Video Intercom, Cabling and Installation
Project No 25.2
Exhibit C - Network Final Specifications

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

Before publishing your final version of this specifications Section, remove all red bold italic instructions.

Part 1 - GENERAL

1.1 SUMMARY

A. This section specifies the basic requirements for communications installations as indicated or required and includes requirements common to more than one specification section of this division (such as related documents, related sections, definitions, governing requirements, contractor requirements, warranty requirements, submittal requirements/procedures, and project closeout requirements/procedures, as well as other requirements). This section may expand upon and/or supplement the requirements specified in division 01.

B. Examine the contract documents in their entirety (including drawings and specification sections in the other divisions) for requirements or work which may affect work under this section, regardless of whether such requirements or work are specifically indicated in this section.

C. Related Sections:

1. Section 00 00 00 – Procurement and Contracting Requirements
2. Section 01 00 00 – General Requirements
3. Section 07 84 00 – Penetration Firestopping
4. Section 26 05 26 – Grounding and Bonding for Electrical System
5. Section 27 05 26 – Grounding and Bonding for Communication Systems
6. Section 27 05 39 – Surface Raceway for Communications Systems
7. Section 27 05 53 – Identification for Communication Systems
8. Section 27 06 28 – Pathways for Communication Systems
9. Section 27 06 36 – Cable Trays for Communication Systems
10. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
11. Section 27 11 19 – Communications Termination Blocks and Patch Panels
12. Section 27 11 23 – Communications Cable Management

13. Section 27 11 26 – Communications Rack Mounted Power Protections and Power Strips
14. Section 27 13 23 – Communications Fiber Backbone Cabling
15. Section 27 15 13 – Communications Copper Horizontal Cabling
16. Section 27 15 43 – Communications Faceplates and Connectors
17. Section 27 16 13 – Communications Copper Custom Cable Assemblies
18. Section 27 16 13.01 – Communications Fiber Custom Cable Assemblies
19. Section 27 16 19 – Communications Patch Cords
20. Section 27 17 00 – Testing of Structured Cabling Systems

1.2 DEFINITIONS

A. ANSI – American Northern Standards Institute

A. AWG – American Wire Gauge

B. BICSI – Building Industry Consulting Service International

C. BCT – Bonding Conductor for Telecommunications

D. EIA – Electronics Industry Alliance

E. ETL – Intertek Certification Services

F. IEC – International Electrotechnical Commission

G. IEEE – Institute of Electrical and Electronic Engineers

H. IDC – Insulation displacement contact

I. ISO – International Standards Organization

J. NECA – National Electrical Contractors Association

K. NFPA – National Fire Protection Agency

L. NRTL – Nationally Recognized Testing Laboratory

M. TIA – Telecommunications Industry Association

N. UL – Underwriters Laboratory

O. Provide: Furnish, install, terminate, label, test and certify a complete operating cabling system.

P. Contract Documents (CD): Design drawings, specifications, sketches and schedules provided by the Engineer as they directly relate to this scope of work and this project.

Q. Structured Cabling Systems (SCS) wiring is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber cable installed and configured to provide computer data and voice connectivity.

R. Point–of–Entry (POE): Unmarked Manholes/Vaults at property line

S. NET–POP Rooms/MPOE (Main Point of Entry): The area where the outside plant media/carrier services appear in the facility. The NET–POP contains equipment used by HUSD or carrier to hand–off/transition cable from outside plant into inside plant type.

T. Network Center/Main Distribution Frame (MDF) Areas: This technology space houses Layer 2/3 network switching gear and other main network distribution equipment and acts as the mid–connection point between the Core/Network and the TR/IDF/access zones for all connections.

U. Telecommunications Room (TR)/Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

V. Active Equipment: electronic equipment used to develop various WAN, LAN, and voice services, e.g., digital multiplexers, RS–232 controllers, Ethernet hubs, switches, routers, PBX, etc.

W. Campus Backbone: cabling system consisting of media and termination hardware interconnecting POE, Net–Pop's and Future onsite buildings.

X. Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.

