MEDIUM, LOW AND CONTROL VOLTAGE CABLES

Related Sections

U-M Design Guideline Sections:
260800 - Electrical Acceptance Tests

Products

Medium Voltage Primary Cables

Primary power distribution cable shall be single conductor stranded copper, with ethylene propylene rubber (EPR) insulation rated 15kV, 90 degrees C, 133 percent insulation level, having a 5 mil thick minimum tape shield with 12-1/2 percent minimum overlap, and polyvinyl chloride (PVC) jacket. Cable shall be suitable for use on a 13.2 kV, 3 phase, 3 wire, ungrounded system. Cable shall be suitable for use in cable trays.

Medium voltage service cables of voltages other than 13.2-kV (2.4kV, 4.8-kV) shall be of the type noted immediately above. The cable and terminations will be provided, and installed, to allow possible, future, conversion of the service to 13.2-kV.

Medium voltage cables serving loads directly at voltages below 13.2-kV (2.4-kV, 4.16-kV. 4.8-kV) shall be single conductor stranded copper, with ethylene propylene rubber (EPR) insulation rated 5kV, 90 degrees C, 133 percent insulation level, and polyvinyl chloride (PVC) jacket. Cable shall be suitable for use on a 5 kV, 3 phase, 3 wire, ungrounded system. Cable shall be suitable for use in cable trays.

Wires and Cables (600 Volts and Below)

Power distribution and lighting wire for indoor use shall be single conductor stranded copper, No. 12 AWG minimum, with NEC Type THHN, or THHN/THWN-2 insulation rated 90 degrees C, 600 volts.

Power distribution and lighting wire for outdoor use, for use in parking structures and tunnels, and for underground use in conduits shall be single conductor stranded copper, No. 12 AWG minimum, with NEC Type XHHW insulation rated 90 degrees C in dry locations and 75 degrees C in wet locations, 600 volts.

Insulated power cable for use as fire pump supply cables shall be able to pass the two hour fire rated test under UL 2196 test (and shall be so labeled), be NEC Type MI rated 600-volts ,and shall be one of the following types:

1. Mineral insulated, single conductor, solid copper conductor, using compressed magnesium oxide insulation, and shall have a liquid and gas tight seamless copper sheath. The cable is NEC Type MI. This cable is Factory Mutual (FM) approved, and

may be used without need for a 'clearance from FM... Install and support as required by manufacturer and Code.

2. Ceramfied silicone insulated (Lifeline), single conductor, stranded copper conductor, cermafied silicone rubber insulated. The cable to be NEC Type RHH. This cable is not FM approved. FM must review each application before giving an approval for that project. Install cable in EMT, and install and support as required by manufacturer and Code

Control wire shall be single conductor stranded copper, No. 14 AWG minimum, with NEC Type THHN, or THHN/THWN-2 insulation rated 90 degrees C, 600 volts.

Instrumentation and special systems wire shall be in accordance with manufacturer's recommendations, but shall not be less than No. 20 AWG.

Execution

Medium Voltage Primary Cables

Cables shall be pulled in lengths not exceeding 500 feet.

Cables shall be pulled using generous amounts of compatible cable pulling lubricant.

AE shall make calculations to insure maximum cable pulling tensions, sidewall pressures and cable bend radii do not exceed manufacturer's instructions.

Cables passing through manholes shall be trained neatly in the same relative position as in the duct bank, without crossing each other, and shall be supported by porcelain or fiberglass insulators attached to manhole cable racks.

Cables shall be identified by numbered tags. Identification numbers and tagging requirements shall be coordinated with the Plant Electric Shop through the Owner's Representative.

Wires and Cables (600 Volts and Below)

All wiring, including low voltage control, telecommunications, and power limited wiring shall be installed in raceways. (Raceways include conduits, ducts, trays, surface raceways, and wireways.) The only exceptions include:

1. NEC Type MI cable.

2. Control wiring at VAV boxes, serving sensors and actuators associated with that VAV box.

3. Type MC Cable serving light fixtures.

4. Type MC cable run in hollow wall cavities

5. Manufacture prepared wiring systems associated with lighting fixtures. An example of this would be, Lithonia 'RELOC'. Said systems shall have a corrugated metal cover.

