This specification is reworked & new in its entirety.

# GENERAL

1.1 SUMMARY

* 1. Section Includes:
     1. Light fixtures, lamps, boards, ballasts, and drivers.
     2. Emergency lighting units.
     3. Exit signs.
     4. Light fixture supports, accessories, extra materials.
  2. Related Documents & Sections:
     1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections apply to the work of this Section.
     2. Division 26 "Basic Materials and Methods" sections apply to the work in this Section.
  3. Coordination Requirements:
     1. Coordinate the installation of all light fixtures with the work of other trades. This includes but is not limited to placement of fixtures in conjunction with HVAC diffusers, ductwork, equipment, fire suppression and alarm devices and infrastructure, plumbing piping, and all associated mounts, mounting hardware, and supports required for other system installations.
     2. Coordinate the installation of all light fixtures with mounting surfaces fixtures will be mounted within, onto, or through. Coordinate placement of fixture supports, anchors, and mounts in conjunction with ceiling and wall system supports, anchors and mounts. Light fixture trims shall be coordinated with ceiling and wall surfaces.
     3. Coordinate installation of recessed fixtures with ceiling system installation.
     4. Coordinate the installation of all light fixtures with required external surge protection devices as applicable. See Paragraphs 2.8 & 2.10 below for more on surge protection requirements.
  4. SUBMITTALS
     1. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
        1. Submit manufacturer's product datasheet on each and every lighting fixture. Each fixture
        2. Furnish shop drawing portfolios (collated & bound sets) containing the following information:
           1. Name of manufacturer, make and model of each particular fixture in the project
           2. Product listing information (UL, ETL, DLC, Dark Sky, etc…)
           3. Descriptive cut sheets Indicate fixture catalog number selections, highlight or make obvious which part numbers are used to build the complete fixture catalog number.
           4. Complete photometric information and coefficient of utilization tables
           5. Fixture voltage, match to project specifics. Generally multi-
           6. The number, type and wattage of the fixture lamps. Include lamp rated life, color temperature, color rending index (CRI), initial & mean lumen output
           7. The wattage and illumination information for LED fixtures. Include rated life, color temperature, CRI, initial & mean lumen output of LED fixtures
           8. Lens information including type, pattern, thickness, material type, special features
           9. Fixture options, mounting details and ceiling compatibility information
           10. Construction of fixture housing and door, door type, access hole information
           11. Fixture ballast and driver manufacturer and type information
        3. All lighting fixtures required to be used on this project shall be submitted in one single submittal so that all fixtures can be reviewed at one time. Those fixtures not receiving a shop drawing action of "Reviewed" or "Reviewed and Noted" on the first submittal shall be resubmitted for review. A light fixture receiving a shop drawing action of "Resubmit" or "Rejected" after the third review for any reason, shall be furnished as originally specified.
        4. The portfolios shall be made from standard manufacturer's specification sheets. Each fixture shall be identified by the letter or number indicated on the fixture schedule or project plan sheets as applicable. The combining of more than one fixture type of fixture on a single sheet shall not be acceptable.
     2. Shop Drawings for nonstandard or custom lighting fixtures: Show details indicating dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast and driver, dimmer-controlled fixtures, provided by manufacturer.
     3. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
     4. Provide all applicable field quality-control reports.
     5. Project Record Documents: Record actual connections and locations of luminaires and any associated remote mounted components. Provide this information along with project ‘as-builts’ per the contract documents plans and specifications.
