SECTION 271300 - COMMUNICATIONS BACKBONE CABLEING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pathways.
   2. UTP cable.
   3. 62.5/125-micrometer, optical fiber cabling.
   5. Cable connecting hardware, patch panels, and cross-connects.
   7. Single Mode Fiber.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
F. EMI: Electromagnetic interference.
G. IDC: Insulation displacement connector.
H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
I. LAN: Local area network.
K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
M. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.

N. UTP: Unshielded twisted pair.

O. Owner: Salt River Project.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Refer to Division 27, Section 270513 “Communication Services”

2. Include the following installation data for each type used:
   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Source quality-control reports.

D. Field quality-control reports.

E. Maintenance Data: For splices and connectors to include in maintenance manuals.

F. Testing Documentation
1. Provide three hard copies and one electronic copy (CD-rom) of test reports for horizontal UTP cables, coaxial cables, and fiber-optic cables. Test reports provided in electronic format shall include a shareware copy of the appropriate software for managing the reports in CSV format.

2. Documentation (printed form) shall be submitted to the Architect within five working days of the completion of each testing phase (e.g., subsystem, cable type, area, floor, etc.).

1.7 QUALITY CONTROL

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.
2. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
2. Test each pair of UTP cable for open and short circuits.
3. Cable shall be stored according to manufacturers’ recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. Air temperature at cable storage location shall not exceed 50°F minimum, 130°F maximum. Storage location shall be well ventilated to prevent condensation. If necessary, cable shall be stored offsite at the Contractor’s expense.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Cable shall be stored according to manufacturer’s recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. Air temperature at cable storage location shall not exceed 50°F minimum, 130°F maximum. Storage location shall be well ventilated to prevent condensation. If necessary, cable shall be stored offsite at the Contractor’s expense.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner’s telecommunications and LAN equipment and service suppliers.

B. Coordinate layout and install of telecommunication pathway and cabling with other trades (Electrical, Mechanical, Plumbing, Etc.)

PART 2 - PRODUCTS

2.1 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. Berk-Tek; a Nexans company.

B. Description: 100-ohm, 200 pair UTP, formed into 25-pair binder groups covered with a gray thermoplastic jacket and overall metallic shield.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, General Purpose: Type CM or CMG.
   b. Communications, Plenum Rated: Type CMP complying with NFPA 262.
   c. Communications, Riser Rated: Type CMR complying with UL 1666.
   d. Communications, Limited Purpose: Type CMX.
   e. Multipurpose: Type MP or MPG.
   f. Multipurpose, Plenum Rated: Type MPP complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR complying with UL 1666.

2.2 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. Ortronics.

B. 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 shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 5e or Category 6 New Construction. 66-style IDC for renovations when 66 blocks are existing. Provide blocks for the number of cables
terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

Patch Cords: Factory-made, 4-pair cables in [36-inch (900-mm)] [60-inch (1524-mm)] lengths; terminated with 8-position modular plug at each end or as directed by SRP. (SRP TO MODIFY)

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.3 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corning Cable Systems.

B. Description: Multimode, 62.5/125-micrometer, tight buffer and optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

   a. General Purpose, Nonconductive: Type OFN or OFNG.
   b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
   c. Riser Rated, Nonconductive: Type OFNR complying with UL 1666.
   d. General Purpose, Conductive: Type OFC or OFCG.
   e. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
   f. Riser Rated, Conductive: Type OFCR complying with UL 1666.

4. Conductive cable shall be aluminum armored type.
5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

D. Description: Singlemode, 8/125-micrometer, tight buffer and optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
   a. General Purpose, Nonconductive: Type OFN or OFNG.
   b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
   c. Riser Rated, Nonconductive: Type OFNR complying with UL 1666.
   d. General Purpose, Conductive: Type OFC or OFCG.
   e. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
   f. Riser Rated, Conductive: Type OFCR complying with UL 1666.

4. Conductive cable shall be aluminum armored type.
5. Maximum Attenuation: 3.50 dB/km at 1310 nm; .2 dB/km at 1550 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
8. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
9. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.4 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corning Cable Systems.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths or lengths as directed by SRP.

