-mount type on walls and hard ceilings, of the recessed or troffer type in dropped or grid-type ceilings, of the open, industrial or turret type where suspended from high ceilings or installed in mechanical spaces, and of the open, strip type behind architectural conceal panels, as shown on the Contract Documents. These types shall use the F32T8, rapid-start, medium bi-pin lamp of 48" straight configuration, and a high-frequency electronic instant-start ballast (with or without dimming provisions) as specified herein. Use of T5, T12 or larger, U-tube, circular, single-pin, recessed double-contact, HO, and VHO lamps shall not be permitted unless expressly shown in the Contract Documents for a specific application and location.
2. The SNL standard fluorescent luminaire for building accent lighting, low-light-level areas, and downlighting shall be of a configuration and finish as shown in the Contract Documents and shall use the FxxT4 or FxxT5, rapid-start, four-pin, compact fluorescent lamp with a separate high-frequency rapid-start or instant-start electronic ballast (with or without dimming provisions). Wattage for each application (represented by the xx above) shall be as shown on the Contract Documents. Use of a self-ballasted, compact fluorescent lamp with medium screw-in base is permitted where similar performance, better economy, and improved maintenance can be demonstrated.

##### B. Quality Requirements:

1. Provide fluorescent luminaires and related electrical components listed and labeled by a NRTL. The term "luminaire" shall be used to mean the complete equipment assembly used to provide illumination, including but not limited to: the fixture housing or envelope; mounting and attaching provisions; light reflectors, collectors, or refractors; lenses, grids, louvers, directional devices, or covers; lamps, lamp sockets, and lamp retainers; fuses and fuse holders where specified; line filters and surge arresters or suppressors; internal wiring; pigtail or whip wiring for connection to building power; ballasts, to include the dimmer control and wiring if a dimming ballast is specified; and labeling.
2. Provide luminaires that comply with applicable requirements of NEMA LE4 pertaining to recessed luminaires, and with NFPA 70 as applicable to construction and installation of building luminaires. Lighting equipment shall comply with UL standards pertaining to luminaires, including but not limited to UL 1570 and UL 542.

## 1.05 SUBMITTALS

Not all submittal types may be required for all work under this Section; however, when a given submittal type is required by the Contract Documents, the following provisions explain what information is required in that submittal.

- A. Shop Drawings, Type A: Prepare shop drawings where manufacturer's data is incomplete, or where custom installation procedures or accessories are required. Indicate materials, finishes, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, joints, end conditions, mounting provisions, and provisions for the work of others as appropriate for the custom installation. Indicate all details of luminaire, including manufacturer's catalog numbers for sockets, ballasts, light shields, switches or controllers, fuses and fuseholders, type of wiring, and targeting and locking devices for adjustable luminaires. Standard catalog cuts may be used, but shall be supplemented by additional drawings if information or descriptions listed herein are not included in the cuts.
- B. Product Data, Type B: Submit luminaire manufacturer's information to include annotated/highlighted catalog cuts, illustrations and photographs, complete photometric and test data of the assembled luminaire, including lenses if any, ballast data and factors, lighting controls and wiring if any, certificates of compliance with the requirements herein, complete ordering information for the luminaire and all options provided, and manufacturer's or installer's warranty information. Provide copies in the quantities specified of all documents normally shipped with the luminaire.
- C. Installation Instructions, Type C: Submit information showing mounting and installation provisions for the luminaire as applicable to the Contract conditions, manufacturer's installation manuals, recommended accessory parts lists, special equipment, special materials and procedures required to complete the installation, and provision for work by others. Provide copies in quantities specified of all documents normally shipped with the luminaire. For custom installations, this information may be submitted as a shop drawing.
- D. Operating Manuals, Maintenance Instructions, and Parts Lists, Type D: Submit information including owner's manuals, parts lists and recommended spare parts stocks, maintenance and care data including periodic and preventive maintenance procedures and intervals, expected lifetime, diagnostic procedures, and complete ordering information and sources for all parts provided. Include copies in quantities specified of all documents normally shipped with the luminaire.
- E. Internal Wiring Diagrams, Type E: Submit information including complete electrical details of luminaire, including manufacturer's catalog numbers for sockets, ballasts, dimmers (when supplied as part of a dimmable lighting system), switches, fuses and fuseholders, voltage and current requirements, type of wiring, and point-to-point schematics.
- F. Special Submittals, Type S: Submit information as required by the Contract Documents, including (as appropriate) all documentation detailing method used and results obtained to determine projected life cycle costs, luminaire performance and suitability, feasibility studies, lamp and ballast mortality curves both as rated and as corrected for the anticipated Contract installation conditions, and any assumptions made.

