

SECTION 900 -- ELECTRICAL

A. GENERAL

1. Every Specification Section is required to include in Part 2 (as the first item), “SUBSTITUTIONS: Materials shall be as specified...” (refer to “SECTION 100 -- GENERAL” for the entire statement).
2. Make sure all specification sections are coordinated with the Bureau’s General Conditions, Document 000708.
3. Penetration Firestopping: Provide penetration firestopping in fire-resistance-rated walls, horizontal assemblies, and smoke barriers in accordance with building and fire code requirements. Firestop systems will be UL Classified to ASTM E814 (UL 1479). Submittals are required, including for product data, product schedule, qualification data, and product test reports (with locations).
 - a. Projects with Architect: Firestopping specifications are required in Division 7. Include requirement for firestopping in fire sprinkler, plumbing, hvac, electrical, and communications specification sections with reference to the firestopping specification located in Division 7.
 - b. Projects with Engineer (and no Architect): For fire sprinkler, plumbing, hvac, electrical, and communication projects where there is no Architect involved in the project, firestopping specifications are required and may be located in and are required to be coordinated with all corresponding specification sections.

B. ELECTRICAL DESIGN GUIDE AND STANDARDS

1. General:
 - a. This section of the design standard outlines general requirements for electrical and telecommunications designs to be performed for the State of New Hampshire, Bureau of Public Works, Design and Construction (the Bureau). This standard is intended to provide useful information to the design firm to establish a baseline of design. The responsibility of the engineer is to apply the principles of this section and to achieve a level of quality and consistency in the design and the construction of State facilities.
 - b. This standard is tailored to design of prototypical office facilities. The design shall consist of detailed specifications, as well as detailed drawings that reflect project specific requirements.
 - c. Renovation projects with increased electrical load require electrical engineer verification for overall panel/service capacity.
2. Codes And Standards: Use of the following Codes and Standards as a baseline for programming and should not be considered as a complete requirement.
 - a. New Hampshire State Building Codes.
 - b. New Hampshire State Fire Codes.
 - c. NEC National Electrical Code.
 - d. IESNA Illumination Engineering Society (of North America).
 - e. New Hampshire Energy Code (IECC).
 - f. NH State Accessibility Codes.
 - g. EIA/TIA 568, 569, 607 - Telecommunications Standards.
 - h. Local City and Town construction standards and ordinances.
3. Design/Drawing Requirements: In addition to the specific requirements of the sections of the standard that follow, use the following as baseline programming guidelines. A typical Division 26

designed project shall include, but not be limited to the design and specifications for the following guidelines.

