

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide all lighting outlets indicated on the Drawings with a fixture of the type designated and appropriate for the location. Outlet symbols on the Drawings without a type designation shall have a fixture the same as those used in similar or like locations.
- B. Provide lamps or LED modules for all fixtures.
- C. Coordinate installation of fixtures with the ceiling installation and all other trades to provide a total system that is neat and of orderly appearance.

1.2 QUALITY ASSURANCE

- A. Fixtures shall conform to the following specifications.
- B. Manufacturers specified are indicative of the general type and performance desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved by the Architect prior to the bid. Digital IES files shall be provided as part of Submittal and Substitution Request processes upon request in order to properly evaluate proposed fixtures.
- C. Equality shall be determined by comparisons of performance, construction, installation ease, maintenance, and appearance.
- D. All light fixtures shall be UL listed and labeled.

1.3 SUBMITTAL AND RECORD DOCUMENTATION

- A. Submit product data describing fixtures, lamps, LED modules, ballasts, drivers, and emergency lighting units. Arrange product data for fixtures in order of fixture designation.
- B. Include data on features and accessories and the following information.

1. Outline drawings of fixtures indicating dimensions and principle features.
 2. Electrical ratings and photometric data with specified lamps/LED modules and certified results of laboratory tests.
 3. Data on batteries and chargers of emergency lighting units.
- C. Submit shop drawings from manufacturers detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.

PART 2 - PRODUCTS

2.1 LED FIXTURES

A. General:

1. LED lighting fixtures shall be in accordance with IED, NFPA, UL, as shown on the Drawings and as in these Specifications.
2. LED drivers shall include the following features unless otherwise indicated:
 - a. Power factor: > 0.9 nominal
 - b. Input Voltage: 120V – 277V, 60 Hz
 - c. Total Harmonic Distortion: < 20%
 - d. Temperature Rating: 0 deg C – 40 deg C
 - e. Integral short circuit, open circuit, and overload protection.
3. LED modules shall include the following features unless otherwise indicated.
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum 80 CRI and color temperature 4000 deg K unless otherwise specified in Lighting Fixture Schedule/List.
 - c. Minimum Rated Life: 70,000 hours per IES L70, unless otherwise specified in Lighting Fixture Schedule/List.
 - d. Light output initial lumens as specified in Lighting Fixture Schedule/List.
 - e. LED modules shall be field replaceable and contain quick-disconnects.
4. LED lighting fixtures shall have available digital IES files from a NVLAP accredited testing laboratory in accordance with IESNA LM-79, which specifies the entire luminaire as the source, resulting in an efficiency of 100%. Lighting fixtures that do not have these test results available will not be accepted.

2.2 FLUORESCENT FIXTURES

A. Ballasts for linear T8 lamps shall be as follows:

1. Provided with integral leads, color-coded to ANSI standard.
2. Ballast shall be Programmed Start.
3. Ballast shall contain auto restart circuitry to restart lamps without resetting power.
4. Ballast shall be 'electronic' in design and capable of operating either 120V or 277V (+/- 10%) on the same ballast.
5. Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz.
6. Multi-lamp ballasts shall be parallel wired.
7. Ballast power factor shall be >98%.
8. Ballast factor (BF) shall be >.85.
9. Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less.
10. Ballast input current shall have Total Harmonic Distortion (THD) of less than 20%.
11. Ballast shall have a Class A sound rating.
12. Ballast shall have a minimum starting temperature of -18C (0 deg F).
13. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.
14. Ballast shall be UL listed, Class P and Type 1 Outdoor and CUL certified.
15. Ballast shall comply with ANSI standards for Transient protection.
16. Ballast shall comply with FCC regulations, Non-Consumer (Class A) for EMI/RFI.
17. Minimum five year ballast and complete replacement labor warranty by manufacturer.
18. Ballast shall comply with 'Restrictions of Hazardous Materials' (RoHS) standards.
19. Approved manufacturers: Advance Transformer 'Centium', Sylvania, GE, Universal/Magnetek.

B. Ballasts for linear T5 and T5 HO lamps shall be as follows:

1. Provided with integral leads, color-coded to ANSI standard.
2. Ballast shall be Programmed Start.
3. Ballast shall contain auto restart circuitry to restart lamps without resetting power.
4. Ballast shall be 'electronic' in design and capable of operating either 120V or 277V (+/- 10%) on the same ballast.