Y. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

Z. Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

AA. Basket Cable Tray: A cable support and management system fabricated of continuous, rigid, welded steel wire mesh and available in many sizes with attachment hardware suiting multiple installation methods

BB. Cable Tray: vertical or horizontal open supports, usually made of aluminum or steel, which are fastened to the building structure. Cables are laid in and fastened to the trays.

CC. Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

DD. Channel: The end–to–end transmission path between two points at which application specific equipment is connected; encompasses all the elements of the horizontal cabling link, plus the equipment cords in the telecommunications spaces and work area.

EE. Cross–Connect: equipment used to terminate and tie together communications circuits.

FF. Cross–Connect Jumper: a cluster of twisted–pair conductors without connectors used to establish a circuit by linking two cross–connect termination points.

GG. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

HH. Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight–position/eight–contact modular jacks.

II. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

JJ. LAN: Local area network.

KK. Link: Horizontal cabling link encompassing all components of the horizontal cabling (TO, patch panels, blocks, jumpers and patch cords that join them in the horizontal cross–connect). It is distinguished from a channel because it does not include the equipment cables/cords at the telecom spaces or work area.

LL. Media: twisted–pair, and fiber optic cable or cables used to provide signal transmission paths.

MM. Mounting Frame: rectangular steel framework, which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.

NN. Outside Plant (OSP): generally, any and all portions of the cable system that runs outside of an environmentally enclosed structure and/or building with each end terminated at different buildings. This specifically includes inter–building cables, conduits, manholes, hand–holes, and innerduct.

OO. UTP: Unshielded Twisted Pair.

PP. FO: Fiber Optic

QQ. Passive Equipment: non–electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, patch panels, wiring blocks, fiber optic shelves, etc.

RR. Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.

SS. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.

TT. Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

UU. Protectors: electrical protection devices used to limit foreign voltages on metallic communications circuits.

VV. Raceway: an enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wire ways, under floor raceways, overhead raceways and surface raceways; does not include cable tray.

WW. Racks: An open, freestanding, floor–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

XX. Riser Backbone: The Riser Backbone subsystem links the main cross connect (MDF) in the equipment room to the distribution rooms (TRs).

YY. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

ZZ. Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.

AAA. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

BBB. Work Area Subsystem: The connection between the telecommunications outlet and the station equipment in the work area is provided by the Work Area Subsystem. It consists of cords, adapters, and other transmission electronics.

CCC. Wireless Access Point (WAP): Telecom outlet designated for use with wireless network devices. Such outlet shall be mounted above ceiling.

DDD. Contractor – The successful bidder engaged to provide the work of this specification

1.3 REFERENCES

A. Most recent editions and addenda of the following documents:

A. ANSI/TIA 568 series, most recent revisions, addenda and systems bulletins. All applicable

B. ANSI/TIA–569 Telecommunications Pathways and Spaces, most recent revision including all relevant addenda and systems bulletins

C. ANSI/TIA–606 Administration Standard for Telecommunications Infrastructure, most recent revision including all addenda and systems bulletins

D. ANSI/TIA–607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, most recent revision including all addenda and systems bulletins

E. ANSI/TIA–862 Structured Cabling Infrastructure Standard for Intelligent Building Systems, most recent revision including all addenda and systems bulletins

F. ANSI/TIA–942 Telecommunications Infrastructure Standard for Data Centers, most recent revision including all addenda and systems bulletins

G. ANSI/TIA–1179 Healthcare Facility Telecommunications Infrastructure Standard, most recent revision including all addenda and systems bulletins

H. ANSI/TIA–4966 Telecommunications Infrastructure Standard for Educational Facilities, most recent revision including all addenda and systems bulletins

I. TIA–TSB–162 Telecommunications Cabling Guidelines for Wireless Access Points, most recent revision including all addenda and systems bulletins