  5. QUALITY ASSURANCE
     1. Manufacturers: Firms regularly engaged in the manufacturer of interior and exterior light fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
     2. Installer: Qualified with at least three (3) years of successful installation experience on projects with interior and exterior lighting fixture work similar to that required for this project.
     3. Electrical Components, Devices, and Accessories: Listed and labeled as defined by NFPA 70 by a qualifying testing agency and marked for intended location and application.
     4. Comply with NFPA 70.
     5. Fixtures shall be furnished and installed to meet seismic requirements as outlined in ASCE/SEI 7 and CISCA. All fixtures mounted within suspended ceilings shall have slack wire supports provided apart from the ceiling grid system itself. See execution section below for further details.
  6. REFERENCES
     1. NEC Compliance: Comply with the NEC (NFPA 70) as applicable to the installation and construction of lighting fixtures.
     2. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.
     3. ANSI/UL Compliance: Comply with ANSI/UL Standards pertaining to interior and exterior lighting fixtures for hazardous locations. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements.
     4. CBM Labels: Provide fluorescent lamp ballasts that comply with Certified Ballast Manufacturers Association Standards and carry the CBM label.
     5. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
     6. IESNA LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.
     7. IESNA LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources
     8. NECA 1 - Good Workmanship in Electrical Construction, latest edition.
     9. NECA/IESNA 500 – Standard for Installing Indoor Commercial Lighting Systems, latest edition.
     10. NECA/IESNA 502 – Standard for Installing Industrial Lighting Systems, latest edition.
     11. Underwriter’s Laboratories (UL) Listings. Provide fixtures that have been UL Listed and labeled to any or all of the following standards, latest edition, as applicable to the project:
         1. UL 844 - Luminaires for Use in Hazardous (Classified) Locations.
         2. UL 924 - Emergency Lighting and Power Equipment.
         3. UL 935 - Fluorescent-Lamp Ballasts.
         4. UL 1598 - Luminaires.
         5. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.
  7. DELIVERY, STORAGE AND PROTECTION
     1. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and all manufacturer’s written instructions.
     2. Keep fixtures in original product packaging until ready for installation. Do not leave unpackaged fixtures unattended or where they are subject to dirt, debris, or damage.
     3. All fixtures shall be kept warm, dry, safe and secure. Adhere to manufacturer storage requirements.
  8. EXTRA MATERIALS
     1. At substantial completion of the project, furnish the following extra materials that match specified and installed products to the Owner for future use after completion of project warranty periods. Extra materials shall be delivered and stored at a location or locations directed by the Owner. Products shall be packaged with protective covering for storage and shall be suitably labeled by product type.
        1. Provide ten extra lamps for every 100 lamps (of each rating and type) installed on the project. Provide a minimum of at least one extra lamp for each lamp type and rating used.
        2. Provide one extra lens or louver for every 100 units (of each type) installed on the project. Provide a minimum of at least one extra lens and one extra louver for each type used.
        3. Provide one extra ballast for every 100 units (of each type) installed on the project. Provide a minimum of at least one extra ballast for each type used.
        4. Provide one extra driver for every 100 units (of each type) installed on the project. Provide a minimum of at least one extra driver for each type used.
  9. WARRANTY
     1. Provide a five (5) year manufacturer warranty for all linear fluorescent ballasts, LED drivers, and LED light boards (light engines) from date of substantial completion of the project. This warranty to cover all product defects, performance criteria, and parts.