5. Ballast shall be high frequency electronic type and operate lamps at a frequency above 42 kHz.
6. Multi-lamp ballasts shall be parallel wired.
7. Ballast power factor shall be >98%.
8. Ballast factor (BF) shall be > .95.
9. Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less.
10. Ballast input current shall have Total Harmonic Distortion (THD) of less than 20%.
11. Ballast shall have a Class A sound rating.
12. Ballast shall have a minimum starting temperature of -18C (0 deg F).
13. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.
14. Ballast shall be UL listed, Class P and Type 1 Outdoor and CUL certified.
15. Ballast shall comply with ANSI standards for Transient protection.
16. Ballast shall comply with FCC regulations, Non-Consumer (Class A) for EMI/RFI.
17. Minimum five year ballast and complete replacement labor warranty by manufacturer.
18. Ballast shall comply with 'Restrictions of Hazardous Materials' (RoHS) standards.
19. Approved manufacturers: Advance Transformer 'Centium', Sylvania, Universal/Magnetek GE.

C. Ballasts for compact fluorescent lamps shall be as follows:

1. Provided with poke-in wire trap connectors, color-coded to ANSI standard.
2. Ballast shall be available in a plastic/metal can construction to meet plenum requirements.
3. Ballast shall be Programmed Start.
4. Ballast shall contain auto restart circuitry to restart lamps without resetting power.
5. Ballast shall operate from 50/60Hz input source of 120V or 277V with sustained variations of +/- 10%.
6. Ballast power factor shall be >98%.
7. Ballast shall be high frequency electronic type and operate lamps at a frequency above 50 kHz.
8. Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less for primary lamp and 1.6 or less for all others.
9. Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
10. Ballast shall have a Class A sound rating.

11. Ballast shall have a minimum starting temperature of -18C (0 deg F).
12. Ballast shall provide Lamp EOL Protection Circuit.
13. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.
14. Ballast shall be UL listed, Class P and Type 1 Outdoor and CUL certified.
15. Ballast shall comply with ANSI standards for Transient protection.
16. Ballast shall comply with FCC regulations, Non-Consumer (Class A) for EMI/RFI.
17. Minimum five year ballast and complete replacement labor warranty by manufacturer.
18. Approved manufacturers: Advance Transformer 'Smartmate', Sylvania, GE.

D. T8 linear fluorescent lamps shall be as follows:

1. 32 watt (unless otherwise specified), suitable for operation with the ballast provided in the fixture.
2. Minimum 2800 initial lumens.
3. 3500 K color temperature.
4. 85 CRI.
5. 20,000 hours average rated life.
6. Compliant with Federal Toxic Characteristic Leaching Procedure (TCLP).
7. Approved manufacturers: Sylvania, Philips, General Electric.

E. T5 linear fluorescent lamps shall be as follows:

1. 28 watt (unless otherwise specified), suitable for operation with the ballast provided in the fixture.
2. Minimum 2900 initial lumens.
3. 3500 K color temperature.
4. 85 CRI
5. 20,000 hours average rated life
6. Compliant with Federal Toxic Characteristic Leaching Procedure (TCLP).
7. Approved manufacturers: Sylvania, Philips, General Electric.

F. T5 HO linear fluorescent lamps shall be as follows:

1. 54 watt, suitable for operation with the ballast provided in the fixture.
2. Minimum 5000 initial lumens.
3. 3500 K color temperature.
4. 85 CRI
5. 20,000 hours average rated life.
6. Compliant with Federal Toxic Characteristic Leaching Procedure (TCLP).
7. Approved manufacturers: Sylvania, Philips, General Electric.

G. Compact fluorescent lamps shall be as follows:

1. CFT (twin tube-2 pin), CFQ (quad tube-4 pin), CFT (triple tube-4 pin), FT (long tube-4 pin).
2. 3500 K color temperature.
3. Wattages as noted on Lighting Fixture List
4. Amalgam technology
5. 82 CRI
6. 12,000 hours average rated life
7. Compliant with Federal Toxic Characteristic Leaching Procedure (TCLP).
8. Approved manufacturers: Sylvania, Philips, General Electric.

