

SECTION 28 05 13  
WIRE AND CABLE  
(Part of the Work for Section 260001)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the GENERAL REQUIREMENTS AND COVENANTS - DIVISION I, and the SPECIAL PROVISIONS - DIVISIONS IIA and IIB, which are hereby made a part of this Specification Section.
- B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the Work of this Section.

1.2 TRADE CONTRACT REQUIREMENTS

- A. Work of this Section is part of the Electrical Trade Contract. Refer to Section 26 00 00 "Electrical Trade Contract Requirements" for additional information about this Trade Contract.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUMMARY

- A. This section provides specifications for the installation of a wire and cable and related components.
- B. Provide labor, materials, inspections and supervision, necessary for a turnkey installation and operation of the equipment specified herein. Work includes providing items and accessories required or necessary for the correct operation of the equipment as shown on plans and/or specified herein exception of those items noted within this specification.
- C. The Security Subcontractor will provide wire and cable necessary to comply with the Contract Drawings. wire and cable components will be able to withstand the environment the wire or cable is installed in for a minimum of 20 years.
- D. Interconnecting cable carrying digital data will be not less than 18-22 AWG and will be copper wire for each conductor. The cable or each individual conductor within the cable will have a shield that provides 100 percent coverage. Cables with a single overall shield will have a tinned copper shield drain wire. Plenum or riser cables will be ANSI-C2 CL2P certified. Wiring will meet NFPA 70 standards.
- E. Wiring/cablings is to be protected from accidental and/or intentional tampering through the use of conduit and/or concealment. In areas where cabling is exposed and easily accessible, it must be placed into conduit or armor cable utilized.
- F. Wiring and cable will be plenum rated.
- G. Cable jackets for security devices, except for fiber, should be yellow in color.
- H. All conductors will be copper and will be in accordance with the Institute of Electrical and Electronic Engineers (IEEE) standards.
- I. Provide fiber optic media converters for site equipment, including intercoms, call for assistance stations and pole mounted cameras.
  - 1. Converters shall include transmitters, transmitter power supplies, receivers and receiver power supplies, receiver racks and NEMA 4X rated enclosures.

2. Converters shall be hardened and features high shock & vibration resistance, electrical noise immunity and wide operating temperature range
- J. Provide ethernet over coax converter for elevator cameras.
1. Provide ethernet over coax converters for IP cameras over coax.
  2. Converters shall provide PoE power.
  3. Shall be fully automatic with no configuration required
  4. Converters shall be hardened and features high shock & vibration resistance, electrical noise immunity and wide operating temperature range
  5. Converters shall include transmitters, transmitter power supplies, receivers and receiver power supplies and receiver racks or wall mount brackets.
- K. Cable will follow the following requirements:
1. All cable carrying voice or data will be shielded with the exception of category (CAT) cabling.
  2. For hardwired card readers doors, a composite cable that has individual cables bundled together in a single outer jacket will be acceptable.
  3. Wiring for card readers will be six conductor 22 AWG for signal and power.
  4. Wiring for electric locks will be two conductor 18 AWG.
  5. Wiring for request to exit devices will be four conductor 22 AWG.
  6. Wiring for door contacts will be four conductor 22 AWG.
  7. Wiring for pushbutton exit devices will be two conductor 18 AWG.
  8. Wiring for door release buttons will be four conductor 18 AWG.
  9. Wiring for duress buttons will be four conductor 22 AWG.
  10. Wiring for audible alarms will be four conductor 18 AWG.
  11. Wiring for glass break devices will be four conductor 22 AWG.
  12. Wiring for IP devices, including cameras and intercoms, will be CAT cabling.
- L. Section Includes:
1. UTP and F/UTP Cabling
  2. Fiber Optic Cable
- M. Related Sections:
1. Section 08 71 00 Door Hardware
  2. Division 21 Fire Suppression
  3. Division 26 Electrical
  4. Division 27 Communications
  5. Division 28 Electronic Safety and Security
- 1.5 ACTION SUBMITTALS
- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- 1.6 DESCRIPTION OF WORK