# PRODUCTS

2.1 FIXTURES, GENERAL

* 1. All fixtures shall be UL or other qualified third party listed for the environment where they will be installed including: damp, wet, extreme temperature, or hazardous locations.
  2. Polycarbonate lenses shall be used as standard. Lenses shall be 100% virgin acrylic thermoplastic with a minimum thickness of 1/8” of an inch.
  3. Flat style ‘smooth’ lens per Paragraph 2.4.A below. Alternatively, diffused prismatic pattern #12 (A12) lens are acceptable if provided so as to obscure lamps and LED pixelation.
  4. All raw material used shall meet ASTM D 788, Grade 8, and shall exceed IES-SPI-NEMA by 100%.
  5. Housings shall be made of cold-rolled, die-formed steel, 22 gauge minimum, with mitered corners.
  6. Doors and Frames: Operable without tools, free of light leaks.
  7. Luminaire Disconnect: Separate (pull-apart) connector installed in ballast or driver compartment of each fixture. Allows for safe and quick disconnection of fixture ballast or driver from line voltage. Finger-safe style unit disconnect devices, UL listed, 600V rated, suitable for aluminum or copper wiring. Provide disconnect as one of the following:
     1. Luminaire manufacturer’s quick disconnect standard device, factory installed.
     2. Thomas & Betts LD2 luminaire disconnect kit, or equal, field installed.
  8. MANUFACTURER: Manufacturers of lighting fixtures are noted on the drawings by notes and/or by the light fixture schedule.
  9. STANDARDIZATION - GENERAL: It is the University’s intent to limit general light fixture selections to a few major manufacturers. The term ‘general light fixture’ refers to troffer style fixtures in 2’x4’, 1’x4’, 2’x2’ sizes in both flush and surface mounted varieties. Standardization is intended to keep maintenance and replacement costs predictable, provide consistency in fixture performance, aesthetics, and features, and will allow stock piling of commonly needed spare parts.
     1. DESIGNER/SPECIFIER NOTE: Every project is unique and fixture aesthetics, performance, user requirements, and installation environments all play a factor in fixture selections. However, on large renovation projects or new construction projects it will be expected that fixture schedules limit the standard troffer LED fixtures allowed to one or a few of the fixture manufacturers listed within this specification.
  10. STANDARDIZATION – LED LENSED TROFFERS: The following features and example products shall be reviewed and considered for projects as applicable. Products listed here shall generally be acceptable to all University projects but shall be first reviewed and considered by the Client or Department funding the project, the UNL Project Manager, and the design consultant. All LED lensed troffers shall have local regional distribution center(s) with finished good inventory and local regional manufacturing centers for luminaire assembly with short lead times.
      1. Standard expected features of LED Lensed Troffers:
         1. Smooth, edge-to-edge, uniform, glare-free illumination (i.e. smooth lens, not prismatic lens)
         2. 3500K CCT and minimum 80 CRI performance levels
         3. LED driver with quick disconnect
         4. LED driver with standard 0-10V dimming capability
         5. Fixture DLC Standard (>100 LPW) or DLC Premium (<125 LPW) listed
         6. Fixture with integral T-bar clips. Fixture shall fit in 9/16” or 15/16” T-grad as applicable without any modifications to the fixture or ceiling.
         7. Fixture lumen maintenance LM70-60000 or better (i.e. 70% of initial lumens at 60K hours)
         8. Fixture shall be suitable for direct installation contact (IC rated)
         9. Fixtures available in standard 2’x4’, 1’x4’, 2’x’2 sizes, both surface and flush mount in suspended or hard ceiling applications.
         10. Fixtures shall be damp location listed
         11. Fixtures shall carry a minimum 5-year warranty
      2. Acceptable products include, but are not limited to, the following products:
         1. Acuity Brands; Lithonia Lighting GTL LED Troffer Series
         2. Acuity Brands; Lithonia Lighting TL LED Troffer Series
         3. Eaton; Metalux GR LED Troffer Series
         4. Hubbell Lighting; Columbia Lighting LJT LED Troffer Series
         5. Philips; Day-Brite FluxPanel LED Troffer Series
      3. UNL encourages the use of flat panel type LED luminaires as an alternative to lens troffers described above. Flat panel type fixtures are ideal for shallow plenum applications and where less features, controls, and serviceability in the field are necessary. Flat panel type LED fixtures shall adhere to the performance requirements found in Paragraph 2.4.A.1 – 2.4.A.11 above.
