
Intermediate Solicitation Document

ADDENDUM NO. 2

Fern Ridge School District No. 28J

88834 Territorial Rd.
Elmira, OR 97437

ADDENDUM NO. 2

April 8, 2016

RE: **ISD for Network Wiring Project**

ISD # 16-4

These addenda, together with the original ISD shall form the complete request for proposals. This addendum sets forth only the changes and additions, which are to be made in the original ISD. The original documents remain in full force and effect except as specifically modified in these addenda.

1. This addendum made changes to the ISD. **Attached** is a new ISD form.
 - a. Section A: Project description references this Addendum
 - b. Section B: Line 2 changes delivery date to June 20th
 - c. Section D: Evaluation factors changes description of upgradable
 - d. Part III Quotation form references this addendum
 - e. **This addendum changes the quotation deadline to 4/14/16.** All dates have been changed in the ISD to reflect this new date.
2. **Attached** are specification sections related to the work described in the ISD. These specifications are to assist in determining pricing for quotation
3. **Attached** is a drawing to show locations of WAPs and IDF rooms. This document is to assist in determining pricing for quotation
4. Please confirm receipt of this Addendum with Quanah Bennett, Fern Ridge School District at erate@fernridge.k12.or.us and acknowledge receipt of this addendum in section VI, Signature Page of the ISD.

END OF ADDENDUM NO. 2

INTERMEDIATE SOLICITATION DOCUMENT (“ISD”)

for

NETWORK WIRING PROJECT

ISD #16-4

Fern Ridge School District #28J (“District”)

Quotation Deadline: 4/14/16

For more information or for clarification of any part of this ISD, the **SOLE** District point of contact is Quanah Bennett; Fern Ridge School District #28J; 88834 Territorial Rd.; Elmira, OR, 97437 and Email: erate@fernridge.k12.or.us. **Information and clarification based on vendor inquiries will be posted at <http://www.fernridge.k12.or.us/technology/erate/>**

PART I.

STATEMENT OF WORK

A. DESCRIPTION OF PROJECT

Network Data Connections to support Wireless Access Ports in Ceilings

Install the necessary Cat6 wiring and hardware to support wireless access ports in the ceilings of (1) school site using PoE+ connections. Connections to return to one of 7 IDF/MDF closets at the school site, each connection with redundant wires, 10' slack loops at telecommunications room and 25' slack loops at destination. WAPS to be supplied by owner. Estimated drops; based on Addendum 2 Drawing and spec. District requires project pricing based on Addendum 2 Drawing and Specs. Mandatory Vendor walkthrough of the building will be held on March 23 at 4:00 PM. Meet at the District office, 88834 Territorial Rd.; Elmira, OR, 97437

Further questions will be publicly addressed at URL <http://www.fernridge.k12.or.us/technology/erate/>

This solicitation is part of the District’s e-rate process and the successful Vendor must be a registered service provider with the Schools and Libraries Division (SLD) of the Universal Service Administrative Company (USAC) and must have a valid Service Provider Identification Number (SPIN). Vendors that wish to submit a quotation and do not have a valid SPIN number, may apply for and receive the number prior to award of quotation. Acceptance of a contract will constitute agreement by vendor to meet all vendor requirements for the District to successfully process and receive the appropriate e-rate reimbursement.

B. SPECIFICATIONS

1. The District item descriptions and proposed quantities sought are listed on PART III. QUOTATION FORM. These are projected quantities and in no way commit the District to the purchase of any amount whatsoever.

2. Any awarded items shall be delivered on or after June 20th, 2016. Vendor submission shall show the

proposed delivery date and shall be part of the evaluation items.

3. All submissions shall include: A. Warranty coverage provided on all equipment purchased. Minimum basic maintenance shall be 1 year from the date of equipment delivery. B. Additional services included by Vendor/Reseller.

C. ADDITIONAL INFORMATION

1. Each Quotation shall be irrevocable for period of at least one hundred twenty (120) days from the Quotation Deadline and each vendor so agrees in submitting a Quotation.

2. Quotations submitted that require award of **“all or none”** of the items will **NOT** be considered. The District reserves the right to award to one or more vendors.

