

SECTION 27 16 00 - HORIZONTAL CABLING

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents. Unless noted otherwise all work included in this section is included in the electrical contract.

1.2 SCOPE

- A. Horizontal cabling includes Category 6a UTP from the communications equipment room (CER) to the station outlet. Station outlet locations and jack quantities are shown on the plans. In addition to the outlets shown on the plan,
- B. This section includes minimum requirements for the following:
 - 1. UTP Cable and Terminations
 - 2. Patch Panels
 - 3. Patch Cables
 - 4. Connecting Hardware

1.3 QUALITY ASSURANCE

- A. All cable shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Strictly adhere to all Category 6a-installation practices when installing UTP cabling.
- C. Provide with the submittals, documentation from an independent testing agency indicating that the complete assembly including cable and termination hardware has been tested and meets the performance criteria called for in the TIA/ISO Channel.
- D. Materials and work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA- 568C.1
 - 2. ANSI/TIA/EIA – 569 – 1995
 - 3. ANSI/TIA/EIA – 607
 - 4. Latest Edition of NFPA 70
 - 5. BICSI Telecommunications Distribution Methods Manual
 - 6. FCC 47 CFR 68
 - 7. NEMA - 250
 - 8. NEC - Articles 770 and 800

1.4 SUBMITTALS

- A. Manufacturers catalog sheets, specifications and installation instructions for all cable, connecting hardware and patch cables.
- B. Termination details for all cable types.
- C. List of three (3) installations of equivalent or larger systems that have been installed within the past five (5) years and have been operating satisfactorily for a minimum of two years. (Include names and phone numbers of references at the site of installation)
- D. Cable Test Reports (prior to hardware/software installation).
- E. All cabling shall be plenum rated.

PART 2 - PRODUCTS

2.1 100 OHM UNSHIELDED TWISTED PAIR CABLE (UTP)

- A. Physical Characteristics:
 - 1. Shall be plenum rated and meet applicable requirements of ANSI/ICEA S-80-576. All 4 pairs must be F.E.P. 2x2 or 3x1 F.E.P. designs are not acceptable. Show proof of this with submittals. Provide proof of this with the submittal.
 - 2. Outer jacket shall be yellow for connections to Wireless Access Points, Blue for data cables and grey for voice cables.
 - 3. Shall be enhanced type cable optimized to frequencies up to 350 MHz
 - 4. The diameter of the insulated conductor shall be .048 in. maximum.
 - 5. Shall consist of (4) 24 AWG Twisted pairs.
 - 6. Provide plenum rated cable.
 - 7. The color coding of pairs shall be:
 - a) Pair 1 - W-BL ; BL
 - b) Pair 2 - W-O; O
 - c) Pair 3 - W-G; G
 - d) Pair 4 - W-BR; BR
 - 8. The overall diameter of the cable shall be less than 0.25 inches.
 - 9. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum

10. Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking
11. Enhanced Performance complying with the following:
 - a) Full duplex operation over four cable pairs
 - b) Full power sum performance
 - c) Increased usable bandwidth up to 200 MHz
 - d) Documented balance characteristics (LCL, LCTL)
 - e) Establishes PS-EL FEXT requirements
 - f) Reduced attenuation
 - g) Compliant to ISO/IEC 11801 requirements
 - h) Capable of handling the next generation of applications, which will utilize full duplex operation.
 - i) Improved overall cable performance and reduced cable emissions.
 - j) Capable of handling full broadband and baseband video signals.
 - k) Modal Decomposition testing allows high frequency characterization of the cable to 500 MHz.

