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Oakhurst Dairy – New Milk Cooler**SECTION 16515 - INTERIOR LIGHTING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 16 Section "Exterior Lighting" for exterior security lighting, roadway and parking lot lighting, poles, and standards.

**1.3 DEFINITIONS**

- A. Emergency Lighting Unit: A fixture with integral emergency battery-powered supply and the means for controlling and charging the battery. It is also known as an emergency light set.
- B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.
- C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.

**1.4 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:
  - 1. Outline drawings indicating dimensions and principal features of fixtures.
  - 2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.
    - a) Furnish photometric information of the space or area involved, with point by point footcandle values if substitute luminaires are used.
    - b) Provide photometric data on magnetic media, in IES format, for any substitute luminaire proposed.
  - 3. Detailed information on electronic ballasts.
  - 4. Battery and charger data for emergency lighting units.
- C. Product certificates signed by manufacturers of lighting fixtures certifying that their products comply with specified requirements.

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- D. Maintenance data for fixtures to include in the operation and maintenance manual specified in Division 1.

**1.5 QUALITY ASSURANCE**

- A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.
- B. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.
- D. Coordinate fixture locations with the discharge of air units. If discharge air flow cannot be avoided, provide additional bracing and/or safety cables for pendent-mounted fixtures.

**1.6 WARRANTY**

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Electronic ballasts shall be warranted against defects and cover replacement labor for a minimum of three years.
- C. Special Warranty for Batteries: Submit a written warranty executed by the manufacturer agreeing to replace rechargeable system batteries that fail in materials or workmanship within the specified warranty period.
  - 1. Special Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last 9 years.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Lamps: 10 lamps for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

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- A. Products: Subject to compliance with requirements, provide products of the type specified in Exterior Lighting Unit Schedule shown on the Drawings and of the quantity needed to satisfy the requirements of the plans.

**2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL**

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: 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.
- D. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
1. White Surfaces: 85 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
  4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.
1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  2. Lens Thickness: 0.125 inch minimum; except where greater thickness is indicated.
- F. Fixture Support Components: Comply with Division 16 Section "Basic Electrical Materials and Methods."
1. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- G. Spacers: Where required to allow heat dissipation for surface mounted fixtures, provide spacers with fixture to allow 1-1/2" for air circulation between fixture and ceiling.
- H. Fluorescent Fixtures: Conform to UL 1570.
- I. Fluorescent Ballasts: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
1. Certification by Electrical Testing Laboratory (ETL).
  2. Labeling by Certified Ballast Manufacturers Association (CBM).
  3. Type: Class P, high power factor, except as otherwise indicated.
  4. Sound Rating: "A" rating, except as otherwise indicated.

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5. Voltage: Match connected circuits.
  6. Integral thermal protection.
  7. Lamp Flicker: Less than 5 percent.
  8. Minimum Power Factor: 90 percent.
  9. Lamp current crest factor: 1.7 or less.
  10. ANSI ballast factor: .90 or higher.
  11. Total Harmonic Distortion (THD) of Ballast Current: Less than 20 percent.
  12. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
  13. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
  14. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp fixtures where possible.
  15. Lamp-ballast connection method does not reduce normal rated life of lamps.
  16. Acceptable Ballast Manufacturers:
    - a) Sylvania-Osram.
    - b) Magnetek-Triad.
    - c) Valmont.
    - d) Advance.
  17. Low-Temperature Fluorescent Ballasts: Comply with above requirements, except ballast may be Class P electromagnetic type. Starting temperature is minus 20 deg C or colder.
- J. High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.
- K. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include the following features, except as otherwise indicated.
1. Constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise indicated.
  2. Operating Voltage: Match system voltage.
  3. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
  4. Normal Ambient Operating Temperature: 40 deg C.
  5. Open circuit operation will not reduce average life.
  6. High-Pressure Sodium (HPS) Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
- L. Incandescent Fixtures: Conform to UL 1571.
- M. Exit Signs: Conform to UL 924 and the following:
1. Sign Colors: Conform to local code.
  2. Minimum Height of Letters: Conform to local code.
  3. Arrows: Include as indicated.

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4. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum rated life.
- N. Self-Powered Exit Signs (Battery Type): Integral automatic high/low trickle charger in a self-contained power pack.
1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
- O. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with the following features:
1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
  2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
  3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.
  4. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

**2.3 LAMPS**

- A. Comply with ANSI C78 series that is applicable to each type of lamp.
- B. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 4100 K and 85 CRI, except as otherwise indicated.
- C. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.
- D. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.
- E. Incandescent lamps shall be rated at 120 volts, nominal, unless noted otherwise.

**2.4 FINISHES**

- A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. General: Assemble where required, wire and install lighting fixtures, accessories, supports, brackets, etc., at locations and mounting heights indicated on the Drawings.
1. Ground light fixtures according to requirements of NEC Article 410-E.

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2. Lamp those permanent light fixtures, as used for temporary lighting during construction, with Contractor's own lamps. Remove temporary lamps at acceptance of work and install new proper lamps in each fixture. New lamps shall be in perfect working order.
- B. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 16 Section "Basic Electrical Materials and Methods."
- C. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures: Units may be supported from suspended ceiling support system. Install ceiling support system rods or wires at a minimum of 4 rods or wires for each fixture, located not more than 6 inches from fixture corners.
1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.
  2. Fixtures Smaller than Ceiling Grid: Install a minimum of 4 rods or wires for each fixture and locate at corner of ceiling grid where fixture is located. Do not support fixtures by ceiling acoustical panels.
  3. Fixtures of Sizes Less than Ceiling Grid: Center in acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- D. Exposed Fixtures: Install surface mounted and exposed fixtures as indicated on the Drawings.
1. Install surface mounted fixtures drawn up tight against the substrate to eliminate gaps, except where NEC, USDA or local or other code restrictions require a separation between fixtures and substrate.
- E. Support for Suspended Fixtures: Brace pendants and rods over 48 inches long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
- F. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

**3.2 CONNECTIONS**

- A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

**3.3 FIELD QUALITY CONTROL**

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.

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- D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:
  - 1. Duration of supply.
  - 2. Low battery voltage shutdown.
  - 3. Normal transfer to battery source and retransfer to normal.
  - 4. Low supply voltage transfer.
- E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- F. Report results of tests.
- G. Replace fixtures that show evidence of corrosion during Project warranty period.

**3.4 ADJUSTING AND CLEANING**

- A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16515