J. Telecommunications Distribution Methods Manual, most recent edition

K. Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition

L. National Electric Codes (NEC) – all applicable

M. OSHA Standards and Regulations – all applicable

N. Local Codes and Standards – all applicable

O. UL444 – Standard for Safety of Communications Cable

P. UL 1666 – Standard for Safety of Flame Propagation Height

Q. Local Authority Having Jurisdiction (AHJ)

R. Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either

S. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense

1.4 SUBMITTALS

A. Make submittals in accordance with:

1. Section 00 00 00 – Procurement and Contracting Requirements

2. Section 01 33 00 – Submittal Procedures.

B. Action Submittals:

1. Shop Drawings – RCDD stamped

a. HUSD Construction Project Manager will provide electronic files in CAD format, containing the contract document drawing files, for use in the preparing of the shop drawings, by the RCDD.

b. Submit Overall Floor Plans: floor and site plans showing the locations of devices and cable routing paths with cable types and quantity called out.

c. Submit Shop drawings for the entire structured cabling system and grounding and bonding system, identifying such items as PBB, SBB, TBB, rack fills, cabling pathways and pathway fills, ladder and other cable raceways, coordination with other trades, etc.

2. Product specifications

3. Wiring diagrams

4. Rack Elevation drawings

5. Catalog cut sheets and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication, and material finish. Clearly indicate on each sheet what is being submitted on

6. Qualification Data: Submit at least three references for telecommunications cabling jobs already completed, involving both fiber optics and twisted pair cabling, similar in scope to the project described herein. Include, for each customer reference, the following information: Company name, address, phone number, name and email address of contact and type of job completed.

7. Provide copies of the Contractor's Panduit certification.

8. Provide copies of Panduit Fiber and Copper technician training certificates.

C. Provide all applicable portions of the following information for sections listed in paragraph 1.1 above, in addition to the standard requirements, within 7 days after receiving each reel and/or box of cable:

1. Manufacturer's product test data for fiber optic cable components.

2. Visually inspect Category–6A UTP. Materials cannot be used before results have been submitted to CM and approved by the HUSD or its representative.

3. On–reel OTDR testing of all fiber.

D. Provide all applicable portions of the following completed test documentation for sections listed in paragraph 1.1 above, in addition to the standard requirements, within 10 days after completion of the tests for each cable channel or link:

1. Test reports shall be submitted in the following manner:

a. To the HUSD: One copy on eight and one–half inch by eleven papers providing for quality reproducible printing, and Fluke Native format for viewing in Fluke LinkWare by HUSD.

b. Submit test report documentation through CM for review by the Engineer and HUSD for specification conformance and one copy in LinkWare electronic format.

2. Twisted–pair field test documentation

3. Fiber optic test documentation

1.5 CLOSEOUT DOCUMENTS

A. Final close out documents including, but not limited to, test results on a CD–ROM or USB drive, in native tester format, project manual that includes manufacturer and contractor warranties, product cut sheets, material submittals, etc. Also, include the following:

1. Hard copy documentation of test results for every cable segment and link in 3– ring binder and a copy of all Fluke native format test results viewable in Fluke LinkWare.

2. Provide "As–Built" Drawings in same AutoCAD Version as provided by HUSD, in section 1.4 of this document.

a. "As–Built" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing outlet and identifiers. Indicate labeling for each piece of equipment.

b. As–Built drawings will contain all installed cabling and materials. Outlets will be numbered with each cable associated with the work area outlet.

3. Place a laminated full–size, minimum “C” sized, floor plan of these drawings (coordinate with HUSD) on the wall of each communications room, showing area covered, data locations, and cable labeling

1.6 QUALITY ASSURANCE

A. Manufacturer’s Warranty

1. Contractor shall provide a 30–year Panduit Certification Plus℠ System Warranty on all copper and fiber links and/or channels.

2. Panduit® Certification Plus℠ warranty shall meet the following criteria:

a. A 30–year guarantee that the installed cabling system will pass the Commercial Building Telecommunications Standards cited in this document.

b. This warranty will cover all registered links and/or channels.

c. Contractor shall indicate in warranty documentation whether registered links are to be link or channel.

i. If links are covered, this warranty may be invoked only if the links are comprised entirely of Panduit components and cable.

ii. If channels are covered, this warranty may be invoked only if entire channel links are comprised of continuous Panduit components and cable, including patch cords.

d. The communications Contractor will correct any problems and malfunctions that are warranty–related issues without charge for the entire warranty period.

e. If the Certification Plus℠ warranty is needed by HUSD within the warranted period and the original installer is no longer in business, Panduit shall find a substitute Panduit ONE℠ certified contractor and assume costs to fulfill the obligations of the warranty.

f. Upon acceptance of the warranty paperwork and test results from the Contractor, Panduit will mail a notification letter to the installer and a notification letter with warranty certificate to HUSD.

g. The warranty period shall commence following the final acceptance of the project by HUSD and written confirmation of warranty from Panduit.

