

260513-H: SUPPLEMENTAL MEDIUM, LOW AND CONTROL VOLTAGE CABLES

Related Sections

Basis Guideline: [260513](#) – “Medium, Low and Control Voltage Cables”

[260800-H](#) – “Supplemental Electrical Acceptance Test”

[260553-H](#) – “Supplemental Electrical Equipment Identification”

For an explanation of the use of these guidelines, see “[Design Guidelines for UMHHC Facilities](#)”

Conductors

1. All cables shall be copper, except those listed immediately below. Those listed below may be aluminum as allowed by code, and installed in strict accordance with cable manufacturer and termination manufacturer instructions; and these guidelines:
 - a. Normal Power, Medium voltage cables, not directly connecting to the University (UPE) medium voltage distribution system, or a medium voltage service from the local utility (DTE). In other words, medium voltage distribution ‘within the service point’ of the building.
 - b. Normal Power, 600-volt class feeders from substations or from 600-volt service point panels, out to the first ‘loads’. Such ‘first loads’ would typically be distribution panels, Motor Control Centers (MCC) and other like larger loads. These feeders shall use two-hole compression fittings selected and installed to exactly match the conductor sizes and types being terminated.
 - c. Normal Power Feeders from distribution panels to lighting, receptacle power, and like panels 100-amperes and larger.
2. Medium Voltage Cables
 - a. The size of conductors used for interior distribution of medium voltage power shall be sized for the application, and need not necessarily adhere to 350-MCM size noted in the campus (UPE) guideline.
 - b. Larger or smaller sizes, appropriate for the load being served, may be selected
3. Low Voltage (600-volt class) Power Wires and Cables
 - a. All conductors related to the powering of X-ray systems are to be stranded type THHN, unless otherwise noted, or required by system manufacturers.
 - b. The wiring of the branch circuit wiring from the Isolated Power Systems (IPS) located in Operating Rooms, Invasive Procedure Rooms, and like areas shall have dielectric constant of 3.5 or less, type XHHW-2 meets this need and is the one recommended by the IPS manufacturers.
 - c. Use HFC MCHC and ACHC type wiring listed and labeled for Health Care applications is allowed in both patient care and non-patient care areas but only as allowed:
 - i. For ‘in-wall’ wiring as allowed in 260533-H (16050-H).
 - ii. In non-patient areas above the ceiling using J-Hooks
 - iii. In off site buildings these cables may be used within rooms and in corridors, above dropped ceiling areas only using J-Hooks. When the number of these cables exceed 10 (**Please comment on this number**), use basket trays, and install only a single layer of cables in that tray
 - d. In facilities where non-metallic [Type NM Series (Romex)] cables are already installed, and the area is being renovated, the Type NM may be extended only under the following conditions:
 - i. The building is of Type I construction – ‘fire resistive’ as defined by NFPA 220.
 - ii. The building is of Type II construction – ‘non-combustible’ as defined by NFPA 220.
 - iii. The function of the space is not patient care.

Splices

1. No splices in any conductor are to be made inside the raceway. Splices are to only be made in approved junction boxes, pull boxes, or manholes/handholds.
2. Heat Shrink insulating splicing kits suitable for submersible applications shall be used in wet locations.
3. Wire and cable larger are to be joined or terminated with (a compression type connectors or lugs.
4. Connectors for splicing branch circuit wiring (smaller than #8), lighting wiring, and control and instrumentation wiring shall be of the solderless wire nut type.
5. Lugs for terminating control and instrumentation wiring shall be of the solderless compression ring or spade type.
6. Exam lighting for Operating Rooms shall use type XHHW-2 wire and crimp type splices.
7. Compression connectors and lugs shall be crimped compressed with tools specifically designed for the termination's and wire size being crimped.

Tapping

All splicing or taps in Type THHN, or XHHW-2 conductors #8 and larger are to be insulated with two half-lapped layers of Minnesota Mining #33 electrical tape if uninsulated connectors are used.

Grounding

1. Any conductor intended solely for equipment grounding purposes is to be solid green or green stripe in color, unless bare is allowed for specific applications, in the grounding section of these guidelines. Power conductors having green covering are only to be used to indicate ground.
2. Each box and device is to be individually grounded.

Neutrals

1. Power conductors having white or gray covering are to only indicate neutral (grounded) conductors.
2. Receptacle Branch circuits shall each have a separate neutral conductor: Do not share neutrals except as noted below. The dedicated neutral prevents service disruptions on other circuits, when maintenance needs to be performed on the neutral of another circuit.
 - a. Where NEC requires it, derate current carrying rating of all the conductors in the raceway (or install additional raceway) -to reflect the neutral being a current carrying conductor.
 - b. Raceways and wiring to lighting switches shall either have a neutral installed as now required by NEC 404.2c, or raceways paths for future installation of the neutral. University will accept the NEC exception of not installing the neutral if it can be easily added later when needed.
 - c. In offsite facilities, the sharing of neutrals may be allowed in areas as approved by the UMHS Electrical Engineer. When allowed, these areas will, however, be limited to general use areas like waiting rooms, locker rooms, corridors, storage rooms, and other areas that are neither patient care or staff work areas
3. Low voltage three phase feeders, serving loads that contain a high percentage of non-linear (harmonic current loads) shall have neutrals sized at 150% whenever possible.

Installation Requirements

1. Cable lubricant shall be used when pulling power distribution larger feeder cables. Cables shall be pulled carefully to avoid exceeding the maximum pulling tension, maximum sidewall pressure or minimum bend radius. Do not, however, use pulling lubricants on X-ray systems or operating room isolated power system wiring.
2. For cables number #1 AWG and smaller, install cables by hand.

3. For cables larger than number 1 AWG, power pulling winches with cable tension monitoring equipment may be used.
4. Ensure cable pulling crew have all calculations and cable pulling limitations while pulling cables. The Engineer may require replacing the cable if cable pulling tension exceeds 75% of maximum recommended levels as published by the cable manufacturer.
5. Home runs of 20 amps, 120-volt branch circuits that exceed 150 feet in length shall be No. 10 AWG.
6. Normally the shields of shielded instrumentation and control cables shall have their drain wires grounded at one end only. The shields at the other end shall be insulated from ground. This may not be appropriate unless we add a 50-volt class cable section
7. Identification tags shall be installed on all cables and conductors terminated in panels.
8. Wire is not to be installed, until all other work that may cause injury to the wiring, including pouring of concrete, is complete.
9. Color coding for wiring systems is to be in accordance with Section 260553-H – “Electrical Equipment Identification”.
10. All conductors (phase and neutral) in a panel are to be identified with numbered tabs.
11. Balance the load on 3 phase panels to within 25% (or less). Require contractors to rework circuits and panel directories, whenever imbalance is greater than 25% under normal conditions. When re-balancing is required wire color change identifications of phase shall be done.

Field Quality Control

The contractor shall perform testing in accordance with Section 260800-H, and shall submit a test report.

Prefabricated Wiring for Lighting Fixtures

Pre-fabricated, UL listed, wiring assemblies intended for wiring lighting fixtures, above dropped (accessible) ceilings, are an exception to the above guidelines for wiring of lighting fixtures. These assemblies shall be installed so that any excess cable length is neatly coiled and tied to ceiling drop wires. Wiring to the switches themselves, and homeruns to panels, shall be standard pipe and wire and in full accordance with the main body of this section of the guidelines.