D. SPECIAL TERMS AND CONDITIONS

1. BRAND NAME

Manufacturer’s names and/or brand names used in these specifications are for the purpose of identification and a basis for quality, and do not expressly or implicitly require or in any way limit what brands may be quoted. Unless the vendor states otherwise, it is understood that Quotations are submitted on the specifications as described in this ISD. The District’s decision of alternate acceptability is final.

2. SILENCE OF SPECIFICATIONS

The apparent silence of the specifications and/or any supplemental specifications as to any detail, or the apparent omission of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and that only goods and workmanship of first quality are to be used. The District intends that vendors will furnish complete information for the Quotation. If any omitted specification results in ambiguity as to material characteristics of the goods, and inclusion is necessary to enable a reasonable person in the particular industry to properly identify such characteristics and respond with a complete Quotation then the vendor shall seek written request for clarification or change. Failure to make such a request is at the vendor’s risk, and the vendor shall be required to provide goods meeting the District’s needs with regard to any omitted specification for which a clarification or change should reasonably have been sought.

3. RESERVATION OF RIGHTS WITHOUT PREJUDICE

The District reserves the following rights (in the District’s sole discretion): to amend the ISD; to extend the deadline for submitting Quotations; to decide whether a Quotation does or does not substantially comply with the requirements of this ISD; to waive any minor irregularity, informality, or nonconformance with this ISD; to reject any Quotation that fails to substantially comply with prescribed ISD requirements and procedures; to cancel the ISD; and/or to award or not award any part or all parts of any Quotation.

PART II

QUOTATION SUBMITTAL PROCEDURES

A. GENERAL

1. The terms “contractor”, “offeror”, “vendor”, “company” “firm”, or “respondent” shall all refer to the company or individual submitting a Quotation.
2. The District shall not be responsible for any expenses and/or costs incurred by the vendor in submitting their Quotation. Each vendor does solely at that vendor’s own cost and expense.
3. Vendor accepts all risks of late delivery of or of mis-delivery, regardless of fault.

B. QUOTATION SUBMITTAL

1. The Quotation submitted shall be signed (where required) by a duly authorized representative of the vendor.
2. Alterations or erasures on the Quotation shall be initialed in ink by a duly authorized representative of the vendor.
3. Only one Quotation per vendor shall be submitted.
4. Vendor shall EMAIL a complete, signed Quotation (as an Adobe PDF file) to Quannah Bennett at erate@fernridge.k12.or.us no later than 2:00 pm on 4/14/16. The title **“Quotation for ISD #16- 4: Network Wiring Project”** should appear in the subject line of the Email.
5. The District assumes no responsibility for delays caused by any delivery service. Late submissions shall not be accepted and will be automatically disqualified from consideration. All Quotations and any accompanying documentation become the property of the District and will not be returned.
6. With the Quotation, the vendor shall certify to non-collusion practices on the Signature Page included as part of the ISD. The signature page must be executed by the member, officer or employee of the vendor who makes the final decision on prices and the amount offered in the Quotation.
7. With the Quotation, the vendor shall certify to non-discrimination in employment practices and by submitting a Quotation, the vendor certifies conformance to the applicable federal acts, executive orders, and Oregon statutes and regulations concerning affirmative action toward equal employment opportunities. All information and reports required by the Federal or Oregon state governments having responsibility for the enforcement of such laws shall be supplied to the District in compliance with such acts, regulation and orders.
8. With the Quotation, the vendor shall indicate in their status as a “resident” or “non- resident” on PART V. CERTIFICATIONS, in accordance with ORS 279A.120.

C. QUOTATION FORMAT

1. Information should be presented in a clear and concise manner. To provide consistency in the review of the Quotations, firms are requested to prepare their Quotation to be consistent with the following specified format:
2. Title Page. Vendor should identify the title of the Quotation, date of Quotation, name of company, address, telephone number, fax number, Email address and name of the primary contact.
3. A completed (signed in both sections) PART V. CERTIFICATIONS page.
4. A completed (signed) PART VI. SIGNATURE page.
5. A completed (properly filled out) PART III. QUOTATION FORM.
6. Additional information that will assist District in determining evaluation of product. The information may include, but not be limited to, confirmation the item meets specifications listed, confirmation the item is fully compatible with existing equipment, maintenance information, and any services available from Vendor/Reseller related to the purchase of equipment.