B. Transmission Characteristics: (Cable shall exceed the following):

1. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m at 20 °C. Measured in accordance with ASTM D 4566.
2. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.6 nF
3. DC resistance unbalance between any two conductors of any pair shall not exceed 5% when measured at or corrected to 20 °C in accordance with ASTM D 4566
4. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m
5. Structural return loss swept measurement for 100m or longer shall be 23-10log (f/20) dB at 20-100 MHz
6. The maximum attenuation of any pair shall be less than the following:

Frequency (MHz)	Max. Attenuation (dB)
1.0	2.0
4.0	4.1
10.0	6.5
16.0	8.2
20.0	9.3
25.0	10.4
31.25	11.7
62.5	17.0
100	22.0
155	28.1
200	32.4

300	41.0
500	44.9

7. The minimum ACR shall meet the following:

Frequency (MHz)	ACR
1.0	66
4.0	55
10.0	47
16.0	42
20.0	40
31.25	35
62.5	25
100	21
155	10

8. The NEXT coupling loss between pairs in a cable shall exceed the following:

Frequency (MHz)	NEXT Loss Worst Pair (dB)
1.0	68
4.0	59
10.0	53
16.0	50
20.0	48
31.25	45
62.5	41
100	38
155	35
200	33
300	31
500	30

9. The propagation delay of any pair at 10 MHz shall not exceed 5.7ns/m

2.2 GENERAL REQUIREMENTS FOR CONNECTING HARDWARE FOR 100 OHM UTP

A. Physical Characteristics:

1. Shall be insulation displacement contact (IDC) type.
2. Shall be functional from -10 degrees F to 140 degrees F.
3. Shall be tested in accordance with ANSI/EIA/TIA-568-A Annex A.

B. Transmission Characteristics (as tested in accordance with ANSI/TIA/EIA-569A Annex B)

1. Attenuation shall not exceed the following:

Frequency (MHz)	Max. Attenuation (dB loss)
1.0	0.1
4.0	0.1

8.0	0.1
10.0	0.1
16.0	0.2
20.0	0.2
25.0	0.2
31.25	0.2
62.5	0.3
100.0	0.4

2. The NEXT shall meet the following:

(1)	Frequency (MHz)	NEXT Loss (dB)
	1.0	65
	4.0	65
	8.0	62
	10.0	60
	16.0	56
	20.0	54
	25.0	52
	31.25	50
	62.5	44
	100.0	40

3. Category 6 outlet assemblies with internal conductor paths of >6 in. shall have a minimum return loss of 23 dB at frequencies of between 1 and 20 MHz. and a minimum return loss of 14 dB (or greater) at frequencies that range between 20 and 100 MHz).
4. The dc resistance between the input and output connections of the connecting hardware shall be .3 ohm maximum.

2.3 STATION OUTLETS

- A. Shall be modular RJ45 jacks that snap into user configurable faceplates and jack frames, High-impact 94 V-0 rated thermoplastic meeting durability requirements specified in IEC 603-7.
- B. Faceplates shall high impact 94 V-0 rated thermoplastic. Coordinate and guarantee compatibility of jack, faceplate, raceway and floor boxes.)
- C. Face plates shall have (2) slots per single gang for EIA/TIA labels.
- D. Jacks Shall be 110 IDC, RJ45 type suitable for eight 22-24 AWG wires and be certified Category 5e compliant.
- E. Conductors shall be separated and aligned internally by jack comb.
- F. UL verified and listed Category 6a
- G. Jack contacts are Beryllium copper with a minimum 50-micro-inch gold plating

- H. 110 contacts, tin lead plated IDC
- I. Shall meet F.C.C. part 68.5
- J. Jacks shall be wired in accordance with EIA/TIA T568C polarization sequence.
- K. Design Make:
 - 1. Category 6 Jacks –s (black – Data, Blue - voice)
 - 2. Face Plates - Color by architect. Provide triplex outlets with blank inserts for all used locations.