  11. STANDARDIZATION – LED VOLUMETRIC/CENTER BASKET TROFFERS: The following features and example products shall be reviewed and considered for projects as applicable. Products listed here shall generally be acceptable to all University projects but shall be first reviewed and considered by the Client or Department funding the project, the specific UNL Project Manager, and the design consultant. All LED lensed troffers shall have local regional distribution center(s) with finished goods inventory.
      1. Standard expected features of LED Center Basket Troffers:
         1. Smooth, edge-to-edge, uniform, glare-free illumination (i.e. smooth lens, not prismatic lens)
         2. 3500K CCT and minimum 80 CRI performance levels
         3. LED driver with quick disconnect
         4. LED driver with standard 0-10V dimming capability, standard to 10% with option 1%
         5. Fixture DLC Standard (>100 LPW) or DLC Premium (>125 LPW) listed
         6. Fixture with integral T-bar clips. Fixture shall fit in 9/16” or 15/16” T-grad as applicable without any modifications to the fixture or ceiling.
         7. Fixture shall fit in 9/16” and 15/16” T-grid ceilings with no modifications to fixture or ceiling
         8. Fixture lumen maintenance LM70-60000 or better (i.e. 70% of initial lumens at 60K hours)
         9. Fixture shall be suitable for direct installation contact (IC rated)
         10. Fixtures available in standard 2’x4’, 1’x4’, 2’x’2 sizes, both surface and flush mount in suspended or hard ceiling applications.
         11. Units shall be damp location listed
         12. Fixtures shall carry a minimum 5-year warranty
      2. Acceptable products include, but are not limited to, the following:
         1. Acuity Brands; Lithonia Lighting BTL LED Troffer Series
         2. Acuity Brands; Lithonia Lighting CTRF LED Troffer Series
         3. Acuity Brands; Lithonia Lighting FS LED Troffer Series
         4. Acuity Brands; Lithonia Lighting VT LED Troffer Series
         5. Acuity Brands; Lithonia Lighting TL LED Troffer Series
         6. Eaton; Corelite R2X LED Troffer Series
         7. Eaton; Metalux FR LED Troffer Series
         8. Eaton; Metalux ALN LED Troffer Series
         9. Eaton; Metalux CZ LED Troffer Series
         10. Hubbell Lighting; Columbia Lighting LCAT LED Troffer Series
         11. Hubbell Lighting; Columbia Lighting LSER LED Troffer Series
         12. Hubbell Lighting; Columbia Lighting LTRE LED Troffer Series
         13. Philips; Day-Brite EvoGrid LED Troffer Series
  12. SUBSTITUTIONS: If the Contractor proposes to substitute lighting fixtures for those shown on the drawings or specified herein, he shall submit a list of proposed fixtures together with technical data to substantiate that the substitute fixtures are equivalent in all respects to the specified equipment. Proposed substitute fixtures must be submitted to the architect/engineer for review a minimum of ten (10) days prior to the project bid date. Only original documentation will be accepted for review. Copies sent via facsimile or e-mail will not be accepted. After review of the proposed substitute fixtures, an addendum or bid bulletin will be issued to include acceptable equipment. The review of substitute equipment in no way relieves the contractor of the responsibility to provide equipment that is equivalent in all respects to specified fixtures. Lighting fixtures as shown on the drawings or specified herein shall be used as a basis and standard of comparison in the review and consideration of fixtures of other manufacturers. The Architect/Engineer shall have the final authority as to whether the fixture is equivalent to the specified item. The proposed substitution may be rejected for the aesthetic value if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item.
  13. LED LIGHTING FIXTURES
      1. Complete LED lighting fixtures for general illumination shall have been tested by IES LM-79 and LM-80 requirements.
      2. LED light fixtures shall be fabricated, assembled, and manufactured as a complete fixture unit, including housing, mounting hardware, driver, light boards (light engines), and lens.
      3. LED lighting fixtures shall allow for separate replacement of the light boards and driver. In other words, ‘throw away’ fixtures with non-replaceable components are not permitted.
      4. LED lighting fixtures shall be capable of continuous dimming as a standard offering. Dimming range to be from 100% to at least 20% of rated lumen output. Dimming control shall be 0-10VDC.
      5. All LED fixture control devices shall be compatible with the type of drivers and dimming requirements of the particular project, and coordinated with the lighting fixture submittals prior to ordering.
      6. Universal input voltage (120-277 VAC) drivers shall be provided for all LED applications.
  14. LED DRIVERS
      1. Drivers shall operate from a 60Hz input AC voltage from 120V-277V. Unit shall have an input voltage tolerance range of at least +/- 10%.
