

SECTION 16120 - WIRE AND CABLES

PART 1 - GENERAL

SUMMARY

Scope: Extent of electrical wire and cable by the requirements of this section and section 16521

Types: Types of electrical wire, cable, and connectors specified in this Section include the following:

- Copper conductors.
- Tap type connectors.
- Split-bolt connectors.

QUALITY ASSURANCE

American Society for Testing and Materials (ASTM): Comply with requirements of the following:

- B 1 Standard Specification for Hard-Drawn Copper Wire
- B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft

Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.

Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:

- 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors
- 241 Recommended Practice for Electrical Power Systems in Commercial Buildings

NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

UL: Provide material conforming to the following standards:

- 44 Rubber-Insulated Wires and Cables
- 83 Thermoplastic-Insulated Wires and Cables
- 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
- 854 Service-Entrance Cables

UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

SUBMITTALS

Product Data: Submit manufacturer's data on electrical wire, cables, conductors, connectors and connector crimping tools where specified.

DELIVERY, STORAGE, AND HANDLING

Delivery: Deliver wire and cable packaged in factory-sealed containers, or wound or NEMA wire and cable reels.

Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

COPPER WIRE

Conductors:

Provide wire rated 600 V minimum of the single conductor annealed copper type.

Insulation:

The insulation type for interior wiring shall be dual-rated THHN/THWN or XHHW.

CABLE

General: Provide UL listed cables of sizes, ampacity, temperature ratings and insulating materials suitable for the specified lighting.

CONNECTORS AND SPLICES

General: Provide UL listed metal connectors of sizes, ampacity, temperature ratings, materials, and classes required by NFPA 70 and NEMA standards for applications and services indicated.

Branch Circuits: For wires No. 10 AWG and smaller, provide solderless, insulated pressure cable type connectors, 600 V, of the compression or indent type or wire nut connectors. Temperature rating of connectors shall be at least equal to that of the wire on which they are used.

Copper Conductors: For No. 8 AWG and larger wire, provide socket head cap, hex screw, or bolt clamp type connectors, manufactured of high conductivity copper alloy or bronze castings. Select proper connector for each wire size. Cable sizes 250 kcmil and larger shall be retained in the connector by twin clamping elements.

INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

Tape: Provide plastic electrical insulating tape which is flame retardant, cold and weather resistant. Tape for use in areas subject to temperatures 30 degrees C. to 105 degrees C., or where the tape will be subjected to an oil splash, tape shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant vinyl backing with an oil-resistant acrylic adhesive.

Materials: Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature, and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.

Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

PART 3 - EXECUTION

INSTALLATION OF WIRES AND CABLES

General: Install electrical wires, cables and wiring connectors in compliance with applicable requirements of NFPA 70, NEMA, UL and National Electrical Contractors Association (NECA) "Standard of Installation".

Approval Process: The Contractor will prepare a layout plan to show connection for all lights, the location of a meter base and how the electrical system will be serviced. The plan must be approved before work begins on the electrical system.

Conduit: If noted, install all wiring in non-metallic conduit as indicated on the drawings or in the specifications, in conformance with NFPA 70.

Complete System: Provide wire, cables and connectors necessary for a complete installation from point of service connection to all receptacles, lighting fixtures, devices, utilization equipment and outlets for future extensions as indicated on the drawings, in schedules, and in the specification. Provide ample slack wire for connections.

Voltage Rating: Wire and cables for general wiring shall be rated for 600 volts minimum.

Shelf Life: Wire and Cable manufactured more than 12 months prior to date of delivery to the site shall not be used.

Bundling: Neatly train all conductors located in branch circuit panelboards.

Feeder Identification: Securely fasten nonferrous identifying tags or pressure sensitive labels to all cables, feeders, and power circuits in junction boxes, pull boxes and at termination of cables.

Tags or labels shall be stamped or printed to correspond with markings on drawings or marked so that feeder or cable may be readily identified.

If suspended type tags are provided, they shall be attached by approximately 55 pound test monofilament line or slip free plastic cable lacing units.

WIRE PULLING AND CABLE INSTALLATION

Equipment: Provide suitable installation equipment to prevent cutting and abrasion of conduits during the pulling of wires and cables.

Ropes used for pulling of conductors shall be made of polyethylene or other suitable nonmetallic material.

Metallic ropes shall not be used.

Pull conductors simultaneously where more than one is being installed in same raceway.

Use pulling compound or lubricant where necessary; compound shall not deteriorate conductor or insulation. Where polyethylene insulation is used and a pulling lubricant is required, the lubricant shall be certified by the manufacturer to be non-injurious to such insulation.

Lubricants shall conform to UL requirements applicable.

Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used.

Supports: Install cable supports for all vertical feeders in accordance with the applicable sections of the NFPA 70.

Splices: Keep conductor splices to a minimum. Splice wires and cables only in outlet boxes, junction boxes, pullboxes, manholes and handholes.

In the making of a splice, connectors shall be brought up securely upon the conductors such that all conductors are equally engaged, the insulation is not ruptured, no bare wires are exposed or have "backed off" due to the application of pressure and the connection will not loosen due to cycling or vibration, in order to insure an efficient splice.

The number, size and combinations of conductors permitted as listed on manufacturer's packaging of connector shall be strictly followed.

Connectors shall be fully insulated by a skirt, or taped to provide an insulation value at least equal to rating of wires being connected.

Connectors: Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values or comply with tightening torques specified in UL 486A and 486B.

Color Coding: Color code all secondary service, feeder and branch circuit conductors throughout the project secondary electrical system as follows:

<u>120/240 Volts</u>	<u>Phase</u>
Black	A
Red	B
White	Neutral
Green	Ground

The colors shall be factory-applied entire length of the conductors by one of the following methods except as noted and limited below:

Solid color compound.

Solid color coating.

Surface printing every 12 inches, maximum spacing of 18 inches.

All branch circuit conductors Nos. 12 AWG and 10 AWG shall be solid color compound or solid color coating.

All sizes of conductors used for neutrals and equipment grounds shall be solid compound or solid color coating white, gray, or green, respectively.

All phase conductors No. 8 AWG and larger color coded with pressure sensitive tape shall have a background color other than white or green.

Field applied color coding methods may be used in lieu of factory coded wire in sizes larger than No. 10 AWG.

Color pressure-sensitive plastic tape shall be applied in half overlapping turns for a distance of six inches on all terminal points and in all boxes in which splices or taps are made. The last two laps of tape shall be applied with no tension to prevent possible unwinding.

Tape shall be 3/4-inch wide and colors shall be as specified.

Cable identification markings shall not be obliterated by taping and tape locations may be adjusted slightly to prevent obliteration of cable marking.

FIELD QUALITY CONTROL

Tests: Feeders and branch circuit insulation shall be tested after installation, and before connection to fixtures and appliances.

Tests shall be performed with a 500-volt megger, and conductors shall test free from short-circuits and grounds.

Conductors shall be tested phase-to-phase and phase-to ground.

Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Landscape Architect.

Test readings shall be recorded and delivered.

Demonstration: Subsequent to wire and cable hookups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

PART 4 – MEASUREMENT AND PAYMENT

All wiring, conduits, connectors, panel box and all labor and equipment necessary to complete the work in its entirety will not be measured and paid. This work and product will be included in the price for other items.

END OF SECTION 16120