B. Testing and Inspection of Communications Equipment

1. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.

a. Furnish all test equipment and instruments required for the tests.

b. Responsible, qualified employees of the contractor in the presence of the HUSD or an authorized representative shall perform the cable testing.

c. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.

2. End to end performance of all parts and channels will be tested.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather–tight, wet work in spaces is complete and dry, and work above ceilings is complete

1.8 RESPONSIBILITIES AND COORDINATION

A. The contractor shall provide all materials, qualified labor and services required to ensure a complete and operational system, installed in accordance with the intent of the Contract Documents.

A. The contractor shall furnish and install all incidental items not actually shown or specified, but which are required by best practices to provide complete functional systems.

B. The contractor shall coordinate the details of facility equipment and construction for all specification divisions, which affect the work covered under this Division.

C. The contractor shall coordinate all activities with the overall construction schedule.

D. The contractor shall develop a bill of materials, perform material management and efficient use of the materials whether they are issued by HUSD or purchased by the Contractor.

E. The contractor shall ensure materials, in excess of, those required to complete the project are kept in their original condition and packaging for restocking.

1.9 DESIGN CRITERIA

A. Compliance by the contractor with the provisions of this Specification does not relieve him or she from the responsibilities of providing materials and equipment of proper design, mechanically and electrically suited to meet operating requirements at the specified service conditions.

A. The soliciting HUSD seeks a state–of–the–art infrastructure for this new building. The design intends to achieve a technology infrastructure geared towards a complex environment. The design will also employ features applied at similar facilities and draw concepts from the new TIA–942 – Telecommunications Infrastructure Standard for Data Centers. Furthermore, the design will be of high reliability and offer manageable fault–tolerant topology.

B. The following are incorporated into the design:

1. The intent of the drawings is to restrict the maximum horizontal subsystem cabling length to 295 feet for all horizontal Permanent Link cabling.

1.10 LABELING

A. Comply with TIA/EIA–606–A, TIA/EIA–606–A, Addendum 1 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

A. All copper links shall be identified and labeled by the room number and port number in that room, i.e. 101-01, 101-02, 101-03 as an example with ***-01 starting at the teacher desk and ***-06 ending at the AV cabinet location. Access points shall be labeled by the room number, i.e. ***-AP1 and ***-AP2 and the clock speaker shall be labeled ***-CS. Security cameras shall be identified by room or building number or location -SC.

C. Comply with section 27 05 53.

PART 2 - PRODUCTS

2.1 GENERAL

A. This Section includes General Requirements for each section in Division 27 and shall be used in conjunction with specifications, other related Divisions and related Contract Documents to establish the total requirements for the project: Contractor shall submit an itemized BOM (Bill Of Material) listing all part numbers and quantities for review by HUSD or it representative.

1. Refer to specific sections for Product Part Numbers.

B. All products must be from same manufacturer.

C. HUSD approved Manufacturer:

1. Panduit
2. Hoffman Cabinets
3. Chatsworth Cable Tray

2.2 SUBSTITUTION POLICY

A. This is a performance-based specification developed from the experience of HUSD IT in providing exceptional solutions for all our facilities and departments. As such, substitution of specified products or systems is not allowed.

B. Contractor shall assume all costs for removal and replacement of any product installed in substitution of those specified. Such costs shall include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

2.3 LABELING

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

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV–resistant seal for label.

B. Comply with HUSD numbering and label scheme. Submit a copy of the scheme to HUSD IT for approval prior to labeling.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Manufactured products, materials, equipment, and components shall be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer's specifications and printed instructions.