- G. Samples: For luminaires provided in quantities of 100 or more of the same luminaire, submit two samples when required by the Contract Documents. Supply a completely operable luminaire with lamp(s), and 6ft (1.8 m) long cord-and-plug for standard 120-Volt service. For 277-Volt luminaires, contractor shall provide 277/120-Volt cord-and-plug step-up transformer if required by SNL in the Contract Documents. The transformer assembly is intended to facilitate SNL shop evaluation of the sample, may or may not be a jobsite requirement, and will be returned at the conclusion of the evaluation.
1. Tag samples with project name and number, equipment number, and luminaire type. Deliver samples to SNL representative for review. SDR shall notify Contractor to transport samples to work site after review has been completed. Contractor shall bear transportation costs. Make or provide luminaires that are identical with approved samples, except for the evaluation cord-and-plug.
  2. Unapproved samples shall be returned to Contractor and removed from SNL property at the Contractor's expense. Upon receipt of sample disapproval, immediately submit new samples that meet requirements as specified by drawings and specifications.
- H. Substitutions: Substitutions shall comply with same requirements as stated in 1.5A through 1.5G herein. For all instances wherein the Contractor desires to propose substitution(s) of the luminaires specified herein and the Contract documents, submit the following information:
1. For luminaire quantities of 100 or more of the same type:
    - a. A photometric study shall be prepared by a NRTL for the same lamp/ballast combinations as specified in the Contract Documents. Photometric data shall be submitted with the specified lamp/ballast combination at the time manufacturer's cuts are submitted. Photometric testing and reporting shall conform to IESNA LM-41 procedures and include: luminaire catalog number; lamp type; ballast type; ballast factor; input watts; lumen distribution data; candela readings at 90°, 45°, and 0° to the luminaire and 10° increments for 0° to 180° vertical; candlepower distribution curves; lumen output data; and spacing criteria. Manufacturer's data may be provided if obtained through a NRTL and if complete as herein specified.
    - b. Substitutions shall be equal to or better than luminaires specified and include the same lamp lumens (average maintained values), same color rendering, and equal or greater specified lamp life. Substituted ballast shall match or exceed BF and BEF of specified ballast. Substitute information shall include manufacturer's recommended fuse size, if required by the job.
    - c. A cost savings report shall be prepared and shall include maintenance factors for group re-lamping; HVAC cost savings; luminaire heat load contribution and heat cost savings, ballast replacement cost, group re-lamping cost, ballast factor for lamp/ballast combination, ballast efficacy factor, wattage per square foot for total area(s) where substitute luminaire is being proposed, and projected payback period. Submit NRTL test data for ballasts, verifying compliance with requirements for project-specific lamp/ballast combinations. Cost analysis shall compare no less than 3 different luminaires and shall support decision for selecting substitute luminaire of choice.

2. For luminaire quantities of less than 100 of the same type:
  - a. Submit manufacturer's photometric data for the same lamp/ballast combinations as specified in the Contract Documents. Photometric testing and reporting shall conform to IESNA LM-41 procedures and include luminaire catalog number; lamp type; ballast type; ballast factor; input watts; lumen distribution data; candela readings at 90°, 45°, and 0° to the luminaire and 10° increments for 0° to 180° vertical; candlepower distribution curves; lumen output data; and spacing criteria. Manufacturer's data may be provided if obtained through a NRTL and if complete as herein specified.
  - b. Substitutions shall be equal to or better than luminaires specified and include the same lamp lumens (average maintained values), same color rendering, and equal or greater specified lamp life. Substituted ballast shall match or exceed BF and BEF of specified ballast. Substitute information shall include manufacturer's recommended fuse size, if required by the job.
- I. Certifications: Provide certification that all materials used are free of asbestos, polychlorinated biphenyl (PCB) compounds, and lead paint. Manufacturer's data, certifications, or labeling may be provided if adequate.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

##### A. Shipping, Delivery, and Protection

1. Luminaires and their components shall be delivered to job site fully assembled in accordance with approved shop drawings, samples, and catalog cuts. Lamps and lenses may be delivered separately in cartons to prevent breakage during installation, but shall be part of the shipment.
2. Exposed finishes shall be protected during manufacture, transport, storage, and handling. Delivered materials shall be identical to approved samples. Damaged materials shall be repaired or replaced as directed by SDR.

