CITY OF FORT WAYNE MASTER UPDATED: 11/16/18

SECTION 26 51 00

INTERIOR LIGHTING

1. - GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install lighting fixtures and associated controls.
			2. Section Includes:
				1. Interior lighting fixtures
				2. Lamps
				3. Ballasts
				4. Drivers
				5. Emergency lighting units
				6. Accessories.
		2. Coordination:
			1. Coordinate location of fixtures with piping, ductwork, openings, and other systems and equipment and locate clear of interferences.
			2. Coordinate fixtures to be mounted in hung ceilings with the ceiling suspension system proposed.
		3. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural division 01 sections.

* + - 1. Section 26 05 05, General Provisions for Electrical Systems.
			2. Section 26 05 53, Identification for Electrical Systems.
			3. Section 26 09 23, Lighting Control Devices
	1. REFERENCES

NTS: Retain applicable standards and add others as required. Remove HID/Fluorescent items if not used.

* + 1. Standards referenced in this Section are:
			1. ANSI C78, Electric Lamps
			2. ANSI C78.51, Electric Lamps - LED
			3. ANSI C82.4, Ballasts for High Intensity Discharge
			4. ANSI C82.16, LED Drivers
			5. ETL, Electrical Testing Laboratory
			6. IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
			7. NEC, National Electrical Code
			8. NEMA SSL 1, Electronic Drivers for LED Devices, Arrays, or Systems.
			9. UL 486 A, Wire Connectors
			10. UL 844, Luminaires for Use in Hazardous (Classified) Locations.
			11. UL 924, Emergency Lighting and Power Equipment
			12. UL 1029, Safety of High-Intensity- Discharge Lamp Ballasts.
			13. UL 1570, Fluorescent Lighting Fixtures
			14. UL 1572, High Intensity Discharge Lighting Fixtures
			15. UL 8750, Standard for LED Equipment for Use in Lighting Products
			16. UL 8752, Standard for OLED Panels
			17. UL 8753, Standard for Field-Replaceable LED Light Engines
	1. DEFINITIONS
		1. Emergency Lighting Unit: Fixture with integral emergency battery-powered supply and means for controlling and charging battery. Also known as an emergency light set.
		2. Fixture: 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 battery and means for controlling and recharging battery. Emergency lighting units include ones with and without integral lamp heads.

NTS: Edit article “1.4” below to suit the Project. DO NOT DELETE (NOT USED) ITEMS. LED is preferred. Remove HID/Fluorescent Items if not used.

* 1. SUBMITTALS
		1. Submit the following:
			1. Product Data
				1. Manufacturer's technical information for proposed fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation.
				2. Include data on features and accessories and following:

Outline drawings indicating dimensions and principal features of fixtures.

Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.

Battery and charger data for emergency lighting units.

* + - 1. Shop Drawings:
				1. Detail nonstandard fixtures and indicate dimensions, weights, method of field assembly, components, features, and accessories.
			2. Test Reports:
				1. Field test reports indicating and interpreting test results.
			3. Maintenance and Operating Data (O&M):
				1. Maintenance data for fixtures to include operation and maintenance information.
			4. Extra Materials
				1. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

Lamps: 10 lamps for every 100 of each type and rating installed. Furnish at least 1 of each type.

Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least 1 of each type.

Ballasts: 1 for every 100 of each type and rating installed. Furnish at least 1 of each type.

Drivers: 1 for every 100 of each type and rating installed. Furnish at least 1 of each type.

Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least 1 of each type.

