

**SECTION 260519.2 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**  
**FIRE-RATED WIRING SYSTEMS - MINERAL INSULATED (MI) CABLE**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mineral-insulated cable, Type MI.
2. Fire-alarm wire and cable.
3. Connectors and splices.

B. Related Requirements:

1. Division 01 Section "Construction Waste Management"
2. Division 01 Section "Sustainable Design Requirements - LEEDv4 BD+C" for additional LEED requirements
3. Section 260519 "Low-Voltage Electrical Power and Cables" for low voltage (600V or less).
4. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
5. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For each conductor and cable indicating lead content.
2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
3. Product Data: For solvents and adhesives, indicating VOC content.
4. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.

C. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Conform to requirements of Canadian Electrical Code, Part I.
2. Conform to requirements of the System Listing in the ULC Fire Resistance Director
3. Furnish products certified by CSA as suitable for the purpose specified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Cables shall be shipped from manufacturer with ends sealed against moisture.

B. Storage:

1. Protect exposed cable ends with shrinkable, molded polyolefin end caps or other suitable means such as hot-melt glue and/or heat-shrink tubing.
2. Store cable in clean, dry location.

C. Handling:

1. Uncoil cable by rolling or rotating supply reel.
2. Take precautions necessary to prevent damage to cable from contact with sharp objects, such as when pulled over foreign material on sheaves.

1.6 WARRANTY

A. Manufacturer's Warranty: Provide Owner a product warranty for fire-rated wiring products described below.

1. Contractor must complete insulation resistance testing prior to Commissioning and maintain records of test results.
2. Warranty Period for Wiring Cable: 30 years from date of Sale.
3. Warranty information must be published on manufacturer's website.

PART 2 - PRODUCTS

2.1 MINERAL-INSULATED CABLE, TYPE MI

A. Description: Solid copper conductors encased in compressed mineral oxide with an outer metallic sheath, rated 600 V or less.

B. Basis-of-Design Product: Subject to compliance with requirements, provide PYROTENAX, a brand of nVent; System 1850 MI cables or comparable product by one of the following:

1. Watlow Electric Manufacturing Company.
2. Or Equal Manufacturer.

C. Standards:

1. Listed and labeled as defined in NFPA 70/CSA 22 part 2, by a qualified testing agency, and marked for intended location and use.
2. UL 2196/ULC S139 for fire resistance.
3. Conductor and Cable Marking: Comply with wire and cable marking in accordance with UL's "Wire and Cable Marking and Application Guide."

D. Properties:

1. Inorganic composition. Polymeric insulation not allowed. Cables that generate toxic or combustible gases when heated shall not be permitted.
2. Insulation Voltage Rating: 600 volts.
3. Cable Temperature Rating: 482 deg F.
4. Termination Temperature Rating: 392 deg F.
5. Conduit not required.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper.

F. Insulation: Compressed magnesium oxide.

G. Sheath: Seamless soft-drawn copper.

H. Optional Jacketing: Low-smoke, zero-halogen polyolefin.

I. Components:

1. Mineral Insulated cable components shall be cCSAus Certified.
2. Splices, Field and Factory:
  - a. Basis of Design Product: PYROTENAX, a brand of nVent; field performed splices based on factory field FIFRS splice kits.
3. Terminations, Field and Factory:
  - a. Basis of Design Product: PYROTENAX, a brand of nVent; QuickTerm FQT terminations.

## 2.2 FIRE-ALARM WIRE AND CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide PYROTENAX, a brand of nVent; System 1850 MI cables or comparable product by one of the following:

1. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Genesis Cable Products; Honeywell International, Inc.

4. Superior Essex Inc.
5. West Penn Wire.

B. Properties:

1. Inorganic composition. Polymeric insulation is not allowed. Cables that generate toxic or combustible gases when heated shall not be permitted.
2. Insulation Voltage Rating: 300 volts.
3. Cable Temperature Rating: 482 deg F.
4. Termination Temperature Rating: 392 deg F.
5. No conduit required.

C. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760/CSA.

1. Lead Content: Less than 300 parts per million.

D. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG .

E. Non-Power-Limited Circuits: Solid-copper conductors with 300-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196/ULC-S139 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.

### 2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Basis-of-Design Product: Subject to compliance with requirements, provide PYROTENAX, a brand of nVent; splices and terminations or comparable product by one of the following:

1. ILSCO; Solid copper conductor compatible connectors.
2. Thomas & Betts Corporation; A Member of the ABB Group.

C. Splices, Field and Factory:

1. Basis of Design Product: PYROTENAX, a brand of nVent; [FRJ] [FIFRS] [STJ] splices.

D. Terminations, Field and Factory:

1. Basis of Design Product: PYROTENAX, a brand of nVent; QuickTerm FQT terminations.

E. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.

2. Type: Two hole with long barrels.
3. Termination: Compression.
4. Approved for use with solid copper conductors.

### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
  1. Copper; solid for No. 16 AWG and to 500 kcmil.
- B. Branch Circuits:
  1. Copper: Solid for No. 16 AWG and to 500 kcmil.
- C. Power-Limited Fire Alarm and Control: Solid for No. 8 AWG and smaller.

#### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Mineral-insulated, metal-sheathed cable, Type MI.
- B. Exposed Feeders: Mineral-insulated, metal-sheathed cable, Type MI.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Mineral-insulated, metal-sheathed cable, Type MI.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Jacketed Mineral-insulated, metal-sheathed cable, Type MI.
- E. Feeders Installed below Raised Flooring: Mineral-insulated, metal-sheathed cable, Type MI.
- F. Feeders in Cable Tray: Mineral-insulated, metal-sheathed cable, Type MI.
- G. Exposed Branch Circuits, Including in Crawlspace: Mineral-insulated, metal-sheathed cable, Type MI.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Mineral-insulated, metal-sheathed cable, Type MI.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Mineral-insulated, metal-sheathed cable, Type MI.
- J. Branch Circuits Installed below Raised Flooring: Mineral-insulated, metal-sheathed cable, Type MI.
- K. Branch Circuits in Cable Tray: Mineral-insulated, metal-sheathed cable, Type MI.

3.3 INSTALLATION, GENERAL

- A. Complete raceway installation between conductor and cable termination points in accordance with Section 260533 "Raceway and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. Use pulling means, including cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- D. Support cables in accordance with Section 260529 "Hangers and Supports for Electrical Systems."
- E. Complete cable tray systems installation in accordance with Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 INSTALLATION OF MINERAL INSULATED (MI) CABLE

- A. Examination:
  - 1. Examine surfaces and substrates to receive wiring cables for compliance with requirements for installation tolerances and other conditions affecting performance.
    - a. Prior to installation of wiring cable system, verify that all mounting structures are suitably fire rated.
    - b. Ensure surfaces in contact with wiring cables are free of burrs and sharp protrusions.
    - c. Ensure mounting structures are suitably spaced per installation manual.
    - d. Ensure system for pulling of cable into final locations is suitable per guidelines in installation manual.
- B. Preinstallation Testing:
  - 1. Prior to pulling wiring cable into place, an insulation resistance test shall be performed by installing contractor to ensure integrity of wiring cable as described in the installation manual.
  - 2. Proceed with installation only after any unsatisfactory conditions have been corrected.
- C. Preparation:
  - 1. Protect all wiring cable ends from moisture ingress until cable is terminated with end seals.
- D. Installation:
  - 1. In the field, all wiring cables shall be meggered with 500 V dc for MI 300 V and 600 V cables. The following field megger readings shall be taken on each cable:

- a. Wiring cable shall be meggered when received at Project site before installation.
- b. Wiring cable shall be meggered after sealing termination of the MI cable, prior to being attached to the gear, breaker, etc.
- c. Insulation resistance must exceed 200 megohms at 500 V dc.
- d. All results must meet manufacturer's specification.

### 3.5 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Examination:

1. Examine surfaces and substrates to receive wiring cables for compliance with requirements for installation tolerances and other conditions affecting performance.
  - a. Prior to installation of wiring cable system, verify that all mounting structures are suitably fire rated.
  - b. Ensure surfaces in contact with wiring cables are free of burrs and sharp protrusions.
  - c. Ensure mounting structures are suitably spaced per installation manual.
  - d. Ensure system for pulling of cable into final locations is suitable per guidelines in installation manual.

C. Preinstallation Testing:

1. Prior to pulling wiring cable into place, an insulation resistance test shall be performed by installing contractor to ensure integrity of wiring cable as described in the installation manual.
2. Proceed with installation only after any unsatisfactory conditions have been corrected.

D. Preparation:

1. Protect all wiring cable ends from moisture ingress until cable is terminated with end seals.

E. Installation:

1. In the field, all wiring cables shall be meggered with 500 V dc for MI 300 V and 600 V cables. The following field megger readings shall be taken on each cable:
  - a. Wiring cable shall be meggered when received at Project site before installation.
  - b. Wiring cable shall be meggered after sealing termination of the MI cable, prior to being attached to the gear, breaker, etc.
  - c. Insulation resistance must exceed 200 megohms at 500 V dc.
  - d. All results must meet manufacturer's specification.

F. Wiring Method: Install wiring in metal pathway in accordance with Section 270529 "Hangers and Supports for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.

2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.
    - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
  3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Type MI, is permitted.
  4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.
- G. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal in accordance with system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- H. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
- I. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
- 3.6 CONNECTIONS
- A. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values.
  - B. Use manufacturer's terminations and/or field splices.
  - C. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.
- 3.7 IDENTIFICATION
- A. Identify and color-code conductors and cables in accordance with Section 260553 "Identification for Electrical Systems."
  - B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.8 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. When required, install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.9 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly in accordance with Section 078413 "Penetration Firestopping."

3.10 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test all conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:
  - a. Inspect exposed sections of conductor and cable for physical damage and correct connection in accordance with the single-line diagram.
  - b. Test bolted connections for high resistance using one of the following:
    - 1) Low-resistance ohmmeter.
    - 2) Calibrated torque wrench.
  - c. Inspect for correct identification.
  - d. Inspect cable jacket and condition.
  - e. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V and 600 V cable for a one-minute duration.
  - f. Continuity test on each conductor and cable.
  - g. Uniform resistance of parallel conductors.

- B. Installation will be considered failed if it does not pass tests and inspections.

- C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519.2