      2. The Total Harmonic Distortion (THD) of the driver input current shall be no more than 20% when operating at nominal input voltage.
      3. Drivers shall have a minimum Power Factor (PF) of 0.90.
      4. Drivers shall comply with IEEE/ANSI C62.41 Category B3 (high) for transient voltage protection. This shall include a 6kV rating, and 3kA rating per the standard 8x20us combo wave testing parameters.
      5. Drivers shall comply with the requirements of the FCC rules and regulations, Title 47 CFR Part 18, Non-consumer (Class A) for EMI & EMF (conducted and radiated) interference.
      6. LED high bay and Indoor sports lighting: fixtures shall comply with IEEE/ANSI C62.41 Category C2 (medium) for transient voltage protection. This shall include a 10kV rating, and 5kA rating per the standard 8x20us combo wave testing parameters.
      7. Fixtures may require additional surge protection apart from what is integral with the LED driver. See Paragraph 2.10 below for more details.
  15. LED BOARDS
      1. Rated minimum life of 60,000 hours minimum per IES LM-70 testing requirements.
      2. Provide a TM21 report on LED boards to be used which tests LED life and lumen maintenance per the IES LM-80 standard, and LED light output and efficacy per the IES LM-70 standard.
      3. The correlated color temperature (CCT) of the LEDs shall be 3500K unless noted otherwise. The CCT shall be uniform for all LED modules within like luminaire types and luminaires within a given project. The LED CCT measurements shall have a maximum of three standard deviations (three SDCM, +/-90K) tolerance on the MacAdam Ellipse.
      4. Provide LED boards such that any individual LED failure on a section of LED board within the fixture will not result in significant output loss of the overall fixture.
  16. EXTERNAL LED DRIVER SURGE PROTECTION DEVICE (SPD)
      1. All high bay LED light fixtures, high wattage LED light fixtures, specialty fixtures, and indoor sports lighting LED products shall come equipped with an additional layer of SPD protection. This additional protection shall be in addition to requirements of the surge protection integral to the LED driver itself.
      2. The SPD shall be circuited immediately upstream of the LED driver and mounted either within the fixture or immediately adjacent to it in a concealed, protected, and accessible location. Do not void manufacturer warranty or listing requirements when mounting the SPD.
      3. The external SPD shall be circuited either in series or parallel with the light fixture circuit as required of the project and Owner needs. In series circuiting shall de-energize the fixture upon SPD failure (indicating a problem) while parallel circuiting shall allow for continued fixture use after SPD failure.
      4. The additional SPD shall have a kilo-amp rating in excess of the kilo-amp rating of the fixture it is protecting. Minimum specifications shall meet IEEE/ANSI Category C2 (medium) 10kV, 5kA@ 8/20us standard combo and 6kV, 100kHz ring wave protection.
      5. The additional SPD shall have a let-through voltage rating or Voltage Performance Rating (VPR) that limits the voltage to the downstream driver to within the voltage tolerance of the driver. Anticipated maximum clamping voltage (8/20us @ 10kA) as follows: 600V (120V circuit), 1000V (208-240V circuit), 1500V (277V circuit), and 2500V (480V circuit).
  17. FLUORESCENT BALLASTS
      1. Ballasts for fluorescent lamps shall be of the high frequency electronic type, operating lamps at a frequency of 20 kHz or higher with no detectable flicker. Ballasts for fluorescent lamps shall be manufactured by Osram Sylvania, Advance, Universal Lighting Technologies or General Electric unless otherwise noted or specified herein. The warranty period for fluorescent ballasts shall be five years from the date of substantial completion of the project, including all parts and labor. Ballasts shall be specifically designed for the type and quantity of lamps indicated on the drawings, and shall be designed to provide full light output (except for emergency fluorescent power packs). All fluorescent ballasts shall be UL listed and CSA certified. Ballasts shall have an audible noise rating of Class ‘A’.
      2. Ballasts for T2, T4, or T5 lamps shall contain dynamic end of lamp life sensing circuiting to protect against overheated bases and sockets.
      3. Universal input voltage (120-277 VAC) ballasts shall be provided for T8 instant start, T8 programmed rapid start and T4 compact fluorescent applications. All other ballasts shall have a nominal line voltage of 120 or 277 VAC as indicated on the drawings or as required for proper system operation.
      4. Ballasts shall have an input current total harmonic distortion content of less than 10 percent (based on the full light output current level). The lamp current crest factor for any ballast shall not exceed