* + 1. Submit in accordance with Section 01 33 00.
	1. QUALITY ASSURANCE
		1. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
			1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
			2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
			3. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for specific hazard.
		2. Regulatory Requirements:
			1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
			2. NEC Article 410, Luminaires, Lampholders, and Lamps.
		3. Fixtures for Hazardous Locations: Conform to UL 844. Provide units that have Factory Mutual Engineering and Research Corporation (FM) certification for indicated class and division of hazard.
		4. 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.
	2. DELIVERY, STORAGE AND HANDLING
		1. Delivery:
			1. Upon delivery, inspect equipment for evidence of water that may have entered equipment during transit.
		2. Storage:
			1. Store lighting fixtures, controls, related materials and equipment in clean, dry location with controls for uniform temperature and humidity. Protect materials and equipment with coverings and maintain environmental controls.
			2. Store materials and equipment for easy access for inspection and identification. Keep materials and equipment off ground, using pallets, platforms, or other supports. Protect materials and equipment from corrosion and deterioration.
	3. WARRANTY
		1. LED Drivers and lamps shall be warranted for a minimum of 5 years as a unit.
		2. Special Warranty for Batteries: Submit written warranty executed by 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 yrs after date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last 9 yrs.
1. - PRODUCTS
	1. MANUFACTURERS
		1. Subject to compliance with requirements, provide products by one of the following:
			1. Eaton Lighting
			2. Hubbell Lighting
			3. Lithonia Lighting
			4. Philips Lighting
	2. FIXTURES AND FIXTURE COMPONENTS
		1. Metal Parts: Free from burrs, sharp corners, and edges.
		2. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.
		3. 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.
		4. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
			1. White Surfaces: 85%.
			2. Specular Surfaces: 83%.
			3. Diffusing Specular Surfaces: 75%.
			4. Laminated Silver Metallized Film: 90%.
		5. Lenses, Diffusers, Covers, and Globes: 100% 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 in. (3 mm) minimum; except where greater thickness is indicated.
		6. Fixture Support Components: Comply with Section 26 05 29.
			1. Single-Stem Hangers: 1/2 in. (12 mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
			2. Twin-Stem Hangers: Two, 1/2 in. (12 mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
			3. Rod Hangers: 3/16 in. (5 mm) minimum diameter, zinc-plated, threaded steel rod.
			4. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
		7. Fixtures located in area identified as hazardous in Section 26 05 05, General Provisions for Electrical Systems, shall each be approved as a complete assembly, shall be clearly marked to indicate maximum wattage of lamps for which they are approved, and be protected against physical damage by suitable guards.
		8. Hardware: Provide necessary hangers, supports, conduit adaptors, reducers, hooks, brackets, and other hardware required for safe fixture mounting. Hardware shall have protective, non‑corrosive finish.
		9. Fluorescent Fixtures: Conform to UL 1570.
		10. Fluorescent Ballasts: Programmed Start, Electronic integrated circuit, solid-state, full-light-output, high-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.
			5. Voltage: Match connected circuits.
			6. Lamp Flicker: Less than 5%.
			7. Minimum Power Factor: 90%.
			8. Total Harmonic Distortion (THD) of Ballast Current: Less than 20%.
			9. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
			10. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
			11. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp fixtures where possible.
			12. Lamp-ballast connection method does not reduce normal rated life of lamps.
			13. Low-Temperature Fluorescent Ballasts: Comply with above requirements, except ballast may be Class P electromagnetic type. Starting temperature is minus 20° C or colder.

NTS: The preferred option is LED. If LED is not available or practical for specific project applications keep HID Sections below, otherwise delete.

* + 1. Light Emitting Diodes (LED)
			1. Driver shall be accessible for easy replacement.
			2. Weatherproof fixture housing shall be sealed completely against moisture and environment contaminants.
			3. 4100K temperature, Color rendering index (CRI) greater than 70.
			4. CSA Certified to US standards for 40°C ambient.
		2. LED Fixtures:
			1. Conform to UL 8750 and UL 8752.
			2. LED fixtures shall be modular and allow for separate replacement of lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.
			3. Dimmable LED fixtures shall have either a 0-10 volt, three wire dimming driver or a two-step (50%, 100%) dimming driver.
		3. LED Drivers: Electronic type, labeled as compliant with RFI requirements of FCC Title 47, Part 15, Level “A” sound rating, minimum of 0.8 power factor, and THD less than 20%.
			1. Conform to UL 8753.
			2. Certification by Electrical Testing Laboratory (ETL).
			3. Dimming Drivers shall be 0-10 volt dimming with low end dimming to 10%.
			4. Dimming drivers shall be strobe and flicker-free across the full dimming range.
			5. Voltage: 120-277 volt unless listed on fixture schedule.
			6. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.