- B. Acceptance at Site: SDR may refuse damaged luminaires, their accessories, and materials not approved by SNL submittal process, and may deny their delivery to and storage at the work site. Costs for removing refused materials and re-supplying approved luminaires will be borne by the Contractor.

##### C. Storage and Liability Provisions

1. Luminaires shall be stored under cover, above ground, in clean, dry areas, and shall be labeled as to type of fixture, project number, and location to be installed. Bonded storage requirements shall be as appropriate and as identified by the SDR.
2. Unless otherwise provided in the Contract Documents, Contractor shall be responsible for all costs for transportation of fixtures to the job site, including labor, vehicle drayage, packing materials, and pallets.

## PART 2 - PRODUCTS

### 2.01 LUMINAIRES

- A. Required Components: Luminaires shall be provided complete with fluorescent lamps, disconnecting means, ballasts, and all other accessories in quantity, type, finish, voltage, and wattage as specified in the Contract Documents, and shall be fully assembled when shipped from the factory. Lamps and lenses may be shipped separately and installed at the work site.
- B. Electromagnetic Compatibility: When specified in the Contract documents, fluorescent luminaires shall have electromagnetic interference filters. Filters may be either internal or external to the ballast, but shall be integral to luminaire assembly. Provide filters that suppresses electromagnetic interference to levels as required by MIL-STD-461. The suppression requirements shall apply to the performance of the assembled luminaire.
- C. Testing Requirements: Luminaires shall meet applicable UL 1570 requirements. The appropriate UL label or listing, or other NRTL label or listing, will be acceptable as evidence of compliance with UL 1570. Luminaires shall also comply with applicable NFPA 70 provisions, with energy efficiency requirements as herein specified.
- D. Normal and Standby Power: Luminaires intended for operation entirely on normal or standby power shall be shipped with a single ballast rated for the number of lamps in the luminaire. Luminaires intended for operation from two power sources shall be shipped with two ballasts, each rated for the number of lamps to be operated from each source.
- E. Marking: Luminaires shall be plainly marked for operation of specified lamps and ballasts in accordance with UL 1570. As a minimum, the following luminaire characteristics shall be marked (may be on a manufacturer's label):
  - 1. Lamp diameter T-code, nominal wattage, phosphor code, and quantity.
  - 2. Ballast type and number, line voltage requirement, and rated line current.
- F. Hardware and Access: Unless otherwise noted, use only completely concealed hardware. Latching on luminaire door frames shall be unobtrusive. Luminaire shall be free from light leaks by the inherent design of the body and frame. Gaskets, when used, shall be bonded to the luminaire metal. Provide luminaires with bottom re-lamping access unless otherwise noted.
- G. Materials and Finishes: Unless otherwise specified, the luminaire body shall be fabricated of mild steel, treated for corrosion protection suitable for the environment in which it is to be installed, and finished with either a baked-enamel or powder-coat paint finish free from lead or asbestos fibers, or a natural silver metal finish with clear overcoat.
- H. Wiring: Luminaire wiring between fluorescent lampholders and associated operating and starting equipment shall be in compliance with UL 1570 and the NEC. Asbestos-containing insulation materials shall not be used. Lamp wiring insulation shall be chosen to withstand the ignition pulse of the electronic instant-start ballast.