D. EVALUATION FACTORS

Quotations will be initially reviewed for completeness and compliance with the requirements of this ISD. Those Quotations “which are incomplete, which do not meet all requirements of the ISD, or otherwise deemed by District to be “non-responsive” will be rejected. Quotations considered complete, or “responsive”, will be reviewed further to determine if they comply with the administrative, contractual, and technical requirements of the ISD. If the Quotation is unclear, Vendor may be asked to provide written clarification. Committee will evaluate each responsive Quotation received; rating each responsive Quotation based on the following factors. The importance of each factor will be scored as follows:

FACTOR	Possible Points	Description
Pricing	40	Points based on Quotation
Warranty	20	Points based on Warranty provided
Support from Reseller	15	Describe support provided
Upgradeable	10	Upgrade pricing to Category 6A infrastructure (cable and patch panels.)
Timeline – completed by 8/15/16	15	Provide key date schedule including shipping time
<hr/>		
Total Possible Points	100	

PART III. QUOTATION FORM

Manufacturer’s names and/or brand names used in these specifications are for the purpose of identification and a basis for quality, and do not expressly or implicitly require or in any way limit what brands may be quoted. The District’s decision of ‘equal’ acceptability is final.

1. Please provide prices for the items below based on the description and the proposed order quantity.

Description	Proposed Order Quantity	Proposed Item Make/Model	Price Per Item	Expanded Price
Pricing based on Addendum 2 Drawing and Spec		Please provide breakdown quantities of cable, labor, parts		
Quotation Total				

2. Please state anticipated delivery date.

3. Please provide your USAC SPIN #: _____

PART IV

TERMS AND CONDITIONS

The Terms and Conditions hereto shall take priority over any other terms and conditions which may be submitted by a vendor pursuant to this ISD. These Terms and Conditions shall be deemed to supersede and replace any conflicting terms and conditions.

1. This District is tax exempt. Goods used hereon are for the exclusive use of this District. Federal Identification No. 93-6000600.
2. No alteration in any of the terms, conditions, delivery, price, quality, quantities or specifications will be effective without the prior **written** consent of the District.
3. No charges will be allowed for handling which includes, but is not limited to, packing, wrapping, bags, containers or reels, etc. unless specifically stated herein.
4. No exception to delivery dates shall be allowed unless prior written approval is first obtained from the Purchasing Office. The District reserves the right to cancel any undelivered portion of this order.
5. Time of delivery is of the essence and the District reserves the right to cancel any undelivered portion of this order for failure by the vendor to deliver on time. Vendor assumes responsibility of delay notwithstanding the cause.
6. All payments to the vendor shall be remitted by mail. The District shall not honor drafts, nor accept goods on a site draft basis. Furthermore, the provisions or monies due under the contract, if any, shall not be assignable.
7. **SHIPPING INSTRUCTIONS:** Unless otherwise specified herein, all goods are to be shipped **prepaid, F.O.B. destination.** Where specific authorization is granted to ship goods F.O.B. shipping point, vendor agrees to prepay all shipping charges, route cheapest common carrier, and to bill the District as a separate item on the invoice for said charges. It is also agreed that the District will refuse to accept any C.O.D. shipment.
8. All goods or materials purchased herein are subject to the approval of the District. Any rejections of goods or materials, whether held by the District or returned, will be at the vendor's risk and expense.
9. All invoices, packing lists, packages, shipping notices, and any other written document affecting the contract, if any, shall contain the applicable purchase order number. Packing list(s) shall be enclosed with each and every shipment pursuant to the contract, if any, indicating the content therein. Each container (box, bag, etc.) shall show the purchase order number.
10. The vendor agrees to protect the District against all claims, suits, or proceedings for patent, trademark, copyright, or franchise infringement arising from the purchase, installation or use of the goods and materials purchased herein, if any. The vendor further agrees to assume all expenses and damages arising from such claims, suits or proceedings.

