SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

1.03 SUBMITTALS

A. Submit product data for each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
   1. Materials, finishes, dimensions and wattage of lighting fixtures.
   2. Certified laboratory tests for fixtures for photometric performance.
   3. Emergency lighting unit battery and charger.
   4. Fluorescent and high-intensity-discharge ballasts.
   5. Air and thermal performance data for air-handling fixtures.
   6. Lamps.
   7. EPA rating for all outdoor pole mounted fixtures and support arms.

B. For outdoor lighting poles, submit the following information:
   1. Materials, finishes, dimensions, anchoring pattern and EPA rating.

1.04 QUALITY ASSURANCE

A. Provide lighting fixtures, emergency lighting units, and accessories that are UL listed and labeled.

B. Comply with NFPA 70.

C. Comply with ANSI C2.

D. Comply with NFPA 101 for visibility and luminance requirements for exit signs.

1.05 COORDINATION

A. Coordinate layout and installation of lighting fixtures and associated trim and mounting hardware with ceiling system, diffusers, sprinkler heads, and other construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide the products indicated for each designation in the Lighting Fixture Schedule indicated on the drawings.

2.02 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Housings for light fixtures shall be constructed of formed, die-cast, or fabricated metal. Metal parts shall be free from burrs, sharp corners, and edges. Unless otherwise indicated on the drawings, plastic housings for lighting fixtures are not allowed.

B. Sheet metal components shall be steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Housings for exterior lighting fixtures shall be rigidly formed or fabricated metal enclosures with weather-tight gasketing. Lenses for outdoor fixtures shall be tempered glass unless otherwise indicated on the drawings.

D. Doors and frames shall be smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

E. Reflecting surfaces shall have the minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

F. Lenses, diffusers, covers, and globes shall be 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
   1. Acrylic lenses shall have a high resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
   2. The minimum acrylic lens thickness shall be 0.125 inch (3 mm).

2.03 LIGHT FIXTURES

A. Light fixtures shall be equal to those fixtures as scheduled on drawings..

2.04 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:
   1. Sign colors and lettering size shall comply with authorities having jurisdiction.

B. Internally lighted signs shall be as follows:
   1. Lamps for AC or DC operation shall be light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-powered exit signs (battery type) shall have an integral automatic charger in a self-contained power pack.
   1. Battery shall be sealed, maintenance-free, nickel-cadmium type unless otherwise indicated on the drawings.
   2. Charger shall be fully automatic, solid-state type with sealed transfer relay.
   3. The transfer relay shall automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. Upon restoration of normal input voltage, relay shall disconnect lamps, and battery shall be automatically recharged and floated on charger.

2.04 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Basic Electrical Materials and Methods," for support components.

B. Single-stem hangers shall be 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy, unless otherwise indicated on the drawings. Finish shall match fixture.

C. Twin-stem hangers shall be two, 1/2-inch (12-mm) steel tubes with canopies arranged to mount a single fixture, unless otherwise indicated on the drawings. Finish same match fixture.

D. Rod hangers shall be 1/4-inch- (6.35-mm-) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook hangers shall be an integrated assembly matched to the fixture and line voltage, and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft cable supports shall use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

G. Wind-load strength of exterior lighting poles shall be adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, anchorage and foundation.
   1. For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

H. Pole bases shall be as indicated on the drawings.

2.05 FINISHES

A. Finishes for lighting fixtures shall be the manufacturer's standard, unless otherwise indicated.
   1. Painted finish shall be polyester powder coat, electrostatically applied.
   2. Metallic finishes shall be corrosion resistant.

B. Finishes for exterior poles and associated brackets, arms and base cover shall match that of the associated lighting fixture mounted on the pole.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install interior lighting fixtures level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture. Lamp wattage shall be as specified in lighting fixture schedule indicated on the drawings.

B. Support for Lighting Fixtures in Grid-Type Suspended Ceilings:
   1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners. Rods or wires shall be supported from the building structure.
   2. Fasten support clips to fixtures and to ceiling grid members at or near each fixture corner.
   3. Fixtures of sizes less than ceiling grid shall be arranged as indicated on reflected ceiling plans or center in acoustical panel. Support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Support for Suspended Lighting Fixtures:
   1. Pendants and rods longer than 48 inches (1200 mm) shall be braced to limit swinging.
   2. Stem-mounted, single-unit fixtures shall be suspended using twin-stem hangers.
   3. Lighting fixtures installed in continuous rows shall use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end, unless indicated otherwise on the drawings.

D. Support for Pole Mounted Lighting Fixtures:
   1. Furnish and install pole bases as indicated on the drawings. Use bolt type, size, grade and pattern as recommended by pole manufacturer.

3.02 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests:
   1. Verify normal operation of each fixture after installation.
   2. Verify emergency lighting operation. Interrupt electrical supply to demonstrate proper operation. Verify that emergency battery units, emergency battery ballasts, and emergency exit signs are connected ahead of any local switching.
   3. Verify normal transfer to battery source and retransfer to normal.

C. Replace or repair malfunctioning fixtures and components, and retest.

3.03 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16500