- I. Miscellaneous: Lampholders shall be rated for use in the type of fluorescent luminaire used. They shall be white, constructed of heat-resistant plastic, and comply with UL 542, ANSI C81.61 and ANSI C81.63. Lampholders shall be suitable for specified lamps and operating temperatures, and shall position lamps in optically correct spacing and relationship to lenses, reflectors, filters, and baffles.
- J. Lenses/ Louvers/ Trim/ Retainers
1. All lenses and louvers shall be held positively within door frames such that hinging or motion of frame will not cause element to drop out. Trim shall be drawn to ceiling as tightly as necessary, insuring complete contact of trim or luminaire frame with ceiling surrounding luminaire.
  2. Unless otherwise specified, prismatic lenses shall be made of: clear virgin acrylic of nominal 0.125" (.32 cm) overall thickness for nominal 2' x 4' (60.96 cm x 121.92 cm) lens and shall be covered with either .1875"(.48 cm) square prismatic cones with non-convex prism faces or with parallel Fresnel-type grooving intended to concentrate and direct the light. Lens material shall weigh a minimum of 7.5 oz/ft<sup>2</sup> (.23g/cm<sup>2</sup>); shall be strain-free and uniform in appearance; shall have a minimum 80% initial visible-light transmissivity factor; and shall be resistant to yellowing or other permanent degradation for a period of five years during normal use, when cleaned as directed.
  3. Luminaires shall have provision for lamp retention within the luminaire, should a lamp unexpectedly detach from the lampholder. Uplights constructed such that the lamp is not visible from below, and luminaires with covers, lenses, grids, louvers, or similar devices along the full length of the bottom of the luminaire may be assumed to meet this provision. Open or industrial-type luminaires with fully exposed lamps shall be provided with trim or accessory options such as wire retainers, guards, or baskets to satisfy this requirement. Where specified by the Contract Documents, downlights or accent lights using a single, low-wattage compact fluorescent lamp may be exempt from this requirement.
- K. Reflectors
1. Aluminum reflectors and shielding media shall have a minimum thickness in accordance with current UL 1570. Reflectors shall be absolutely free of tooling marks, spinning lines, and indentation marks caused by riveting or other assembly techniques. Rivets, springs, or other hardware shall not be visible after installation.
  2. Reflectors shall be free from blemishes, scratches, or indentations that would distort their reflective function.
  3. Painted reflectors shall be white baked-enamel or powder-coat with a minimum reflectivity of 86% for a minimum of five years during normal use, when cleaned as directed.
  4. Aluminum reflectors, cones, or baffles, mounted in whole or in part within the bottom two inches of luminaires, shall have a low iridescent coating.
  5. Specular silver reflectors are to be avoided because of glare, but when specified by the Contract Documents shall be comprised of unitized, single-piece

construction for permanent mounting inside luminaire. A multi-piece reflector assembly shall only be considered if parts maintain fixed and accurate positioning in relation to lamps and housing, installation costs are not increased, and ballast access and luminaire maintenance is not compromised. Minimum reflector thickness shall be 0.020 inch (.05 cm), consisting of silver film laminated on aluminum or steel substrate, high-performance aluminum finish, or multiple thin film coating. Material shall retain a minimum 93% specular reflectivity, 96% image clarity, and 95% total reflectivity for a minimum of five years during normal use, when cleaned as directed.

## 2.02 BALLASTS

- A. Certification: Ballasts shall be listed by a NRTL, shall comply with UL 935, and shall be certified to meet ANSI 82.1.
- B. Rating: Ballasts shall be rated as Class P, Type 1, and shall have automatic-resetting thermostatic internal protection.
- C. Environmental Rating: Ballasts shall be rated for use with the lamp(s) and luminaire as assembled, and in the environment in which the luminaire is to be used. In particular, ballasts rated for low temperature operation (temperatures around -20°F or -29°C) shall be provided in luminaires located in cold rooms, unheated buildings or spaces, outdoors, or where indicated in the Contract documents.
- D. Disconnecting Means: Luminaires shall be provided with a means to positively disconnect all supply-side conductors. Supply-side pins shall be guarded or submerged within the disconnect. The disconnect shall permit lock-out, tag-out devices to be installed on the supply side of the opened disconnect.
  - 1. For surface-mounted or troffer-type luminaires, the disconnecting means shall be installed in the ballast compartment between the ballast leads and the service conductors entering the fixture, and shall be accessible when the ballast cover is removed. The disconnect shall be listed for this use, shall be an in-line type, and need not be mounted to the fixture structure. If an approved ballast manufacturer factory-supplies a disconnect as part of a ballast assembly, the manufacturer's disconnect shall be used in lieu of an after-market disconnect.
  - 2. For chain-suspended industrial luminaires and others supplied by a cord-and-plug, the cord-and-plug may be used to satisfy this requirement. However, if a ballast used in a cord-and-plug supplied luminaire is factory-equipped with a disconnect as above, do not remove nor bypass the factory-supplied device.
- E. Prohibited Materials: Ballasts shall not contain asbestos fibers, lead-based compounds other than electrical solder, volatile or flame-supporting compounds, liquids, or PCBs.
- F. T8 Ballasts: Ballasts rated for T8 lamps shall be instant-start type with lampholders wired in parallel. Removal or failure of one lamp on two- and three-lamp ballasts, and removal or failure of two lamps on four-lamp ballasts, shall not diminish operation of the ballast with the remaining lamps. Series-wired preheat, rapid-start, and program-start ballasts shall not be permitted in general, non-dimming use because of their wiring maintenance penalty, single-lamp failure characteristics, and the psychological impact of delayed lamp ignition.