Wiring of different voltage levels shall be segregated. Wiring of different voltage levels shall not share raceways (except wiring to rooftop receptacles, rooftop motor controls and motor disconnect early break auxiliary contacts may share raceways with motor feeders).

Six hundred (600)-volt power feeder wiring shall be spliced with solderless compression butt splices or ring lugs and terminated with solderless compression ring lugs.

Branch circuit wiring, lighting wiring, and control and instrumentation wiring shall be spliced with wire nut connectors.

Control and instrumentation wiring shall be terminated with solderless compression ring or spade lugs.

NEC Type MI cable shall be supported and protected in accordance with its manufacturer's instructions to maintain its UL fire resistive listing, and shall be spliced and terminated with special fittings from the same manufacturer as the cable.

Home runs of 20 amp branch circuits that exceed 150 feet in length shall be No. 10 AWG wire.

Home runs of 480 volt or 208 volt, 20 amp or 30 amp, single phase branch circuits that feed special receptacles shall be installed using 5 wires. Terminate the spare wires to ground at both ends.

Cables and wires terminated in panels shall be uniquely identified by permanent tags.

The shields of shielded instrumentation and control cables shall be grounded at one end only. The shields at the other end shall be insulated from ground.

Color Coding

All wiring shall be color coded, continuous color coded, or tape color coded at each termination and at each intervening 'box/point. 'If no color coding system exists, Campus circuits shall be color coded as follows:

1. Three Phase Power Over 600 Volts:
   - Phase X(A): Black
   - Phase Y(B): Red
   - Phase Z(C): Blue

2. Three Phase Power 480/277 Volts:
   - Phase X(A): Brown
   - Phase Y(B): Orange
   - Phase Z(C): Yellow
   - Neutral: Gray
   - Ground: Green

3. Three Phase Power 208/120 Volts:
   - Phase X(A): Black
   - Phase Y(B): Red
   - Phase Z(C): Blue
   - Neutral: White
   - Ground: Green

4. Single Phase Power 240/120 Volts:
   - Phase X(A): Black
   - Phase Y(B): Red
   - Neutral: White
   - Ground: Green

5. Fire Alarm Wiring (Being updated and expanded for easier identification):
   - Addressable Device: #18 Shielded Twisted Pair (STP) Red with Black Stripe
   - Horn, Horn/Strobe or ZAM Positive (+) 24 VDC: #14 Red
   - Horn, Horn/Strobe or ZAM Negative (-) 24 VDC: #14 Black
   - Speakers: #18 STP Solid Red
   - Strobe Light Positive (+): #14 Solid Yellow
   - Strobe Light Negative (-): #14 Solid Blue
   - Panel Communications: #18 STP Red with Black Stripe
   - Fireman's Telephone: #18 STP Red with Yellow Stripe

6. Synchronized Clock Wiring:
   - Line: Black
   - Neutral: White
   - Clock Correction: Red

7. Less Than 120 Volts: Use Industry Standard Methods

Site lighting wire insulation shall be in solid colors to match the circuit voltage and phase color code.

All UMHS owned facilities, unless noted otherwise, (University Hospital, THC, etc.) circuits shall be color coded as follows:

1. Three Phase Power Over 600 Volts:
   - Phase X(A): Black
   - Phase Y(B): Red
   - Phase Z(C): Blue

2. Three Phase Power 480/277 Volts:
   - Phase X(A): Red
   - Phase Y(B): Blue
   - Phase Z(C): Black
   - Neutral: Gray
   - Ground: Green

3. Three Phase Power 208/120 Volts:
   - Phase X(A): Yellow
   - Phase Y(B): Orange
   - Phase Z(C): Brown
   - Neutral: White
   - Ground: Green

4. Less Than 120 Volts: Use Industry Standard Methods