2.4 PATCH PANELS

- A. Shall meet or exceed all Enhanced Category 6a UTP specifications outlined in this document.
- B. Terminated in accordance with T568B Pin Configuration
- C. Provide only 48 port panels
- D. Paired punch down sequence to allow pair twist within ½" of the termination
- E. Rack or wall mounted as called for.
- F. 19" rack mounting or wall bracket mounting if required
- G. UL listed File # E129878
- H. .09" thick rolled edge black anodized aluminum construction.
- I. Beryllium copper with minimum 50 micro-inch gold plating
- J. 110 termination, fire-retardant plastic with tin lead solder plated
- K. IDC Terminates 22-26 AWG solid conductors Maximum insulated conductor outside diameter .050
- L. Acceptable Manufacturers:
 - 1. Panduit
 - 2. AMP
 - 3. Leviton

2.5 100 OHM UTP PATCH CABLES (Category 6a Cable)

- A. Physical Characteristics
 - 1. Shall have stranded conductors and meet the performance criteria of 100 ohm UTP horizontal cable.
 - 2. Shall be blue colored for data and yellow for wireless access points.

3. Insulated conductor diameters shall not exceed (0.047 in.)

B. Transmission Characteristics

1. The maximum attenuation of any pair shall be less than the following:

Frequency (MHz)	Max. Attenuation (dB)
1.0	2.4
4.0	4.9
10.0	7.8
16.0	9.9
20.0	11.1
25.0	12.5
31.25	14.1
62.5	20.4
100	26.4

C. Acceptable Manufacturers:

1. Belden
2. AMP
3. Lucent Technologies
4. Berk-Tek/Leviton

PART 3 - EXECUTION

3.1 INSTALLATION

A. UTP Cable:

1. All wiring concealed in new walls or soffits shall be installed in metal conduits.
2. Wiring in existing walls with hollow cavities may be installed loose.
3. All exposed wiring shall be installed in surface metal raceway.
4. All wiring above ceilings shall be installed in cable tray or open top cable hangers and brackets.
5. Cable hangers above accessible ceilings shall be installed 4' on center attached to building structure. If cables have more than 12" of sag, install more hangers.
6. Do not untwist cable pairs more than 0.5 in. when terminating.
7. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.

8. Maximum length shall be 90 meters.
 9. Cable shall have no physical defects such as cuts, tears, kinks, bulges or burns in the outer jacket. Cables with defects shall be replaced.
 10. Install cable in neat and workmanlike manner. Neatly bundle and tie all cable in closets. Leave sufficient cable for 90° sweeps at all vertical drops.
 11. Do not tie-wrap cable to a perpendicular support. Tie-raps shall be used to secure cables to other like cables or to an approved tie mount. Do not over tighten cable ties.
 12. Maintain the following clearances from EMI sources.
 - a) Power cable - 6 in.
 - b) Fluorescent Lights - 12 in.
 - c) Transformers - 36 in.
 13. Install Category 6A cable in a separate open cable hanger segment. Do not install with coaxial, optical fiber cable or any other cable type. If cables have more than 12" of sag, install more hangers.
 14. Do not install with more than 110N pull force. (25 lbs.)
- B. UTP Patch Panels (Category 6 cables):
1. Provide rear wire manager near the top of panel.
 2. Route cables from the back of patch panel through coupler openings and attach cable to the wire manager with cable ties.
 3. Do not untwist cable more than 0.5 in. when terminating.
 4. Locate so that combined length of cables and cords from panel to hub does not exceed 3m.
- C. UTP Station Outlets
1. All cables shall be terminated with modular jacks that snap into a faceplate mounted on a wall outlet box , surface raceways, or floor box. Outlet boxes shall be secured to building with mechanical fasteners. Adhesive fasteners are not allowed.
 2. Terminate cable per EIA/TIA T568B standard pin assignments.
- D. Fire Stoppings and Penetrations:
1. Provide firestopping as called for in 260010.

3.2 ADDITIONAL REQUIREMENTS

- A. Provide the following installed spares. Installed spares include the device, backbox, wiring, terminations, testing, and additional patch panels and up to 50ft of surface raceway, cable lengths shall be up to 320'.
- B. 12 additional data drops, locations to be determined by owner. Drops shall include (1) adjacent receptacle extended from the nearest 120 volt receptacle circuit.

END OF SECTION

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