- A. General Requirements
  - 1. Provide labor, materials, tools, equipment, and services for a complete security system as indicated and in accordance with provisions of the contract documents.
  - 2. Although such work is not specifically indicated, provide and install supplementary or miscellaneous items, and devices incidental to or necessary for a sound, secure and complete installation.
  - 3. All system devices and components included will be compatible.
  - 4. Units of the same type of equipment will be products of a single manufacturer. material and equipment will be new and currently in production. Each major component of equipment will have the manufacturer's model and serial number in a conspicuous place.
- 1.7 DEFINITIONS
  - A. EMI: Electromagnetic interference
  - B. IDC: Insulation displacement connector
  - C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than D. 50V or for remote-control and signaling power limited circuits.
  - D. Open Cabling: Passing telecommunications cabling through open space
  - E. UTP: Unshielded twisted pair
  - F. STP: Shielded twisted pair
  - G. TIA/EIA: Telecommunication Industry Association/ Electronic Industries Association
  - H. SLC- Signaling Line Circuits
- 1.8 UTP Description: 100 ohm, 4 Pair UTP
  - A. Comply with TIA/EIA 568-B.1 for performance Specifications
  - B. Comply with TIA/EIA 568-B.2, Category 6
    - 1. Category 6A Shielded
      - a. CMP: 254246AF – HDBaseT Certified
      - b. CMR: 4246AF – HDBaseT Certified
- 1.9 UTP HARDWARE
  - A. General Requirements for cable connecting hardware: Comply with TIA/EIA 568-B.2, IDC Type, with modules designed for punch-down caps or tools. Cables will be terminated with connecting hardware of the same or higher category.
  - B. Data rate: 10Gb
  - C. Connecting Blocks: 110 Style IDC Category 6.
  - D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - E. Patch Panels: Modular panels housings multiple-numbered jack units with IDC type connectors at each jack for permanent termination of pair groups of installed cables.
  - F. Jacks: Modular, color coded, eight position modular receptacle units with IDC type terminals
  - G. Patch Cords: Factory made, four pair cables with varied lengths, terminated with eight position modular plugs at each end.

H. Patch cords meet Category 6 TIA/EIA specifications Color Coded for circuit identification

1.10 MULTIMODE FIBER

A. Installed cable will be 50/125micron core/cladding, enhanced grade, multimode, and graded index glass fiber OM3 or better. Materials in the cable will be dielectric.

1. Data Rate:
  - a. 10Gb minimum
2. Performance
  - a. Installed fiber must meet or exceed the following performance specifications.

Wavelength (nm)	Max. Attn.(dB/Km)	Min. Bandwidth (Mhz*Km)
850	3.0	200
1,300	0.9	500

1.11 SINGLE MODE FIBER

A. Installed cable will be OS2 9/125micron core/cladding, enhanced grade, single mode, and graded index glass fiber. Materials in the cable will be dielectric.

1. Data Rate:
  - a. 10Gb minimum
2. Performance
  - a. Installed fiber must meet or exceed the following performance specifications.

Wavelength (nm)	Max. Attn.(dB/Km)
1,310	1.0
1,550	0.4

1.12 COAXIAL CABLE

- A. Shall be RG59 coax cable
- B. Shall have a solid copper core
- C. Shall have an inner conductor and 95% copper braiding
- D. Shall have an impedance of 75 ohms

1.13 CABLE CONSTRUCTION

A. Installed cable must be manufactured to meet or exceed the following specifications:

1. Plenum Cable (Inside Cable)
  - a. Plenum rated cable will be used for interior installations. Installed cable will meet or exceed the following specifications:
    - i. Tight buffered 900 um, mechanical strippable Teflon (for plenum applications).
    - ii. EIA/TIA -598 color coding for fiber optic cable.

- iii. Aramid yarn strength member, capable of supporting a short-term tensile load of 400 lb. without strbhing.
- iv. Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
- v. Capable of a minimum crush resistance of 850 lb./in.

2. Outside Plant Cable

- a. Outside plant cable will be used for applications where cable is to be run in underground conduits. Outside plant cable may not be used for interior applications and will meet the following specifications:
  - i. Gel filled buffer tube, 250 um, acrylate.
  - ii. EIA/TIA-598 color coding for fiber optic cable.
  - iii. Flooded core
  - iv. Capable of bend radii as small as 20 x outside cable diameter (under installation load) and 10 x outside cable diameter (long term load).
  - v. Capable of a minimum crush resistance of 850 lb./in.