NTS: The preferred option is LED. If LED is not available or practical for specific project applications keep HID Sections below, otherwise delete.

* + 1. High-Intensity-Discharge (HID) Fixtures: Conform to UL 1572.
		2. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include following features, except as otherwise indicated.
			1. Metal Halide Ballasts:
				1. Pulse start ballast.
			2. Operating Voltage: Match system voltage.
			3. Single-Lamp Ballasts: Minimum starting temperature of minus 30°C.
			4. Normal Ambient Operating Temperature: 40°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 hrs at an igniter/starter case temperature of 90°C.
			7. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.
		3. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when fixture is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60% light output.

NTS: Standard design is LED type, if self-luminous exit signs are to be used, edit paragraph “N” below

* + 1. Exit Signs: Conform to UL 924 and following:
			1. LED
			2. Sign Colors: Red, unless local code requires green.
			3. Minimum Height of Letters: Conform to local code.
			4. Arrows: Include as indicated.
		2. Self-Powered Exit Signs (Battery Type): Integral automatic high/low trickle charger in self-contained power pack.
			1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
			2. Provide with self-diagnostics.
		3. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with following features:
			1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10 yr nominal life and special warranty.
			2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
			3. Provide with self-diagnostics.
			4. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% 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.
			5. Wire Guard: Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
			6. 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 outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

NTS: LED is preferred. Remove HID/Fluorescent Items if not used.

* + 1. Emergency Fluorescent Power Supply Unit: Conform to UL 924.
			1. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body.
				1. Test Switch and LED Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
				2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10 yr nominal life.
				3. Charger: Fully automatic, solid-state, constant-current type.
				4. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.
				5. Provide with self-diagnostics.
			2. External Type: Self-contained, modular, battery-inverter unit.
				1. Test Switch and LED Indicator Light: Visible and accessible without entering ceiling space.
				2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10 yr nominal life.
				3. Charger: Fully automatic, solid-state, constant-current type.
				4. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal voltage or below. Battery automatically recharges when normal voltage is restored.
		2. Emergency LED Emergency Lighting Unit: Conform to UL 924.
			1. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body.
				1. Test Switch and LED Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
				2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10 yr nominal life.
				3. Charger: Fully automatic, solid-state, constant-current type.
				4. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.
				5. Provide with self-diagnostics.
	1. LAMPS
		1. Comply with ANSI C78 series that is applicable to each type of lamp.
		2. Fluorescent: Fluorescent lamps shall be 28 watts or less and shall be low mercury as defined by a maximum allowable of 3.5 mg of mercury per 4 ft lamp. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 4100 K and 85 CRI, except as otherwise indicated.
		3. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hrs at 3 hrs per start when used on rapid start circuits.
		4. Metal Halide: Shall be fabricated for low mercury content and be TCLP-compliant when available. Lamps shall be clear-pulse, start type with high-efficacy and lumen maintenance. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.

NTS: REMOVE SECTIONS AS REQUIRED IF 26 09 23 IS INCLUDED. Coordinate time switch requirements with Plant staff.