- a. Electrical and Telecommunications Ductbank Design up to the building electrical and telecommunications service entrance.
 - b. Main Electrical Service Entrance Equipment.
 - c. Building Electrical Distribution Design.
 - d. Emergency Power Systems.
 - e. Special Systems Design: Include Fire Alarm, Access and Security Systems. These systems need to be carefully coordinated with the Bureau's Contract Administrator and Using Agency for how they are to be bid and what systems are acceptable.
4. Electrical Standards:
- a. Energy conservation should be a primary objective. Comply with the New Hampshire Energy Code as mandated.
 - b. Wiring Method for all systems shall be in conduit or metal raceway. MC Cable may be allowed. However, pre-approval is required from the Bureau. Where MC cable is approved for use, all homeruns shall be in conduit.
 - c. Conductors shall be copper unless pre-approval is obtained from the Bureau to use aluminum conductors. This includes service entrance cabling.
 - d. Voltage drop calculations are required to be performed for all feeders and branch circuits and the wire sized accordingly.
 - e. Fault current calculations are required before selecting electrical equipment.
 - f. Coordination studies shall be performed on all buildings where in the judgment of the consultant, the safety of the occupants would require that breakers and fuses be selectively coordinated.
 - g. All electrical equipment shall be listed for its use.
 - h. Panelboards shall be dead front with bolt-on thermal magnetic circuit breakers with copper busses. Panelboard trims shall have front hinged to box.
 - i. All devices shall be specification grade, as a minimum, with heavy-duty industrial grade to be considered.
 - j. All outlet boxes, device boxes and supports shall be steel or cast aluminum.
 - k. Grounding systems in all cases shall include the main water service, grounding electrodes, building steel and concrete encased electrode (in new construction). A separate equipment grounding conductor shall be pulled in all feeder and branch circuit conduits. Provide a comprehensive diagram of the grounding system for both new and existing electrical systems.
 - l. All ballasts (for maintenance purposes) shall be individually fused.
 - m. Meet seismic restraint requirements for electrical equipment and conduit in accordance with the requirements of the New Hampshire State Building Code. Refer to *Design Guidelines* "Section 100 -- General" paragraph pertaining to seismic requirements.
 - n. Adequate space shall be provided around electrical equipment.
 - o. Telecommunications Systems Design: Refer to *Design Guidelines* "Section 1000 -- Communications." Voice, Data and Communications wiring should typically be installed in conduit.
 - p. All Fire Alarm Equipment and Manufacturers shall be pre-approved by the Bureau. Fire alarm wiring should typically be installed in conduit.
 - q. Coordinate fire-alarm monitoring company requirements with the Contract Administrator and Using Agency and specify one-year monitoring period following Substantial Completion.
 - r. Power Quality and PC's: The following guidelines shall be used when addressing this issue. Any considered deviation from this shall be addressed with the Bureau's Electrical Engineer.

- 1) TVSS Devices: If the design engineer feels that such device are warranted, they shall be installed as close to the supply transformer. One TVSS at the supply point will generally suffice for a facility.
- 2) Dedicated Computer Circuit Panels (no motors): Where known computer connections are part of a project, the design engineer shall provide for dedicated computer panels.
- 3) Convenience outlets for offices, which may be used for desktop computers, are limited to four desktop computers per circuit.
- 4) Consider using K-rated transformers and panelboards with 200% neutrals.
- s. Systems Furniture: Many office spaces are currently being designed utilizing a Systems Furniture approach. The following guidelines should be utilized when designing for such systems.
 - 1) Thorough coordination between the electrical designer, architect, and the interior designer is critical during the design process. If proper coordination has not occurred during the design process, field interface problems could be very costly.
 - 2) Systems Furniture is prewired to a wiring harness. The standard harness configuration is a 3 circuit, 8-wire (3 circuit conductors, 3 neutral conductors and 2 equipment grounding conductors). Typically, an 8-wire harness is adequate for up to 12 cubicles. Care needs to be taken to allow proper circuiting for actual layout and electrical loads involved. Connect each circuit to a different phase and balance loads between phases.
 - 3) A single circuit should serve no more than three computer stations.
 - 4) Provide a junction box detail showing the interface between the Systems Furniture harness and branch circuit wiring. Specify that a licensed electrician make the final connections.
 - 5) Consider using K-rated transformers and panelboards with 200% neutrals.
5. Design Considerations:
 - a. Energy conservation should be a primary objective.
 - b. Voice and Data systems shall be furnished and installed as part of any new or renovation of State owned buildings. The design shall be based on EIA/TIA commercial building standards. The design shall consist of detailed specifications, as well as detailed drawings that reflect specific project requirements. Refer to *Design Guidelines* "Section 1000 -- Communications."
 - c. It is the responsibility of the architectural and engineering team to prepare reflected ceiling drawings that accurately locate ceiling panels, lighting fixtures, A/C supply and return grilles, automatic sprinkler heads, fire alarm system devices, access doors, cctv, security and any other ceiling located devices.
 - d. Require the Contractor to coordinate submittals and the purchase and installation of HVAC and electrical equipment with the Using Agency and Contract Administrator and with the mechanical and electrical subcontractors.
6. Drawings: Refer to *Design Guidelines* "Section 100 -- General" paragraph pertaining to drawings.
 - a. Drawings shall have the appropriate schedules and risers as required for a complete design.
7. Specifications: Refer to *Design Guidelines* "Section 100 -- General" paragraphs pertaining to specifications and substitutions.
 - a. Provide an electrical system testing specification, describing tests to be performed, acceptance criteria, and provide timely notice to the owner to witness testing, and furnish test results to the owner.