1.14 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 years experience installing similar equipment.
- B. Units of the same type of equipment will be products of a single manufacturer. Material and equipment will be new and currently in production. Each major component of equipment will have the manufacturer's model and serial number in a conspicuous place.
- C. Testing Agency Qualifications: Underwriters Labs (UL) or Electrical Testing Labs (ETL).
- D. Manufacturers Independent Testing Data
  - 1. UTP Cabling
    - a. Attenuation
    - b. Near End Crosstalk (NEXT)
    - c. PS-NEXT
    - d. ACR
    - e. Return Loss
    - f. Impedance
    - g. Capacitance

1.15 TESTING

- A. Testing Unit
  - 1. The UL Level 4 testing unit should be capable of testing the installed cables at Category 6A - TIA 568.C.2 or better, Commercial Building Telecommunications Cabling Standards, Category 6A (10GBase-T) specifications. Fluke DTX, and IDEAL LanTEK II are examples of this type of testing unit.
- B. Tests
  - 1. The objective of cable testing is to certify the installed cable to current Category 6A (10GBase-T) for data cables standards. For this installation the definition of "channel" will include the horizontal cable from the patch panel to the work area terminating jack.

The patch cables used for testing should be manufacturer supplied and meet Category 6A (10GBase-T) specifications.

2. At a minimum the following tests should be conducted on each cable and included in the final certification report:
  - a. Wire Map: The wire map test checks the twisted-pair cabling to verify correct wiring. The status should be PASS/FAIL. Cables should achieve a PASS rating in the final certification report.
  - b. Propagation Delay: Propagation delay, or delay, is a measure of the time required for a signal to propagate from one end of the circuit to the other. Delay is measured in nanoseconds (nS). Typical delay for Category 6A UTP is a bit less than 5 nS per meter (worst case allowed is 5.7 nS/m).
  - c. Delay Skew Propagation (skew): is the difference between the propagation delay on the fastest and slowest pairs in a UTP cable. Some cable constructions employ different types of insulation materials on different pairs. This effect contributes to unique twist ratios per pair and to skew.
  - d. Near End Crosstalk (NEXT): NEXT is a measure of the amount of signal which "leaks" from the station's/hub's transmitter to its own receiver. NEXT should be reported on a worst pair basis, and must be tested from both ends (Data Center and work area) to ensure line integrity.
  - e. Attenuation or Insertion Loss: Attenuation measures the amount of signal loss in decibels (dB) on twisted-pair cable.
  - f. Attenuation to Crosstalk Ratio (ACR): ACR reports the difference between NEXT and attenuation on the network. This measurement shows how much larger the received signal of a pair is compared to the noise on the same pair. The reported measurement should represent the cable's worst pair.
  - g. Cable Length: Length should show the overall distance (in feet) covered by the horizontal segment. Measurements should be reported on Fluke DTX printouts (or equivalent) or on a "Certification Report", and should conform to the testing standards as specified in the (TIA/EIA, 2001), Commercial Building Telecommunications Cabling Standard, Part 1 General Requirements.

#### 1.16 WARRANTY

1. Manufacturer's Warranty: Submit manufacturer's standard warranty.
2. The Security Subcontractor, Sub-Subcontractors, and/or hired staff by the Security Subcontractor shall be bonded and shall pay for damage that occurs during the installation of the cabling system, and appears within a period of one year from the date of acceptance of work.
3. The Security Subcontractor shall provide a one-year warranty of the installed system against defects in material and workmanship. Within the warranty period, labor and materials shall be provided at no expense to the Client during normal working hours, and the Security Subcontractor must provide a next business day response time.

#### 1.17 ACCEPTANCE

1. Client acceptance of the structured cabling system shall be based on the results of testing, functionality, inspection and approval of the Engineer, and the receipt of documentation. With regard to testing, cables must meet the specifications included in this RFP. The Security Subcontractor shall be responsible for the testing of 100% of the installed segments/cables at the Town location (see Appendix C – Certification Reports). Segment that does not meet the specifications included in this RFP shall be repaired/replaced, at no labor/materials cost to the Client, by the Security Subcontractor to the satisfaction of the Engineer.

1.18 CERTIFICATION

1. The Security Subcontractor shall submit the required installation and testing documentation to obtain a certified cabling system. At the end of the warranty period, the Security Subcontractor shall provide detailed documentation of emergency maintenance performed from date of acceptance. Documentation shall include description of anomaly, diagnosis, and subsequent action taken to resolve situation. Recommended changes in routine preventative maintenance procedures shall also be performed.
2. Upon successful completion a 20-year minimum Manufacturers Certified Warranty Certificate shall be issued.

