SECTION 16120

WIRE AND CABLE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes specific requirements, products, and methods of execution relating to wire and cable, 600 volts or less, approved for use at ANC.

1.2 QUALITY ASSURANCE

A. Conductors shall be sized according to American Wire Gauge (AWG). Stranding, insulation, rating and geometrical dimensions shall conform to UL and ICEA specifications.

PART 2 - PRODUCTS

2.1 INSULATION TYPES

A. Branch circuit conductors shall be 600 volt insulated, and shall have the following insulation types:

1. Heated indoor spaces - THHN/THWN or XHHW
2. Outdoors or other cold locations (such as unheated attics) - XHHW

B. Feeder conductors shall be 600 volt insulated, and shall have the following insulation types:

1. Heated indoor spaces - THHN/THWN or XHHW-2
2. Outdoors or other cold locations (such as unheated attics) – XHHW-2

C. Nylon-jacketed conductors such as Types THHN or THWN shall not be used in any location subject to ambient temperatures below 20 degrees F.

D. Special applications: Conductors in fluorescent fixture wiring channels shall have 90 degrees C insulation rating, Types THHN, XHHW, or equal. Conductors in high temperature locations shall have one of the special insulation types suitable for the use and as permitted by the NEC.

2.2 FLEXIBLE CORD

A. Flexible cord shall be Type SO or ST, or for the larger sizes, Type G.

2.3 MISCELLANEOUS

A. Miscellaneous: Miscellaneous wire and cable for special purpose applications and not covered in the categories as indicated above or otherwise specified, shall be as required by the intended use.

2.4 MINIMUM SIZES

A. Minimum wire sizes shall be as follows:

1. #12 AWG for branch circuit wiring.

2. #20 AWG for low voltage switching circuits if part of an approved cable assembly, #18 AWG otherwise.

3. #14 for control circuit wiring.

B. On 20A circuits, with one-way conductor lengths measured from panel to farthest receptacle, or center of lighting string (as applicable):

1. #10 AWG for 120V circuits of 75 feet to 120 feet.

2. #8 AWG for 120V circuits of 120 feet to 200 feet.

3. #10 AWG for 277V circuits of 130 feet to 215 feet.

4. #8 AWG for 277V circuits of 215 feet to 330 feet.

C. Similar oversizing shall apply to circuits of other ratings and/or greater lengths, as necessary to comply with the voltage drop limitations in Part 3 of this Section.

D. Cable or conductors for fire alarm systems and other special systems shall be as described in other sections of the specifications, or recommended by the equipment manufacturer, whichever is greater.

2.5 CONDUCTORS

A. Conductors shall be copper, solid or stranded for wiring #10 and smaller, stranded for #8 and larger.

B. Stranded control, communication, and alarm conductors shall have compression terminations where terminated on screw terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unless otherwise permitted by ANC, all conductors shall be run in raceways as specified in Section 16111. Raceways shall be installed as a complete system, free from obstructions, and clean before conductors are installed.

B. Provide conductors from outlet to outlet and splice branch circuit conductors only at outlet or junction boxes. Install all conductors in a single raceway at one time and leave sufficient cable at all fittings or boxes. Keep all conductors within the manufacturer's allowable tension. Do not violate minimum bending radii. Lubricants for wire pullings, if used, shall conform to UL requirements for the insulation and raceway material.

C. Do not install Type XHHW conductors in temperatures below minus 10 degrees F, or the other types in temperatures below plus 20 degrees F.

3.2 CONDUCTOR SUPPORT

A. Provide conductor supports as recommended by the NEC or cable manufacturer in vertical conduits.

3.3 SPLICING

A. No splicing or joints are permitted in branch circuits except at outlet or accessible junction boxes. Prior to splicing, all conductors shall be stripped to the exposed length recommended by the splicing device manufacturer.

B. Utilize compression type solderless connectors when making splices or taps in conductors No. 8 AWG or larger. Provide heat or cold shrink type insulating tubing on all splices and tape with Scotch #88 plastic tape to secure insulation strength equal to that of the conductors joined.

C. Utilize pre-insulated connectors, hard-shell type only, Ideal Industries, Inc., "Super Nut" or "Wing-Nut" for splices and taps in conductors No. 10 AWG and smaller in dry locations. In damp or wet locations Ideal “Twister DB Plus”, water repellent, sealant filled. UL 486D Listed connector.

D. Keep splices in underground junction boxes, handholes, and manholes to an absolute minimum. Where splices are necessary, use resin splicing kits manufactured by 3M Company to totally encapsulate the splice.

E. Feeder conductors shall be installed with no splices unless specifically approved otherwise by ANC. Splices in feeder conductors, where specifically allowed, shall be compression type butt splices.

3.4 CONDUCTOR TERMINATION

A. Provide all power and control conductors that terminate on equipment or terminal strips with solderless lugs or T & B "Sta-Kon" terminals.

B. Prior to termination, all conductors shall be stripped to the exposed length recommended by the termination device manufacturer.

3.5 CONDUCTOR PHASE COLOR CODING

A. All service, feeder and branch circuit conductors throughout the secondary electrical system shall be color coded as follows:

208/120 Volts	Phase	480/277 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray (see following)
Green	Ground	Green

1. Permanently post conductor color code at each panelboard in accordance with NEC Article 210-4(d).

2. Where color coded conductors are not commercially available, colored non-aging, plastic tape may be utilized where permitted by NEC.

B. Where neutrals of different systems exist on a project, neutral conductor identification method shall satisfy the Authority Having Jurisdiction, as to compliance with NEC 200-6(d).

C. Phases in panelboards and similar equipment shall be connected Phase A, B, C from left to right, top to bottom, or front to back.

3.6 DERATING OF CONDUCTORS

A. Derating of conductors shall be per National Electrical Code Article 310-15(b)(2).

3.7 VOLTAGE DROP

A. The maximum total voltage drop shall not exceed three (3) percent in branch circuits or feeders, for a total of five (5) percent to the farthest outlet based on steady state design load conditions. Base voltage-drop calculations on NEC Chapter 9, Table 9.

3.8 OPEN WIRING ABOVE LAY-IN CEILINGS PROHIBITED

A. Wiring for all systems shall be installed in raceway systems or cable tray systems.

B. Wiring installed in cable trays in air-handling ceiling spaces shall be approved for the application and the specific system.

C. Raceways and sleeves shall be sized in accordance with the cabling requirements for the special system involved.

3.9 TESTING

A. All feeder cables shall be megger tested prior to final termination in accordance with Section 16050.

END OF SECTION