11. Vendor agrees that the waiver, acceptance, or failure by the District to enforce any provisions, terms or conditions of the contract, if any, shall not operate or be construed as a waiver of prior or subsequent breaches or the right of the District to thereafter enforce such provisions.
12. The vendor warrants all articles supplied under the contract, if any, to conform to specifications herein, to be fit and sufficient for the purposes manufactured, merchantable, of good material and workmanship, and free from defects.
13. In the event that the District is entitled to a cash discount, the period of computation shall commence on the date of delivery, or receipt of correctly completed invoices, whichever is **later**. If an adjustment in payment is necessary due to damage, the cash discount period shall commence on the date final approval for payment is authorized.
14. Vendor warrants and represents that all the goods and material contained herein are free and clear of all liens, claims or encumbrances of any kind whatsoever.
15. Vendor agrees to bear all risks of loss, injury or destruction of goods and materials ordered herein which occur prior to delivery and such loss, injury or destruction shall not release vendor from any obligation hereunder.
16. The vendor agrees not to discriminate against any client, employee or applicant for employment or for services, because of race, color, religion, sex, national origin, physical or mental handicap, sexual orientation or age unless based upon bona fide occupational qualifications with regard to, but not limited to, the following: employment up-grading, demotion or transfer; recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; selection for training; and/or rendition of services. It is further understood that any vendor who is in violation of this clause shall be barred forthwith from receiving awards of any purchase order from the District, unless a satisfactory showing is made that discriminatory practices have terminated and that a recurrence of such acts is unlikely
17. In the event of a breach by the vendor of any of the provisions of the contract, if any, the District reserves the right to cancel and terminate the contract, if any, forthwith upon giving oral and written notice to the vendor.
18. Vendor agrees to accept for credit, repair or replacement, at no charge, any items received defective by the District or proven defective during the agreed warranty period and period and to be responsible for ALL transportation costs for return thereof to the vendor and, when repaired or replaced, the return thereof to the District.
19. This order will not be accepted if it contains any hazardous materials and arrives without labeling meeting Oregon Administrative Rule 437, Oregon Occupational and Health Division. The shipment must include Material Safety Data Sheets (MSDS).
20. DEBARMENT CERTIFICATION The vendor certifies that the vendor is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in the contract, if any, by any Federal department or agency. If requested by the District,
21. The vendor shall complete a Certification Regarding Debarment, Suspension, Ineligibility, and

Voluntary Exclusion form. Any such form completed by the vendor for the contract, if any, shall be incorporated into the contract, if any, by reference.

22. DISPUTE RESOLUTION

22.1 Litigation. Any claim, action, suit, or proceeding (collectively, "Claim") between the District and vendor that arises from or relates to the contract, if any, shall be brought and conducted solely and exclusively within the Circuit Court of Lane County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the District of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the eleventh amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. **VENDOR BY EXECUTION OF THE CONTRACT, IF ANY, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION 22.1.**

22.2 Governing Law. The contract, if any, shall be governed by and construed in accordance with the laws of the State of Oregon without regard to principles of conflict of laws.

23. The vendor agrees that the provisions of ORS 279C.515 to 279C.545 and 279C.800 to 279C.970 pertaining to prevailing wage rates will be included in the Agreement/Quotation if applicable.

PART V

CERTIFICATIONS

ISD 16-4 NETWORK WIRING PROJECT

BOTH SECTIONS MUST BE COMPLETED NON-DISCRIMINATION CLAUSE

The vendor agrees not to discriminate against any client, employee, or applicant for employment or services, because of race, color, religion, sex, national origin, physical or mental handicap, sexual orientation or age unless based upon bona fide occupational qualifications with regard to, but not limited to, the following: employment upgrading, demotion or transfer, recruitment or recruitment advertising, layoffs or termination, rates of pay or other forms of compensation, selection for training, and/or rendition of services. It is further understood that any vendor who is in violation of this clause shall be barred from receiving awards of any purchase order from the District, unless a satisfactory showing is made that discriminatory practices have terminated and that a recurrence of such acts is unlikely.