- G. T4/T5 Ballasts: Ballasts rated for T4/ T5 compact lamps shall be rapid-start or instant-start type. Preheat ballasts shall not be permitted. Rapid-start ballasts for T4/T5 lamps shall remove power from lamp filaments once the lamp(s) have started. Cathode voltage during starting shall be between 3.4v and 4.5v across a dummy load, and between 2.5v and 4.0v during operation, in compliance with ANSI C82.
- H. Minimum Ballast Performance Requirements: Ballasts shall meet or exceed the following minima:
1. Sound rating shall be class "A" (20-24dB maximum).
  2. Power factor reflected into the line shall be 96% lagging.
  3. LCCF shall not exceed 1.7 per ANSI C82.11.
  4. BF shall be between 85% and 100%.
  5. Ballast case temperature shall not exceed 70°C when installed and operated continuously in the luminaire under the ambient conditions identified in the Contract documents.
  6. Ballasts shall maintain light output (by regulation of lamp power during the lamp's average life span) such that lumen output does not vary more than  $\pm 5\%$  for all T8 lamps, in the proper lamp/ballast combination, within operating ranges of  $\pm 10\%$  of center voltage (120v or 277v).
  7. Ballasts shall have a frequency of operation of 20 kHz or greater and incorporate adequate 60 Hz filtering so as to operate with less than 5% flicker (maximum 0.20 flicker index) with any lamp suitable for use with ballast.
  8. Ballast THD<sub>I</sub> shall not exceed 20%. Where specified in the Contract documents, ballasts shall be provided with a THD<sub>I</sub> not exceeding 10%.
- I. Dimmable Ballasts: Dimmable ballasts shall also meet or exceed the following:
1. Dimmable ballasts and dimming controller(s) shall be listed by their respective manufacturers for use together. Controllers shall be load-rated for the full number of ballasts and lamps shown in the Contract Documents for each lighting circuit or luminaire group to be dimmed.
  2. Dimming controllers which require conductors in addition to the those (line or switched, neutral, ground) required for a switched lighting circuit, or which require a voltage source other than the lighting circuit being controlled, shall be clearly identified through a Type C/E submittal, whether otherwise requested by SNL or not. Contractor shall be responsible for providing extra conductors in switching conduit and separate power source, whether shown on other Contract Documents or not, so as to deliver under this Section a completely functional dimmable luminaire system.
  3. Dimmable ballasts shall dim their lamps continuously from 100% at least to 20% of rated luminaire light output without noticeable strobe effect or lamp flicker.

4. Dimmable ballasts and their controller(s) shall, upon non-catastrophic failure of the dimming mechanism, continue to function as a switched lighting circuit.
  5. BF for dimmable ballasts shall not be less than .89 ( $\pm$  .025) at 100% output and not less than 0.15 when dimmed to 20% output.
  6. Dimmable ballast THD<sub>I</sub> shall not exceed 20% throughout the dimming range.
  7. Dimmable ballast LCCF shall not exceed 1.7 throughout the dimming range.
- J. Acceptable Manufacturers and Models: Interior T8 ballasts acceptable to SNL include the following manufacturers' model lines:
1. Philips/ Advance "Standard," "Mark VII," "Mark X," and "Centium" series.
  2. General Electric/ Motorola "High Performance Electronic Ballast" series.
  3. Magnetek "Triad" series.
  4. Lutron "ECO-10," "Tu-Wire," and "TVE" series (dimming applications only).

### 2.03 LAMPS

- A. Types: Lamps provided shall conform to ANSI C78.1. The SNL standard lamp for general-purpose luminaires shall be the F32T8 rapid-start lamp with medium bi-pin base. The SNL standard lamp for accent and downlighting shall be the FxxT4 or FxxT5 rapid-start compact lamp with a four-pin base, where the "xx" is replaced with the lamp's rated wattage.
- B. Phosphors: Unless otherwise specified, lamp phosphors shall be tri-stimulus or modified tri-stimulus rare earth phosphors (RE735) such that the lamp shall meet or exceed the following minima:
1. CRI of 75%.
  2. Initial rated light output of 2850 lumens (F32T8) under test conditions.
  3. Color temperature of 3500°K to 3750°K.
  4. Rated lamp life under test conditions of 20,000 hours, and an as-installed minimum lamp life of 15,000 hours.
- C. Acceptable Manufacturers and Models: F32T8 lamps acceptable to SNL include the following manufacturers' model lines:
1. Philips F32T8/TL735
  2. Osram/Sylvania FO32/735, FO32/735/ECO
  3. General Electric F32T8/SP35