1.7. Ballasts shall have a power factor of 98 percent or greater, and shall contain no PCB's.

* + 1. Ballasts shall comply with all applicable State, Federal and industry performance and safety standards. Ballasts shall comply with FCC requirements governing electromagnetic and radio frequency interference. Ballasts shall comply with IEEE standards for line voltage transient protection, and shall meet or exceed ANSI and IEEE standards for harmonic distortion. Ballasts shall have internal electronic protection to prevent catastrophic failures.
    2. For T8 lamp applications, provide instant start ballasts (equivalent to Osram Sylvania Quicktronic Professional Series) to operate lamps in parallel so that if one lamp fails, other lamps will remain operational.
    3. For T8 lamp applications, provide programmed rapid start ballasts (equivalent to Universal Lighting Technologies AccuStart Series) to properly heat lamp filaments and minimize glow current during the starting process.
    4. For T5 and T5HO lamp applications, provide programmed rapid start ballasts equivalent to Osram Sylvania Quicktronic Prostart Professional Series.
    5. For TT5 lamp applications, provide programmed rapid start ballasts equivalent to Osram Sylvania Quicktronic Prostart Professional Series.
    6. For T4 compact fluorescent lamp applications, provide programmed rapid start ballasts equivalent to Osram Sylvania Quicktronic CF – Universal Professional Series (universal voltage 120 – 277 VAC and multi lamp compatibility).
    7. Ballasts for Dimming: Provide a fluorescent dimming system consisting of electronic dimming ballasts (equivalent to Lutron Hi-Lume Series) and controls made by the same manufacturer. Ballasts and controls shall be produced by the same manufacturer who shall have a minimum of ten-(10) years of experience with electronic dimming ballasts. Dimming shall be smooth and continuous without flicker down to one percent light output. Ballasts shall be capable of striking lamps at any light level without first flashing to full light. Different lamp lengths of the same type

shall dim evenly when controlled by the same dimmer. One- and two-lamp ballasts shall dim evenly when controlled by the same dimmer. Ballasts shall be inaudible in a 27dB room ambient throughout the dimming range. Ballasts must comply with FCC Part 18 regulations and shall not interfere with other properly installed electrical equipment. Ballasts shall be UL listed, Class P and shall meet ANSI C62.41 (IEEE Publication 587, Category A) standards for surge protection.

* + 1. Emergency Fluorescent Power Packs: Where indicated on the drawings, provide fluorescent fixtures equipped with Bodine (or equivalent) REDiTEST® B50ST self-testing fluorescent emergency ballasts. Electronic circuitry shall be self-testing in design and shall automatically test emergency lighting for a minimum of 30 seconds every 30 days, and 90 minutes once per year. An embedded micro-controller shall continually monitor the battery charging current and voltage. An audible alarm and light-emitting diode shall be provided to indicate test results and status conditions. The B50ST shall consist of a high-temperature, maintenance-free nickel-cadmium battery, charger and electronic circuitry contained in one 13 3/8" x 2 3/8" x 1 1/2" red metal case. A solid-state light shall be provided to indicate the status of the charger, the battery and potential fault conditions. A single-pole test switch and all necessary installation hardware shall be provided with each unit. The emergency ballast shall be capable of operating one or two fluorescent lamps (of the type indicated on the lighting fixture schedule) at 1100 lumens (minimum) initial light output in the emergency mode for a minimum of 90 minutes. The B50ST shall require 4.0 Watts of input power, shall have a 24.0 Watt-hour battery capacity, and shall exceed emergency standards set forth by the current NEC. The emergency ballast shall be UL Listed and CSA Certified for installation inside, on top of, or remote from the fixture and shall be warranted for a full five years from the date of substantial completion of the project.
  1. HIGH INTENSITY DISCHARGE BALLASTS
     1. HID lighting products and systems are no longer part of the University standard. HID shall be considered on a project-by-project basis only. Consult UNL FPC Engineering Staff for more information.