1.19 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's labeled packages. Store and handle in accordance with manufacturer's requirements, in a facility with environmental conditions within recommended limits.
- B. Test Cables upon receipt at Project site
  1. Test each pair of the UTP for shorts or opens
- C. Storage and handling of cables in ambient temperatures of 32 degrees F or less:
  1. Prior to installation, condition the cable for at least 24 hours at room temperature to provide the best flex properties for ease of installation

1.20 PROJECT CONDITIONS

- A. Inspect locations where installation work will be performed and verify that conditions found are in accordance with the Contract Drawings and are acceptable for installation work. Report discrepancies in writing to the Engineer requesting clarification.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- C. Environmental Limitations: Do not deliver or install UTP and connecting materials in wet work in spaces until spaces are completely dry, and temporary HVAC or other air-controlled systems are operating and maintaining ambient temperature and humidity conditions.
  1. Exceptions:
    - a. Manufacturer's cable is Indoor/Outdoor Rated

PART 2 - PRODUCTS

2.1 Cable

- A. Belden
- B. Windy City Wire
- C. Allied Wire and Cable
- D. Or Approved Equal

2.2 Fiber Media Converters

- A. Comnet
- B. Interlogix
- C. Pelco

- D. Or Approved Equal
- 2.3 Ethernet Over Coax Converter
- A. Veracity
  - B. NVT Phybridge
  - C. Nitek
  - D. Or Approved Equal

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: UTP- Comply with NEMA and TIA/EIA 569-A-7.
- B. Comply with requirements for demarcation points, pathways, cabinets, and racks. Drawings indicate general arrangements of pathways and fittings.
- C. Comply with TIA/EIA 569-A- for pull box sizing and length of conduit and number of bends between pull points.
- D. Install manufactured conduit sweeps and long radius elbows whenever possible.
- E. Backboards: Install backboards with 96 inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap free corners and joints.

#### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1
- B. General Requirements for cabling:
  - 1. Comply with TIA/EIA 568-B.1 for UTP installations
  - 2. Comply with BICSI Manuals- Cable Termination Practices
  - 3. Install 110 style IDC termination hardware for UTP installations
  - 4. Cables may not be spliced- for Coaxial, Fire Alarm, and Access Control installations cables may have to be spliced.
  - 5. Secure and support cables at intervals not to exceed 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames and terminals for UTP installations.
  - 6. Comply with manufacturer manuals technical section for pull tensions and minimum bend radius requirements for cable installations.
  - 7. Do not install bruised, cut, scored, deformed, or abraded cable.
  - 8. Cold weather installation: Bring cables to room temperature before dereeling. Do not use heating equipment such as heat lamps to make the cable pliable.
  - 9. Pulling cables: Refer to manufacturer manuals.
  - 10. Plenum cables may be installed in portions of the building cable routing and raceways. Do not place outdoor, or Riser rated cables in building plenum areas.
  - 11. Separation from EMI Sources- Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment:
    - a. 2.5 inches – Electrical equipment – rating less than 2kVA
    - b. 6 inches- Electrical equipment- rating between 2-5kVA



- c. 12 inches- Electrical equipment- rating more than 5kVA
  - 12. Separation from EMI Sources- Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures:
    - a. No requirements- Electrical equipment- rating less than 2.5kVA
    - b. 3 inches- Electrical equipment- rating between 2-5kVA
    - c. 6 inches- Electrical equipment- rating more than 5kVA
  - 13. Separation between communication cables and electrical motors/transformers, 5kVA or HP and Larger- min. 48 inches
  - 14. Separation between communication cables and fluorescent fixtures: min. 5 inches
- C. UTP installations
  - 1. Comply with TIA/EIA 568B.2
  - 2. Refer to BICSI Manuals
- 3.3 FIRESTOPPING
  - A. Comply with TIA/EIA 569-A- Firestopping Annex A.
  - B. Comply with BICSI TDMM
- 3.4 GROUNDING
  - A. For communication wiring, comply with ANSI-J-STD-607-A and BICSI TDMM – Grounding, bonding, and electrical protection.
- 3.5 IDENTIFICATION
  - A. Identify system components, wiring, and cabling comply with TIA/EIA 606-A.
- 3.6 FIELD QUALITY CONTROL
  - A. Testing Agency: Engage a qualified testing agency to perform tests and inspections
  - B. Perform test and inspection of the cables upon delivery
  - C. Test and inspection
    - 1. Visually inspect the cables for deformities.
    - 2. Visually inspect the cable packaging for damages.
    - 3. Test for shorts or opens.
  - D. UTP testing will be required for end – to – end verification.
- 3.7 PROTECTION
  - A. Protect installed system from damage during construction.

END OF SECTION