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. **Completeness:** Install luminaires complete with lamps, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames, brackets, fuse and fuse holder, and internal and external wiring as specified by drawings, and with protective wrapping (plastic protective cover on parabolic insert or acrylic lens) in place.
- B. **Coordination:** Coordinate installation of luminaires with other trades to insure installations do not interfere with other work. Particularly consider the requirements for HVAC, ceiling installation, junction box access, and fire protection.
- C. **Arrangement and Security of Installation:** Install luminaires plumb, square, and level with ceiling and walls, and in alignment with adjacent lighting fixtures. Fixture mounting techniques shall be in accordance with applicable SNL Group 300 Standard Drawing Details unless otherwise noted in the Contract Documents. Luminaires weighing 56 pounds (25kg) or more, and luminaires designed to be surface-mounted or suspended by chains or pendants, shall be fully supported from building structure, Unistrut™, or other seismically secure material installed for the specific purpose of supporting the luminaire. Luminaires weighing less than 56 pounds shall not be supported solely by the ceiling material unless that material is rated and installed for that purpose. Unless otherwise specified, all recessed troffer-type luminaires flush-mounted in tee-bar type ceiling grid shall be secured in place using "Caddy Acoustical Tee Bar Clip" (Cat. No. 515) or similar. Luminaires weighing more than 7 pounds (3kg) but less than 56 pounds and mounted to a tee-bar type ceiling grid or other non-structural ceiling shall have dual auxiliary supporting wires (#12AWG minimum) or chains between the fixture and structure. These auxiliary support devices may be installed slack.
- D. **Electrical:** Ground non-current carrying parts of electrical equipment in accordance with UL and NEC requirements. This includes bonding the circuit's green wire to luminaire.
- E. **Conduit:** Conduit shall not be fastened to tee-bar support hangers, but shall be supported by building steel, Unistrut™, or other dedicated hangers and structural material installed for the specific purpose of supporting the conduit.
- F. **Lamp Installation:** New lamps shall be provided for each fluorescent fixture installed. Lamps shall be free of dirt, oils, and fingerprints.
- G. **Fixture Whips:** For fixtures such as troffers in lay-in ceilings or suspended fixtures whose final location is not known, flexible fixture whips shall be used to connect the fixture to the building's lighting conduits. For interior installations under NEMA 1 conditions, type MC cable may be used as a fixture whip. For all other conditions under more severe conditions, flexible metal or Liquidtight® type conduit with separate wiring conductors shall be used. When the fixture is fused as specified in paragraph 2.02(D) above, the whip's conductor size may be reduced to AWG 16 minimum, but not below that required to carry the full load current of the fixture.

### 3.02 FIELD QUALITY CONTROL

- A. **Field Test:** Upon completion of installation of lighting fixtures, and after circuits have been energized, apply power and demonstrate capability and compliance with

requirements. Correct or remove and replace malfunctioning units, then re-test to demonstrate compliance. Coordinate field tests with SDR.

- B. Acceptance Criteria: Luminaires shall be clean and fully operable at the conclusion of the work, with no inoperative units. Contractor shall replace inoperative lamps, fuses, and ballasts at Contractor's expense prior to completion of the work.
- C. Preparation and Cleaning: At the conclusion of the work, or when directed by SDR, remove any protective covering from luminaires. Clean all dirt, fingerprints and debris from lens, parabolic insert(s), lamp(s), and lamp and ballast compartments. Insure proper seating of lamp(s) in sockets. Insure proper and secure engagement of any lens or cover locking devices. Insure proper alignment and leveling of fixtures mounted in a tee-bar type ceiling grid.
- D. Upon completion of all work, securely affix a round, self-adhesive label, light green in color and approximately ½ inch in diameter (Avery #450 or equivalent) to the outside of each fixture. A second label, identical to the first except yellow in color, shall be placed adjacent to the first label. The month and year the fixture was placed into service shall be printed on both label types. The labels will be placed in the same location for each fixture type occupying a given room or hallway, and shall be visible and legible from the floor. Labels shall not be placed on the ceiling surface. These labels are used by Sandia to quickly determine the age of the lamps and ballasts, respectively, for the Group Relamping program.

END OF SECTION