* 1. LAMPS

1. Incandescent lights and systems are no longer part of the University standard and shall only be considered on a project by project basis. Consult UNL FPC Engineering Staff for more information.
2. All fluorescent lamps shall be manufactured by Osram/Sylvania, Philips, General Electric or Venture. Lamps of other manufacturers may be installed only after written approval is obtained from the Architect/Engineer. Failure to obtain written approval will result in the rejection of all installed lamps, and will require the installation of the lamps specified herein, at no expense to the Owner.
3. Provide T8 fluorescent lamps that have full rated life when operating on Instant Start, Rapid Start or Programmed Rapid Start electronic ballasts. Provide lamps with a minimum average rated life of 20,000 hours, a minimum color rendering index of 85, minimum initial lumen output of 2150 (for F25T8 lamps) and a correlated color temperature of 4,100 degrees Kelvin, or as noted on the drawings. Provide low mercury type lamps that are designed and manufactured to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste.
4. Provide T5 and T5HO fluorescent lamps with a minimum average rated life of 20,000 hours, a minimum color rendering index of 82, minimum initial lumen output of 2,900 (for F28T5 lamps), minimum initial lumen output of 5,000 (for F54T5HO lamps), and a correlated color temperature of 4,100 degrees Kelvin, or as noted on the drawings.
5. Provide 4-pin, T4, triple tube compact fluorescent lamps with a minimum efficacy of 75 lumens per watt, a minimum average rated life of 10,000 hours, a minimum color rendering index of 82, and a correlated color temperature of 4,100 degrees Kelvin, or as noted on the drawings. Provide low mercury type lamps that are designed and manufactured to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste.
6. Provide 4-pin, T4, quad tube compact fluorescent lamps with a minimum average rated life of 10,000 hours, a minimum color rendering index of 82, and a correlated color temperature of 4,100 degrees Kelvin, or as noted on the drawings. Provide low mercury type lamps that are designed and manufactured to pass the Federal Toxic Characteristic Leaching Procedure (TCLP) criteria for classification as non-hazardous waste.
7. Provide 4-pin, TT5, long compact fluorescent lamps that have full rated life when operating on Instant Start or Rapid Start electronic ballasts. Provide lamps with a minimum average rated life of 20,000 hours, a minimum color rendering index of 82, minimum initial lumen output of 3150 (for FT40 lamps) and a correlated color temperature of 4,100 degrees Kelvin, or as noted on the drawings.
   1. EMERGENCY LIGHTING UNITS

### UNL preference is ‘AC Only’ type emergency lighting units where generator power is available and circuits exist for emergency lighting backup power. In these cases, generator transfer devices will be expected in the design and circuited as required. Otherwise, emergency lighting units with integral batteries shall be provided as described in the paragraphs below.

### General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

#### Battery: Sealed, maintenance-free, nickel-cadmium type.

#### Charger: Fully automatic, solid-state type with sealed transfer relay.

#### Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. System automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relays disconnects lights from battery, and battery is automatically recharged and floated on charger.

#### Test Push Button: Push-to-test type, integral to unit housing that simulates loss of normal power and demonstrates unit operability.

#### LED Indicator light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

#### Wire Guard: For heavy abuse or vandal resistance areas, heavy-chrome plated wire guard protects light fixture heads.