A. The installation of all system components shall be carried out under the direction of qualified personnel. Appearance shall be considered as important as mechanical and electrical efficiency. Workmanship shall meet or exceed industry standards.

3.2 INTENT OF DRAWINGS

A. The technology drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc., unless specifically dimensioned.

A. The contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable runway, and related components, according to the Contract Documents and subject to prior review by the HUSD and structured cabling engineer.

B. The contractor shall refer any conflicts within the Contract Documents to the Construction Manager and/or HUSD for resolution.

3.3 GROUNDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" and Section 27 05 26 for grounding conductors and connectors.

A. Comply with ANSI/TIA–607 and the National Electrical Code.

3.4 FIRESTOPPING

A. Comply with requirements in the National Building Code and the National Electrical Code.

A. Comply with Section 07 84 00 "Penetration Firestopping".

B. Use of putties, caulk or other permanent firestop materials is not allowed. Approved re-entrant stopping such as Easy-Path or CSFM approved products shall be used.

3.5 SERVICE CONTINUITY

A. Maintain continuity of communications services to all functioning portions of the process or buildings during hours of normal use.

A. Arrange temporary outages for cutover work with CM and HUSD IT. Keep outages to a minimum number and a minimum length of time in order to provide minimum impact.

3.6 LAYOUT AND TOLERANCES

A. Follow as closely as practicable the schematic design shown on the drawings. Make all necessary measurements in the field to verify exact locations and ensure precise location and fit of specified items in accordance with the drawings. Make no substantial alterations without prior approval of the HUSD and the Engineer.

3.7 CABLE TERMINATION AND TEST PLANS

A. General

1. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.

2. Properly calibrated and configured FLUKE test equipment shall be used.

3. *PASS test results will not be accepted. 100% of the installed copper and fiber cables must pass for full warranty by the manufacturer

4. The contractor shall obtain CM and HUSD approval for each termination and test plan prior to execution of the work.

5. This Section covers work necessary to furnish communications system testing, including the following:

a. Outside Plant (OSP) Cabling Infrastructure (Campus LAN/WAN extension)

b. Back–Bone Cabling Infrastructure

c. Horizontal Cabling Systems

6. Inspection Requirements:

a. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.

b. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.

7. Test Report Requirements – Each test report shall include the following sections:

a. Scope of testing

b. List of equipment used in the test with a photocopy of the factory calibration certificate.

c. List of technicians performing the tests identified in the scope of testing

d. All certification tests shall be submitted in FLUKE LinkWare format to the HUSD IT or its representative for final approval.

e. Summary of test results: Hardcopy and electronic copies of the summary forms are to be delivered at conclusion of the project before final payment will be made.

f. Individual test data sheets: The individual test data sheets shall be developed and completed by the contractor. Formatted output from cable scanners is typically acceptable provided they contain all of the test parameters including graphs of the information required by this Section.

B. Cable Termination Plans

1. Submit detailed termination plans for both fiber optic and twisted pair cables, which describe how each system component will be installed and terminated.

C. Cable Test Plans

1. Submit detailed test plans for both fiber optic and twisted–pair cable channels which include at least the following information:

a. Describe the tests to be performed.

b. Explain when and how each system component will be tested.

c. List the test equipment to be used.

d. Itemize how theoretical loss budgets and test parameters will be calculated and listed.

e. Provide an example of the test reporting documentation for each type of test, which provides a written verification of the results, as required in paragraph 2 below.

2. Provide testing documentation which includes:

a. Dates and times of test

b. Personnel performing tests

c. Initial test results

d. Description of discrepancies found or failure, if any

e. Corrective action, if any

f. Date and person performing corrections

g. Retest results, if required

h. Include space for HUSD's sign–off

i. Copy of test equipment calibration certificates

j. Intrabuilding (Vertical and Horizontal Subsystem) fiber optic segment post–installation test plan

3. Twisted–Pair Cable Tests: Testing shall be performed using a minimum Fluke DSX level IIIe tester, approved by the engineer and HUSD.