D. Cable Connecting Hardware:

2. Quick-connect, simplex and duplex, UNICAM connectors. Insertion loss not more than 0.75 dB.

2.5 TESTING

1. Bi-directional splice loss of a single splice must not exceed 0.13 dB when measured with an OTDR at 1310nm and 1550nm.
2. Fiber Loss: Optical Cable with Single Mode Fiber.
   a. Attenuation at 1310 nm = 0.5 dB/mi max
b. Attenuation at 1550 nm = 0.4 dB/mi max

2.6 COAXIAL CABLE

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. CommScope, Inc.

F. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

G. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV, or CATVP or CATVR.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.7 COAXIAL CABLE HARDWARE

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Blonder - Tongue.

J. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.8 IDENTIFICATION PRODUCTS

K. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.9 SOURCE QUALITY CONTROL

L. Testing Agency: Engage a qualified testing agency to evaluate cables.
M. Factory test cables on reels according to TIA/EIA-568-B.1.
N. Factory test UTP cables according to TIA/EIA-568-B.2.
O. Factory test multimode and single mode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
P. Cable will be considered defective if it does not pass tests and inspections.
Q. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 16 Section "Raceway and Boxes for Electrical Systems."
B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF CABLES
A. Comply with NECA 1.
B. General Requirements for Cabling:
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   5. Cables may not be spliced. Cabling shall be installed in continuous runs from cross-connect fields to cross-connect fields, to patch panels, workstation outlets, etc. Cabling shall be free from splices, taps, splitters, baluns and any other in-line connections.
   6. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   7. Unsupported spans between cable trays and conduit sleeves shall not exceed 12" horizontally, 24" vertically.
   8. All cables shall be new and as specified on the drawings. Cables shall be shipped on 1,000 ft. reels or boxed. Coiled cables are not acceptable. Factory shorts and/or factory seconds, salvaged, leftover and reused cables are not acceptable. Cables of a given
type shall be of a single manufacturer and part number. All unapproved or unacceptable cable shall be removed and replaced at the Contractor’s expense.

9. Cables routed above a suspended ceiling in exposed space, and not installed in a conduit system, shall be supported by a cable tray, channel or hangers.

10. Cables shall not be supported from ceiling support wires, lighting fixture support wires, ductwork, plumbing line, fire suppression systems, mechanical systems or electrical conduits. Cables shall not come in contact with ductwork or piping, or lay on top of ceiling systems and lighting fixtures.

11. Where cables are routed through inaccessible ceilings, the Contractor shall install conduit sleeves extending 1 foot beyond the inaccessible area, sized in accordance with ANSI/TIA/EIA-569-A Guidelines, as outlined in Table 1. Install insulated conduit bushing on both ends of sleeve and ground conduit per Division 27 Specification Section 27 05 26 “Grounding & Bonding for Communications Systems”.

12. Install conduit sleeves where cables pass through walls. Conduits shall be sized in accordance with ANSI/TIA/EIA-569-A Guidelines, as outlined in Division 27 Specification Section 27 05 28 “Pathways for Communications Systems” Table 1. Install insulated conduit bushing on both ends of sleeve and ground conduit per Division 27 Specification Section 27 05 26 “Grounding & Bonding for Communications Systems.

13. Cables supported by hangers shall utilize Caddy Cable-Cat hangers or approved equal communication cable hangers. Hangers shall be supported from the building structure. Hangers shall not utilize other system support wires or rods.

14. A maximum of 36 (three groups of 12) cables shall be supported in a single hanger with a spacing of 48” on center. Cables shall be loosely bundled.

15. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

16. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

17. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

18. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

19. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

20. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

21. Cables requiring additional length shall be stored in an extended loop or in a "Figure 8" configuration. Do not store additional length in bundled loops. Each individual loop shall be tagged with cable number.

22. The Contractor shall make certain that during the installation and upon completion, all cables have been installed in good condition, free from jacket cuts or tears, kinks, twist, knots, sharp bends, etc., or any other physical damage. During the installation, the Contractor shall not allow the cables to be exposed to foot, vehicle or equipment traffic, or be exposed to any other form of abuse which shall cause damage to cables, altering the electrical characteristics. Cables exhibiting such damage or an attempt by the Contractor to correct, hide or otherwise conceal such damage, shall result in cables being replaced at the Contractor's expense.

23. Cable pulls shall not exceed 100 feet in length. Cables shall be neatly coiled in a figure "8" pattern at the completion of a pull in preparation for the next pull.