H. Miscellaneous:

1. All surface-mounted lighting fixtures shall have low density label.
2. All recessed lighting installed in fire-rated ceilings shall be provided with fire-rated protective covers per UL standards.
3. All fixtures mounted outdoors or in unheated spaces shall have 0 deg F ballasts.

2.3 RECESSED FIXTURES

- A. In insulated ceilings, recessed fixtures to be equipped with "IC" rated housing or with a field fabricated fireproof box (metal, sheet rock, etc.), complying fully with all clearance requirements.

B. Recessed troffers shall be as follows, unless specified otherwise:

1. Diffusers shall be pattern 12 extruded clear acrylic plastic, 0.125" overall thickness, unless otherwise specified in the fixture schedule by catalog number or remarks. Door shall be securely closed by use of enclosed cams.
2. Finish shall be white baked enamel, unless otherwise specified with a minimum average reflectance of 85% on all exposed and light reflecting surfaces.
3. Housing shall be 22-gauge minimum. Overall depth shall be 4-1/2" minimum. Spacing from bottom of lamp to top of lens shall be 1-7/8" minimum.

2.4 INCANDESCENT FIXTURES

- A. Conform to UL 1571.
- B. Fixture dimensions shall be proper for the various wattages noted on the plans and as recommended by the fixture manufacturer or as specified.
- C. Lamps shall be inside frosted, 120 V rated except where otherwise specified. Provide reflector lamps for fixtures designed and cataloged for such lamps unless otherwise specified, 120 V rated. Lamps shall be manufactured by General Electric, Osram/Sylvania, or Philips.
- D. Recessed incandescent fixtures shall have thermal protection and shall be factory identified as thermally protected, complying fully with NEC 410-65C. Thermal protection must comply with UL #1571. In insulated ceilings, equip each fixture with a field or factory fabricated fireproof box (metal, sheet rock, etc.), complying fully with all clearance requirements and NEC 410-66.

2.5 TRACK LIGHTING SYSTEMS

- A. Conform to UL 1574.
- B. Provide components, including track, fittings, and fixtures, from same manufacturer and as recommended by manufacturer for intended use.

2.6 HIGH INTENSITY DISCHARGE (HID) FIXTURES

- A. Conform to UL 1572.

- B. Ballasts shall be power factor corrected rated for required voltage; shall be for the wattage of lamp specified for fixture; and shall have a lamp current crest factor not exceeding 1.8. Conform to ANSI C82.4 and UL 1029.
- C. Outdoor ballasts shall be high power factor type. Ballasts larger than 100 watts shall be constant wattage type. Ballast housing shall be completely weatherproof. All ballasts shall be capable of providing reliable operation of the lamps at the lowest temperature normally encountered.
- D. Lamps shall conform to ANSI C78.380. High Pressure Sodium (HPS) lamps shall be clear, and shall have low mercury content, meeting the EPA's Toxic Characteristics Leaching Procedure (TCLP), for disposal as non-hazardous waste. Metal halide lamps shall be phosphor coated indoors, clear outdoors, unless otherwise noted on fixture list.
- E. Remote ballasts shall be mounted on heat sink or stand-offs per manufacturer's instructions.
- F. Approved Manufacturers: General Electric, Osram/Sylvania, Venture, Philips.

2.7 EMERGENCY LIGHTING

- A. Wall Packs:
 - 1. Emergency wall packs shall comply with UL 924 and be self-contained units, complete with two adjustable lensed fixtures and tungsten lamps, battery, and battery charger, suitable for 120V or 277V AC power supply as indicated on the Drawings.
 - 2. Battery shall be sealed, maintenance-free, lead-calcium recombination type, 10-year life expectancy. Battery shall have 1-1/2 hour minimum capacity at rated wattage to 87-1/2% of rated DC voltage from a fully charged state. Shall carry a five-year pro-rata warranty.
 - 3. Battery charger shall be solid-state, voltage regulated. Charge circuit shall react to the condition of the battery and alter the rate of charge in order to maintain peak battery capacity and maximum battery life.
 - 4. A solid-state overload monitoring device in the DC circuit shall disconnect the lamp load from the battery should excessive wattage demands be made, and automatically reset when the overload or short circuit is removed.
 - 5. A brownout circuit shall monitor the flow of AC current to the unit and activate the emergency lighting system when a predetermined reduction of AC power occurs.
 - 6. The unit shall incorporate a solid-state switching system, not relays. The switching circuit shall detect a loss of AC voltage and automatically energize the DC lamps. Upon restoration of the AC power, the emergency lamps shall switch off and the charger shall automatically recharge the battery.