* 1. Time Switch:
		1. Type: Astronomic dial time switch with day‑omitting device.
		2. Products and Manufacturers: Provide of one of the following:
			1. Z Series by Tork Time Controls, Inc.
			2. Or equal.
		3. Timing Motor: Heavy-duty, synchronous, self‑starting, high torque, 120-volt or 277-volt, 60 Hertz, as shown on the Drawings.
		4. Capacity: 40 amps per pole at 277 volts.
		5. Dial: 24-hour rotation, with gear to provide one revolution per year that automatically raises the “ON” and “OFF” settings each day according to seasonal changes of sunset and sunrise.
		6. Reserve Power: Spring driven reserve sufficient to operate time switch contacts for not less than 30 hours after power failure. On restoration of power, time switch shall transfer to synchronous motor drive and automatically rewind reserve.
	2. Lighting Contactor and Controls:
		1. Provide a lighting contactor and control system for control of each area where shown on the Drawings.
		2. Product and Manufacturer: Provide products of one of the following:
			1. Square D Company.
			2. Siemens.
			3. Eaton.
			4. Or equal.
		3. System shall include:
			1. Enclosure sized as required, complete with input control fuse and screw type terminal blocks rated 300-volt, 20-amp quantity for all circuits, unless indicated otherwise on the Drawings.
			2. Single coil, electrically-operated, mechanically-held contactor. Contactor shall be rated 30-amp, 600-volt, with 120-volt operating coil, unless indicated otherwise on the Drawings. Number of poles shall be as shown on the Drawings. Provide multiple contactors when necessary.
			3. Where lighting contactors are controlled by photocell, provide a 120-volt, two-pole control relay, enclosure mounted to convert the two-wire photocell control to three-wire control required by contactor. Control shall include a cover mounted on-off-auto selector switch for “manual” or “auto” selection of operation. In “auto” position, contactor shall respond to photocell.
			4. Enclosure: As required for area classification per Section 26 05 05, General Provisions for Electrical Systems.
			5. Identify panel in compliance with Section 26 0 53, Identification for Electrical Systems.
	3. FINISHES
		1. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.
1. - EXECUTION
	1. TEMPORARY LIGHTING
		1. New lighting fixtures **SHALL NOT** be used for temporary lighting.
	2. INSTALLATION
		1. General:
			1. Fixture mounting heights and locations indicated on the Drawings are approximate and are subject to revision in the field where necessary to clear conflicts and obstructions.
			2. Mounting Heights: Mounting heights or elevations are to bottom of fixture or to centerline of device.
			3. Install fixtures in accordance with Laws and Regulations, the Contract Documents, and manufacturer instructions and recommendations.
			4. Mount fixtures so that sufficient access is available for ready and safe maintenance.
			5. Securely fasten equipment to walls or other surfaces on which equipment is mounted.
		2. Suspended Fixtures:
			1. Pendant-mount using 1/2‑inch diameter conduit stems.
			2. Ground to outlet box.
			3. Attach mounting to building structure with expansion anchors.
			4. Fixtures shall not be dependent on the outlet box cover screws for support.
		3. Surface Mounted Fixtures:
			1. Attach to appropriate outlet box.
			2. Attach to surface using fasteners and sealing washers when mounting fixture in damp or wet locations.
		4. Boxes and Fixtures:
			1. For units mounted against masonry or concrete walls, provide suitable 1/4‑inch spacers to prevent mounting back of box directly against wall.
			2. Bolt units rigidly to building with expansion anchors, toggle bolts, hangers, or Unistrut.
			3. Do not install boxes with open conduit holes.
			4. Cable each circuit and identify with tag.
		5. 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 Section 26 05 29.
		6. Support for Recessed and Semi-recessed Grid-Type Fluorescent Fixtures: **DO NOT** support fixtures from suspended ceiling support system. Install ceiling support system rods or wires at minimum of 4 rods or wires for each fixture, located not more than 6 in. (150 mm) 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 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 in. (20 mm) metal channels spanning and secured to ceiling tees.
		7. Support for Suspended Fixtures: Brace pendants and rods over 48 in. (1200 mm) 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.
		8. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.
	3. CONNECTIONS
		1. 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.
	4. FIELD QUALITY CONTROL
		1. Inspect each installed fixture for damage. Replaced damaged fixtures and components.
			1. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source.
			2. Give advance notice of dates and times for field tests.
			3. Provide instruments to make and record test results.
			4. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include 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.
				5. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
				6. Report results of tests.
		2. Replace fixtures that show evidence of corrosion during Project warranty period.
	5. ADJUSTING AND CLEANING
		1. Clean fixtures after installation. Use methods and materials recommended by manufacturer.
		2. Adjust aimable fixtures to provide required light intensities.

NTS: Fixture schedule shall be on the Construction Drawings.

+ + END OF SECTION + +