24. Data/telecommunication and fiber-optic cables shall not be stored or installed in an unheated building where the temperature is less than 40°F. The structure and the cable must be brought to a minimum 50°F ambient for a minimum of 48 hours prior to installation of the cables. Failure to observe this precaution may result in damage to the cable and shall result in the cable being replaced at the Contractor’s expense.
C. UTP Cable Installation:
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
3. Maximum of 12" and minimum of 6" of cable shall be stored in back box or raceway. Slack shall be coiled in the box without exceeding the bend radius.
4. Bend radiuses of the horizontal cable shall not be less than four times the outside diameter of the cable.
5. Cable jacket shall be maintained to within 1" of termination points.

D. Optical Fiber Cable Installation:
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 48 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet (1800 mm) long in Figure 8 configuration not less than 12 inches (300 mm) in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

   1. Administration Class 4.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 4 level of administration including optional identification requirements of this standard.

C. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cable and Wire Identification:
   
   1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
   3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1 and Addenda.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
   a. Fluke (or Equivalent brand) Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex.
   b. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   c. All test cords are to be newly installed prior to any work for Salt River Project.
4. Optical Fiber Cable Tests:
   a. Multi-Mode (62.5 / 125 UM) and Single-Mode (8.7 / 125 UM) Fiber-Optic Cable:
      1) All fiber-optic cables shall be fully tested for continuity and attenuation, utilizing a fiber-optic power motor and fiber-optic LED/laser light source. The fiber-optic test equipment shall be capable of testing multi-mode and/or single-mode fiber cable.
      2) The fiber-optic test equipment shall be an electronic micro-controller with automatic self-testing and data storage. The Contractor shall provide shop
3) Fiber conductor shall be tested with the cable completely installed and in final placement, with connector installed and polished out. The "ST" and/or "SC" connectors shall be inspected for proper termination techniques, workmanship, labeling, etc., and verified by the Contractor to be free from any visual defects, such as scratches and chips. All connector installations exhibiting any defected and/or improper assembly procedures shall be replaced at the Contractor's expense.

b. Each fiber shall be tested in both directions, with both readings recorded. The worst-case reading shall be utilized to determine acceptability of the fiber.

c. Attenuation shall be recorded for each fiber at 850 and 1,300 nm for multi-mode fiber-optic cable, and at 1,310 nm and 1,550 nm for single-mode fiber-optic cable. Fiber-optic cable link test procedures shall be based upon EIA/TIA-568A Annex "H" Standard procedures. The technician performing the fiber-optic verification tests should periodically check and verify the reference dB loss. All fiber-optic "ST" and/or "SC" connectors and couplers shall be thoroughly cleaned before and after testing, and dust caps installed after the test procedures have been completed.

d. The Fluke fiber-optic cable test report shall provide the following information:
   1) Contractor's name.
   2) Test Equipment Identification: Manufacturer, model number, and serial number.
   3) Client/Owner identification.
   4) Date test performed.
   5) Cable manufacturer and part number.
   6) Cable identification number.
   7) Cable location (i.e., building - from/to).
   8) Cable description (i.e., number of fibers, S/M, M/M).
   9) Name, signature and date of signature of the technician performing the tests.
   10) Cable length.
   11) Proper conductor termination verification, both ends.
   12) Link attenuation (loss) measurement in dB per fiber.
   13) Reference dB.
   14) Visual connector (both ends) inspection verification.
   15) Calculated fiber loss based on fiber length and factory OTDR readings.
   16) Calculated optical attenuation per connector pair (fiber link attenuation loss measurement), less the calculated fiber loss, less the reference dB, equals optical attenuation per connector pair.
   17) Test results (i.e., pass/fail).

e. Maximum optical attenuation per connector pair for multi-mode fiber connectors shall be 0.5 dB or less when measured at 850/1,300 nm in accordance with ANSI/EIA/TIA-526-14A, Method A.1. Maximum optical attenuation per connector pair for single-mode fiber connectors shall be 0.5 dB or less when measured at 1,310/1,550 nm in accordance with ANSI/EIA/TIA-526-7, Method B. (NOTE: It is recognized by the Engineer that this specification is much more stringent than the EIA/TIA-568A Annex "H" Standard.) Reflection shall be ≥ 45 dB.

C. Coaxial Cables: All coaxial cables shall be tested for "opens", "shorts", continuity, capacitance, impedance, loop resistance and length. Coaxial cables shall be tested utilizing a programmable
micro-computer-based automatic scanner/tester capable of generating complete printed test reports as noted above.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 271300