* 1. EXIT SIGNS

### UNL preference is ‘AC Only’ type exit signs where generator power is available and circuits exist for emergency lighting backup power. In these cases, generator transfer devices will be expected in the design and circuited as required or exit signs circuited for ‘24/7’ operation. Otherwise, exit signs with integral batteries shall be provided as described in the paragraphs below.

### General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

### Internally Lighted Signs:

#### Lamps for AC Operation: LEDs, 50,000 hour minimum rated life.

#### Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

#### Battery: Sealed, maintenance-free, nickel-cadmium type. AC Only style signs where connected to an emergency generator circuit.

#### Test Push Button: Push-to-test type, integral to unit housing that simulates loss of normal power and demonstrates unit operability.

#### LED Indicator light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

#### Wire Guard: For heavy abuse or vandal resistance areas, heavy-chrome plated wire guard protects light fixture heads.

* 1. PLASTER FRAMES
     1. Standard plaster frames shall be provided for all recessed lighting fixtures installed in plaster or drywall finished walls or ceilings. Coordinate with architectural drawings.
  2. THERMAL PROTECTION
     1. All recessed light fixtures shall be provided with thermal protection per N.E.C requirements.

# EXECUTION

3.1 INSTALLATION

* 1. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of the NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
  2. Coordinate with other electrical work as appropriate to properly interface installation of lighting fixtures with other work.
  3. Adjust and Clean: Clean lighting fixtures of dirt and debris upon completion of the installation. Protect installed fixtures from damage during the remainder of the construction period.
  4. Field Quality Control: Upon completion of the installation of lighting fixtures, and after building circuits have been energized, apply electrical energy to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

* 1. Many lighting designs call for multi-level lighting in some rooms. Where three lamps fixtures are shown in a room, the outer two lamps will be switched from one switch and the center lamp will be switched from the other switch. Where four lamp fixtures are shown in a room, the outer two lamps will be switched from one switch and the center two lamps will be switched from the other switch. A similar multi-level lighting arrangement will be provided where four and three way switches are shown. Two ballasts must be used when dual level switching is shown.
  2. Surface Mounted Fluorescent Fixtures: Where fixtures are indicated for installation on low-density cellulose fiberboard (see room finish schedule on drawings), provide 1-1/2 inch ceiling spacers, unless UL approved for mounting directly to the ceiling material.
  3. Lighting fixture supports: Properly support and install fixtures in strict accordance with all applicable building codes and standards. Fully and completely coordinate the installation of fixtures with actual ceiling systems, and with all building trades. In general, provide fixture supports according to the following (unless applicable codes require more restrictive support details):
  4. All lighting fixtures installed in grid type suspended ceiling systems, shall be positively attached to the ceiling system with clips that are UL listed for the application. This includes all rectangular troffer fixtures and downlights. For troffer fixtures, provide two (2) No. 12 gauge hangers at opposite corners (“catty corner”) from each fixture housing to the building structure above (wires may be installed slack). Light fixtures that weigh more than 56 pounds shall be supported directly from the structure above by UL listed and approved hangers. Downlights shall be installed with a minimum of one (1) No. 12 gauge hanger to the building structure above (wires may be installed slack). Light fixtures that are smaller than the ceiling grid shall be installed at locations indicated on the reflected ceiling plans, or shall be installed in the center of the ceiling panel and shall be supported independently by at least two metal channels that span and are secured to the ceiling system.
  5. Suspended lighting fixtures shall be supported directly from the building structure without using suspended ceilings as support systems. Support systems shall be UL listed and approved for the specific installation. Where pendants or rods exceed 48 inches in length, brace support systems to limit swinging.
  6. Square and rectangular fixtures shall be mounted with sides parallel to building and ceiling lines, unless otherwise noted.
  7. Where special fixtures to be used in special ceilings are scheduled, verify all ceiling system details and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling system supplier in the preparation of ceiling system shop drawings.
  8. Install fluorescent and LED fixtures as recommended by the manufacturer, or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures suspended in continuous rows.

END OF SECTION 265100