4. Twisted–Pair Test Plans: Provide separate post–installation test schemes for the following activities:

a. Backbone Subsystem twisted–pair segment test plan.

b. Horizontal Subsystem twisted–pair segment test plan.

5. Fiber–Optic Cable Tests: Testing shall be performed using a Fluke DSX level IIIe tester, with approved test–heads approved by the engineer and HUSD.

6. Fiber–Optic Test Plans: Provide separate post–installation test schemes for the following activities:

a. Backbone subsystem fiber–optic segment test plan.

b. Horizontal subsystem fiber–optic segment test plan.

3.8 TESTING AND INSPECTION OF COMMUNICATIONS EQUIPMENT

A. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.

1. Furnish all test equipment and instruments required for the tests.

2. Responsible, qualified employees of the contractor in the presence of the HUSD or an authorized representative shall perform the cable testing.

3. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.

3.9 FINAL TEST AND ADJUST

A. The contractor shall be responsible for post–installation performance testing of all cabling systems specified elsewhere in this Section of the Contract Documents.

1. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber, including space for sign–off by CM and HUSD.

2. Any cable links or fiber strands, which fail to meet performance test criteria, shall be re–terminated, re–connectorized, or replaced by the contractor free of charge.

3. Submit final field test documentation in Fluke native format viewable in Fluke LinkWarelist form, including the CM signature for HUSD approval.

B. Unshielded Twisted–Pair Cable System Testing

1. Permanent Link Test Configuration: Perform metered tests on each multi–pair twisted–pair and/or four–pair UTP cable through the wiring block, patch panel, at each end of the cable section and/or telecommunication outlet (T.O.). The permanent link test shall be undertaken as described in ANSI/TIA 568.2-D.

2. All testing shall be completed on the final installed Permanent Link with all terminations installed in the patch panel and faceplate.

3. Performance Testing:

a. Horizontal Cable System:

i. Use a minimum Fluke DSX Level IIIe field test instrument capable of the following swept/stepped frequency voltage measurements in accordance with the performance parameters required by ANSI/TIA 568.2-D

ii. Test each horizontal link to verify/determine, wire map, length, attenuation, skew, and near–end–crosstalk (NEXT) as described in ANSI/TIA 568.2-D.

b. Test Reports: Include field test results for each cable including cable link length in accordance with ANSI/TIA 568.2-D.

c. The test summary shall include:

i. All certification reports shall be submitted in native format for review in Fluke LinkWare. PDF's will not be accepted.

ii. Cable Identification as it appears on cable schedule.

iii. Cable identification as it appears on the individual test reports.

iv. Cable identification as it is labeled in accordance to the Specifications.

v. Pass/Fail Status.

vi. All test parameters shall appear on each test document including graphics and indicating each test parameter result.

vii. The individual test data sheet shall include the automated print out produced by the cable scanning equipment.

3.10 CONSTRUCTION REVIEW

A. The Engineer and HUSD will review and observe installation work to ensure compliance by the contractor with requirements of the Contract Documents.

A. The contractor shall inspect, and test completed communications installations to demonstrate specified performance levels including the following:

1. Furnish all instruments and personnel required for the inspections and tests.

2. Perform tests in the presence of the Engineer and HUSD.

3. Demonstrate that the system components operate in accordance with the Contract Documents.

B. Review, observation, assistance, and actions by the Engineer and HUSD shall not be construed as undertaking supervisory control of the work or of methods and means employed by the contractor. The Engineer and HUSD review and observation activities shall not relieve the contractor from the responsibilities of these Contract Documents.

C. The fact that the Engineer and HUSD does not make early discovery of faulty or omitted work shall not bar the HUSD from subsequently rejecting this work and withholding payment until the contractor makes the necessary corrections.

D. Regardless of when discovery and rejection are made, and regardless of when the contractor is ordered to correct such work, the contractor shall have no claim against the Engineer or HUSD for an increase in the Subcontract price, or for any payment on account of increased cost, damage, or loss.

3.11 PROJECT RECORD DOCUMENTS

A. Provide detailed project record documentation for sections listed in paragraph 1.1.C above, in addition to the standard requirements, within 30 days after completion of the work.