7. When the battery's terminal voltage falls below 80% of the rated voltage, the low voltage circuitry shall disconnect the lighting load. The disconnect shall remain in effect until normal utility power is restored, preventing deep battery discharge.

- B. Fluorescent Emergency Ballast: Emergency ballasts shall be capable of operating the following lamps in the emergency mode for a minimum of 90 minutes. The minimum initial lumen light output shall be as follows:

1.	F32T8	1350 lumens
2.	FT40W (biax)	900 lumens
3.	FT50W (biax)	900 lumens
4.	CFM 42W (triple, 4-pin)	1000 lumens
5.	CFM 32W (triple, 4-pin)	750 lumens
6.	CFM 26W (triple, 4 pin)	600 lumens
7.	CFQ26W (quad, 4-pin)	675 lumens
8.	CFT13W (twin, 2-pin)	625 lumens

2.8 OUTDOOR FIXTURES

- A. Outdoor fixtures shall be weatherproof, heavy duty types designed for efficient light utilization, adequate dissipation of lamp and ballast heat and safe cleaning and relamping. Ballasts shall be incorporated in the luminaire housings unless otherwise noted. Luminaires shall be sealed unless charcoal filters are provided. Lenses shall be heat and impact resistant, tempered glass. Lens gasket shall be heat and weather resistant. Materials shall be rustproof. Latches and fittings shall be nonferrous metal or stainless steel.
- B. Reflectors on HID fixtures shall be secured with lock washers.
- C. Set screws on HID fixture reflectors shall be factory furnished in size and quantity to assure that reflector does not vibrate when touched or struck.

2.9 POLES AND STANDARDS

- A. Lighting standards, assemblies, and pole bases shall be designed and constructed to withstand a steady wind velocity of 100 miles per hour without permanent distortion or displacement. Where unusual soil or base installation conditions occur, the Contractor shall provide adequate reinforcement under the guidance of the Architect to assure the specified strength for 100-mile-per-hour wind. Generally poles/bases shall be suitable for installation in earth having an allowable bearing of 1800 pounds per square foot.

2.10 FIXTURES

- A. See Drawings for Lighting Fixture List/Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project. Provide lamp type as recommended by the fixture manufacturer.
- B. Fixtures shall be left clean at the time of acceptance of the work with every lamp in operation. If fixtures are deemed dirty by the Architect at completion of the project, the Contractor shall clean them.
- C. Fixtures shall be carefully aligned, leveled in straight lines, and located as shown on the Architectural reflected ceiling plan. The final decision as to adequacy of support and alignment shall be made by the Architect. The fixtures shall be supported and fastened to the ceiling system.
- D. Verify all ceiling conditions and provide all lighting fixtures complete with factory furnished stems, balls, aligners, and canopies as required for a complete installation.
- E. Recessed troffers installed in suspended T-bar ceiling shall be independently supported on two opposite corners by #12 gauge steel wire attached to structure, per UBC Standard #47-18.
- F. Surface mounted light fixtures shall be securely fastened to the building surface via factory-created holes in the fixtures. Attachment of fixture merely to recessed outlet box is not sufficient.
- G. Where two switches are shown dedicated to an office, room, or area, provide two-level lighting.
- H. Lighting fixtures in any single enclosed room shall be connected using a common (one) circuit, except in cases where the loading requires a second circuit.

- I. Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.
- J. Standards shall be plumb with arms aligned and square. Arms shall be perpendicular to the parking axis unless specifically shown otherwise.
- K. Standards shall be in line such that sighting along straight lines of standards will show no standard out of line with the others. The Contractor is cautioned that some curbs or roadway edges may not be straight and, therefore, should not be used for alignment.
- L. The Contractor shall erect the luminaires and pole assemblies complete on locations called out on the Drawings.
- M. The poles shall be installed with leveling nuts (galvanized). The space between the bottom of the pole base flange and the top of the footing shall be grouted to present a finished appearance with a 1/2" drain hole.

END OF SECTION 26 50 00