Legal Name of Vendor: _____

DBA Name (if applicable): _____

Address: _____

Officer's Signature: _____

Print Name and Title: _____

RESIDENT CERTIFICATE

Please Check One:

_____ Resident Vendor: Vendor has paid unemployment taxes or income taxes in this state during the last twelve calendar months immediately preceding the submission of this Quotation, has a business address in this state and has stated in this Quotation whether the bidder is a "resident bidder" under ORS279A.120(1)(b).

OR

_____ Non-Resident Vendor: Vendor does not qualify under requirements stated above.

Please specify your state of residence: _____

Officer's Signature: _____

Type or Print Officer's Name: _____

PART VI

SIGNATURE PAGE

ISD 16-4 NETWORK WIRING PROJECT

The undersigned proposes to furnish all goods as described, for the price(s) stated, and that all articles supplied under any resultant contract will conform to the specifications herein, to be fit and sufficient for the purpose manufactured, merchantable, of good material and workmanship, and free from defect.

The undersigned agrees to be bound by all applicable laws and regulations, the accompanying specifications, and by District policies and regulations.

The undersigned, by submitting a Quotation, represents that:

A. The vendor has read and understands the specifications and the Quotation is made in accordance herewith.

B. The Quotation is based upon the materials required by the specifications unless otherwise noted. Failure to comply with the specifications or any terms of this ISD may disqualify the vendor as being non-responsive.

The undersigned certifies that the Quotation has been arrived at by the vendor independently and has been submitted without any collusion designed to limit independent responses or competition.

The undersigned Respondent certifies that he has received and duly considered all addenda to the specifications and that all costs associated with all addenda have been included in this Response:

Addenda: No. _____ to No. _____ inclusive.

We therefore offer and make this Quotation on furnishing the following goods at the prices indicated hereon in fulfillment of the specifications of the District.

Legal Name of Firm: _____

DBA Name (if applicable): _____

Address: _____

Telephone Number: _____ FAX Number: _____

E-Mail: _____ Federal ID Number: _____

Officer's Signature: _____ Date: _____

Print Name and Title: _____

ELMIRA HIGH SCHOOL
FERN RIDGE SCHOOL DISTRICT
ELMIRA, OREGON

NETWORK WIRING PROJECT

ISD #16-4:
APRIL 7, 2016

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SECTION 271513	COMMUNICATIONS COPPER HORIZONTAL CABLING

SECTION 270000 - COMMUNICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Division 27 – Communications governs the infrastructure for the low-voltage information transport systems, which include voice and data and their pathways.
- B. The Scope of Work covered by this document is to furnish and install the Structured Cabling Systems (SCS) for existing portions of Elmira High School. This work will provide the SCS for Wireless Access Points.
- C. Description of Work:
 - 1. Furnish and install materials for the Wireless Access Point infrastructure systems as specified herein and as shown on the Drawings. Upon completion, the systems shall be functioning in compliance with performance requirements specified.
 - 2. The cabling specified and shown on the Drawings is for complete, performance based, workable systems. Deviations from the cabling shown due to a particular manufacturer's requirements shall be made only with the written approval of the Architect and the Owner, and at no additional cost to the Owner.
- D. Telecommunications system shall include the following systems:
 - 1. Structured Cabling System (SCS) For Telecommunications Systems
 - 2. Pathways for Telecommunications Systems
 - 3. Grounding and Bonding System (GBS) For Telecommunications Systems
 - 4. Firestopping for Telecommunications Systems

1.2 SECTION INCLUDES

- A. Related Documents, Codes, and Sections
- B. Abbreviations, Acronyms and Definitions
- C. Project Drawings
- D. Quality Assurance
- E. Submittal Requirements
- F. Additional Requirements

1.3 RELATED DOCUMENTS AND CODES

- A. Comply with the referenced codes and standards and with the Contract Documents. Where conflicts occur, the more stringent shall apply.