A. Maintain separate sets of redlined record drawings for the communications work, which show the exact placement, and identification of as–built system components. These are subject to weekly review by the CM, HUSD, or its representative.

B. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, and cross–connect equipment, etc.

C. Provide communication wiring and cabling record drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted–pair cables, splices, cable cross–connect termination locations, enclosures, telecommunications outlets, and cross–connect jumpers, patch cords, etc.

D. Provide network schematics when appropriate.

E. 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.

F. Cabling Administration Drawings: Show building floor plans with cabling administration–point labeling. Identify labeling convention and show labels for TR/IDFs, backbone pathways and cables, entrance pathways and cables.

3.12 CONTRACTOR REQUIREMENTS

A. General

1. Contractor shall be a current Panduit One^{SM} Partner, Silver and above, that has completed the Structured Cabling Deployment training. A copy of the corporate Panduit manufacturer certification shall be included with all bids.

2. Contractor shall have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.

3. Contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD) to sign–off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.

4. Contractor shall have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.

5. At least 30 percent of the technicians installing low–voltage copper systems on the job shall have a current Panduit Certified Copper Technicians certificate.

6. At least 30 percent of the technicians installing any Fiber Distribution Systems shall have a current Panduit Certified Fiber Technicians certificate.

7. The Telecommunications contractor shall provide a Project Manager to serve as the single point of contact to manage the installation, speak for the contractor and provide the following functions:

a. Initiate and coordinate tasks with the HUSD Project Manager and others as specified by the project schedule.

b. Provide day–to–day direction and–site supervision of Contractor personnel.

c. Ensure conformance with all contract and warranty provisions.

d. Acknowledge and remediate findings of HUSD weekly site project meetings.

e. This individual will remain Project Manager for the duration of the project. The contractor may change Project Manager only with the written approval of HUSD.

8. Contractor Project Manager on site shall have completed the Panduit Structured Cabling Deployment training and hold certificates for both copper and fiber.

B. References and Response Times

1. Communication Contractor shall provide with bid, a list of four (4) reference accounts where similar Data, Voice, Fiber Optic Cable, and related equipment installation work was performed within the last year (twelve–month period).

C. Termination of Services

1. HUSD reserves the right to terminate the Communication Contractor's services if at any time it is determined the Communication Contractor is not fulfilling their responsibilities as defined within this document and all associated project documentation.

2. Upon termination, the Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

3. Contractor's appearance and work ethic shall be of a professional manner. Dress shall be appropriate to the work being performed.

4. Conduct on HUSD property will be professional in nature.

5. Any person in the Contractor's employ working on a HUSD project considered by HUSD to be incompetent, disorderly, or for any other reason unsatisfactory or undesirable to IT, such person shall be removed from the HUSD project.

D. Other Contractor Responsibilities

1. Confirmation of Pathway and Cable Manager sizing:

a. Wherever cabling pathways or managers are installed, it is the Contractor's responsibility to confirm pathway or manager sizing to represent no more than 25% fill upon installation according to manufacturer's fill tables.

b. Pathways deemed overfilled upon installation will not be accepted and shall be remedied at Contractor expense.

2. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job.

3. All work areas will be cleaned at the conclusion of the HUSD and no tools or materials shall be left in a manner as to pose a safety hazard.

4. Projects are not considered finished and will not be paid by HUSD until all debris, dust, etc. has been cleaned and removed to the satisfaction of HUSD.

5. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory. Contractors shall consider this when placing bids.

6. Contractor shall abide by all HUSD Security Policies pertaining to access and conduct while on HUSD property.

7. Contractor shall obey all posted speed limits and parking regulations at the HUSD facilities where the work is being performed.

8. Contractor understands that illegally parked vehicles will be towed, and Contractor is responsible for and will assume all costs associated with towing.

3.13 DEFINITION OF ACCEPTANCE

A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

1. All submittals and documentation have been submitted, reviewed, and approved.

2. The complete system has successfully completed all testing requirements.

3. Warranty documentation has been submitted and approved by HUSD

B. All punch list items have been corrected and accepted.

END OF SECTION 27 05 00