C. LIGHTING DESIGN GUIDE AND STANDARDS

1. General:
 - a. This section of the design standard outlines general requirements for lighting designs to be performed for the Bureau. This standard is intended to provide useful information to the design firm to establish a baseline of design. The responsibility of the engineer is to apply the principles of this section and to achieve a level of quality and consistency in the design and the construction of State facilities.
 - b. This standard is tailored to design of prototypical office facilities. The design shall consist of detailed specifications, as well as detailed drawings that reflect project specific requirements.
2. Codes And Standards:
 - a. The lighting design and luminaire selection shall meet applicable ANSI Standards. All Luminaries shall be UL listed for the application. The overall design shall be in accordance with the State of New Hampshire Energy Code (IECC, ASHRAE 90.1).
 - b. Lighting levels shall be in accordance with the guidelines outlined in the Illuminating Engineering Society of North America (IESNA) *IES Lighting Handbook*. Light levels shall be closely coordinated with the Bureau.
 - c. Lighting calculations shall be performed to verify that the light levels meet the requirements indicated in 2.b above. The professional is responsible for coordinating with the Architect and any required field investigation to develop parameters required for the calculations.
 - d. Energy conservation should be a primary objective. The professional is responsible for investigating and designing an energy efficient system. This includes the ballast, lamps and overall system performance (i.e. electronic ballast/T-8) lamps.
 - e. The use of incandescent lighting is discouraged and shall only be used with prior approval.
 - f. The Professional Engineer in coordination with the Bureau shall design all central lighting control systems, including daylight sensors and dimming systems.
 - g. Light levels shall be closely coordinated with the Bureau and Using Agency.
 - h. Consider lower general light levels with task lighting in areas where people are working at computer stations.
 - i. Selection of luminaires and lamp type shall minimize the different lamp types utilized and required to be stocked by maintenance.
3. Controls:
 - a. Each area enclosed by ceiling height partitions shall have at least one accessible lighting control to independently control lighting within the area.
 - b. All enclosed areas larger than 500 square feet shall have an accessible lighting control so that general lighting may be reduced by at least one half throughout the area.
 - c. The total number of accessible lighting controls within an enclosed area shall not be less than one for each 500 square feet, exceptions being made on case by case basis for large spaces used as a whole, spaces served by automatic or programmable lighting controls, and controls for security or safety.
 - d. The use of occupancy sensors shall be investigated for all offices, restrooms, conference rooms, and other areas of intermittent use.
 - e. For normal lighting in common, un-occupied, and corridor areas, the goal is minimum of 30 percent of building lighting load.
 - f. Selection of luminaires and lamp types shall minimize the different lamp types utilized and required to be stocked by maintenance.

4. Lighting Design:
 - a. Sufficient area lighting shall be provided for safe pedestrian transit under all conditions.
 - b. Mercury vapor lamps shall not be used. LED, Metal halide and high-pressure sodium lamps shall be considered.
 - c. Provide control with local over-ride for all exterior lighting except Code required egress lighting. Photocells may be used for architectural accent lighting only (not for transit lighting).
 - d. Dimming lighting control systems for exterior lighting is prohibited.
 - e. Mounting heights of pole and exterior building luminaires should be limited to 36 feet above accessible grade for re-lamping purposes.
 - f. All outdoor site fixtures shall be “dark sky compliant.” Refer to New Hampshire Outdoor Lighting Efficiency and Dark Sky Policy, RSA 9-E: <http://nhrsa.org/law/chapter/9-e/>.

D. ELECTRICAL REVIEW CHECKLIST

1. Refer to “APPENDIX A -- ELECTRICAL REVIEW CHECKLIST” (for reference).