SECTION 25 05 13

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes conductors and cables for signal transmission, communications, power, and other miscellaneous cables for DDC and Delta V systems.

B. Related Sections:
   1. 25 05 28 Pathways
   2. 25 05 53 Identification
   3. 25 06 11 Integrated Automation Definitions

1.2 REFERENCES

A. NEC 725 Class 1, Class 2, and Class 3 Remote Control, Signaling And Power-Limited Circuits

B. NEC 800 Communication Circuits

1.3 DEFINITIONS

A. Refer to 25 06 11 Integrated Automation Definitions

1.4 SYSTEM DESCRIPTION

A. Instrument input and output device wiring cables between instruments and cabinets or between cabinets 50 Volts and less.

B. Terminations of conductors and cables not specifically shown, but required for systems operation including, but not limited to:
   1. Signal cables
   2. Power cables
   3. Communications cables

1.5 SUBMITTALS

A. Product submittals.

B. Refer to 25 00 00 Integrated Automation

C. Submit exceptions to cabling requirements, along with documentation, prior to bid.

Note: Section specific submittal requirements should be defined here but not repeated from other sections.

1.6 QUALITY ASSURANCE

A. All work shall meet the requirements of the National Electrical Code.

B. All wiring shall be done in accordance with all local and national codes and authorities having jurisdiction.

C. Ground and Bond according to manufacturer’s recommendations. Refer to electrical specifications for additional grounding and bonding requirements.

D. Splicing communication and instrumentation cables is prohibited. Wire nuts may only be utilized for instrument termination and not in control panels.
E. Kinked cable is prohibited and must be replaced.

F. Cable jacket must extend into I/O device wiring cavity.

G. Ensure cable is free of tension at both ends. In cases where cable must bear stress, provide Kellom grips to spread stress over longer length of cable.

H. Adhere to the following minimum distances to reduce effects of EMI:
   1. Five (5) inches from power lines of 2kVA to 5kVA
   2. Eighteen (18) inches from 120V (or higher) lighting fixture(s).
   3. Thirty-nine (39) inches from power lines of 5kVA or greater
   4. Thirty-nine (39) inches from transformers and motors greater than 5kVA

I. Maintain separate pathways for signal wire and any wire carrying more than 50 VAC.

J. Separate cable from other building systems.

K. Install cables parallel and perpendicular to building walls. Coordinate space requirements with other trades.

L. Multi-pair cable run between the EMCS enclosure and Field Terminal panels shall be sized to provide an additional 25% spare conductor pairs.

M. Refer to Section 25 0553 for identification requirements.

Note: Section specific quality requirements should be defined here but not repeated from other sections.

PART 2 - PRODUCTS

2.1 FLOOR LEVEL COMMUNICATION CABLE

A. Cabling Requirements:
   1. Cable Type: Per protocol recommendation
   2. Jacket color: Lon - Orange, Bacnet - Blue, Modbus - Purple

2.2 INSTRUMENTATION SIGNAL CABLE

A. Single pair cable (Belden # 1033A, 6400 FE or equal) shall be used between instruments and field terminal panels or controller cabinets, Jacket color: White

B. Either four (4) pair, eight (8) pair, sixteen (16) pair, twenty-four (24) pair, or thirty-six (36) pair wire (Belden # 1056A, 1057A, 1059A, 1060A, 1061A or equal) shall be used between Delta V and field terminal panels.

C. Instrument cables routed through air plenums shall be U.L. / NEC listed, PL plenum rated, TEF jacketed, overall shielded 20 AWG stranded copper paired conductors with single 20 AWG stranded copper drain wire.

D. Instrument and output device wiring within cabinets 50 VDC and less: Wire shall be 18 AWG THHN stranded copper. For power use black wire insulation jacket for negative (-) wire and red for positive (+) wire. For signal, use black wire insulation jacket for negative (-) wire and white for positive (+) wire.

2.3 POWER WIRE (50 VOLTS OR LESS)

A. Cabling Requirements:
   1. Min Size: 18 AWG stranded
   2. Min Number of Conductors 2
   3. Jacket PVC or Plenum Rated
4. **Jacket Color**
   - Green for single circuit, if multiple circuited then green for 1st circuit, unused colors for remainder of circuits.
   - a. Indicate jacket colors and/or color deviations on wiring diagram submittals.

2.4 **POWER WIRE (GREATER THAN 50 VOLTS)**
   - A. Refer to Division 16 (future 26).

**PART 3 - EXECUTION**

3.1 **FLOOR LEVEL COMMUNICATION CABLE**
   - A. Install cable in approved pathways only. Refer to section 25 0528.
   - B. Maintain distance to eliminate equipment noise from VFD’s and other equipment producing EMI noise.
   - C. Provide shielding and grounding per applicable protocol’s recommendations and/or job site conditions.
   - D. Provide plenum rated cable where required.
   - E. Cable is to be labeled at each termination according to Section 25 0553.

3.2 **INSTRUMENTATION SIGNAL CABLE**
   - A. Provide signal cables that are appropriate for the associated instrumentation and are suitable for the respective pathways.
   - B. Install cable in approved pathways. Refer to 25 0528.
   - C. Provide appropriate shielding to eliminate equipment noise from VFD’s and other equipment producing EMI noise.
   - D. Terminate instrument cables at terminal blocks or terminal strips in cabinets.
   - E. For instruments connect to Delta V system, cable drain wires shall be grounded only at the Delta V cabinet. This termination is part of the University’s scope of work. If splicing into a multi-pair cable at a field terminal panel, all I/O cable drain wires must be jumpered together and with the drain wire of the multi-pair cable to which they are spliced.
   - F. For instruments connected to DDC controllers, shielding shall be grounded only at controller.
   - G. Provide plenum rated cable where required.
   - H. Cable is to be labeled at each termination according to Section 25 0553.

3.3 **POWER WIRE (50 VOLTS OR LESS)**
   - A. Unless otherwise specified or noted, provide final power connections including conduit, wire, and/or control panel disconnect switches to all control devices from appropriate electrical j-box.
   - B. Provide power cables for instrumentation and devices.
   - C. Install cable in approved pathways.
   - D. Cable is to be labeled at each termination according to Section 25 0553.

3.4 **POWER WIRE (GREATER THAN 50 VOLTS)**
   - A. Provide final power cables and connections for instrumentation and devices.
   - B. Provide plenum rated cable where required.
C. Install cable in approved pathways.
D. Provide a keyed disconnect at instrument or device, Leviton 1201-2L or equal.
E. Refer to section 26 0519 for additional requirements.
F. Cable is to be labeled at each termination according to Section 25 0553.

3.5 FIELD QUALITY CONTROL (TESTING)
A. Verify cable shield or coupled bonding conductor for end-to-end continuity.

END OF SECTION