- B. The latest versions, including addenda, as enforced by the local authority having jurisdiction of the following codes, associations, acts and agencies:
 - 1. Federal Communications Commission (FCC)
 - 2. National Fire Protection Association (NFPA), specifically:
 - a. NFPA 70, National Electrical Code® (NEC®)
 - b. NFPA 72, National Fire Alarm Code®
 - c. NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
 - d. NFPA 101, Life Safety Code®
 - e. NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
 - f. NFPA 780, Standard for the Installation of Lightning Protection Systems,
 - g. NFPA 5000™, Building Construction and Safety Code
 - 3. National Electrical Safety Code (NESC)
 - 4. Occupational Safety and Health Administration (OSHA)

- C. The following standards:
 - 1. American National Standards Institute (ANSI)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Telecommunications Industries Association (TIA), specifically:
 - a. TIA TSB-125, Guidelines for Maintaining Optical Fiber Polarity through Reverse-Pair Positioning
 - b. TIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
 - c. TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7
 - d. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
 - e. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
 - f. ANSI/TIA-568-C.2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components
 - g. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard
 - h. ANSI/TIA-569-B, Commercial Building Standards for Telecommunications Pathways and Spaces
 - i. ANSI/TIA-598-C, Optical Fiber Cable Color Coding
 - j. ANSI/TIA-604.2-A, FOCIS 2—Fiber Optic Connector Intermateability Standard

- k. ANSI/TIA-606, Administration Standard for Commercial Telecommunications Infrastructures
 - l. ANSI/TIA/607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - m. ANSI/TIA-758-A, Customer-owned Outside Plant Telecommunications Infrastructure Standard
 - n. ANSI/TIA-854-A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling,
 - o. ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems
4. Other Reference Materials
- a. ANSI/NECA/GICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling
 - b. BICSI Outside Plant Design Reference Manual (COOSP)
 - c. BICSI Electronic Safety and Security Reference Manual (ESSDRM)
 - d. BICSI Information Transport Systems Installation Methods Manual (ITSIM)
 - e. BICSI Network Design Reference Manual (NDRM)
 - f. BICSI Telecommunications Distribution Methods Manual (TDMM)
 - g. BICSI Wireless Design Reference Manual (WDRM)
 - h. Institute of Electrical and Electronic Engineers (IEEE)
 - i. National Electrical Manufacturers Association (NEMA)
 - j. Underwriters Laboratories (UL[®]) Cable Certification and Follow Up Program
 - k. American Standards Association (ASA)

1.4 RELATED SECTIONS

- A. Section 270500 – Common Work Results for Communications
- B. Section 270513 – Communications Services
- C. Section 270528 – Pathways for Communications Systems
- D. Section 270528.29 - Hangers and Supports for Communications Systems
- E. Section 270528.39 - Surface Raceways for Communications Systems
- F. Section 270553 – Identification for Communication Systems
- G. Section 270800 – Commissioning of Communications
- H. Section 271100 – Communications Equipment Room Fittings
- I. Section 271119 – Communications Terminations Blocks and Patch panels
- J. Section 271123 – Communications Cable Management and Ladder Rack
- K. Section 271513 – Communications Copper Horizontal Cabling

1.5 ABBREVIATIONS and ACRONYMS

AFF	Above Finished Floor
AWG	American Wire Gauge
BICSI	Building Industry Consulting Services International
CAT5e	Category 5e Copper Cable

CAT6	Category 6 Copper Cable
CAT6A	Category 6A Copper Cable
CMGC	Construction Manager/General Contractor
CMP	Communications Multipurpose Plenum: cable rating
CMR	Communications Multipurpose Riser: cable rating
ELFEXT	Equal-Level Far-End Crosstalk
FEXT	Far End Crosstalk
Gbps	Gigabits per second
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intermediate Distribution Frame - Termination frames, relay racks, and cable management
Mbps	Megabits per second
MDF	Main Distribution Frame, consisting of carrier entrance rooms and head-end
MMF	Multi-mode fiber optic cable, 50/125 μ m or 62.5/125 μ m laser optimized core
NEXT	Near End Cross Talk
OSHA	Occupational Safety and Health Act
PDS	Premises Distribution Systems (See SCS.)
PoE	Power over Ethernet
SCS	Structured Cabling System
SFF	Small Form Factor
SMF	Single-mode fiber optics, 8.3 micron core
TE	Telecommunications Enclosure
TIA	Telecommunications Industry Association
TR	Telecommunications Room
UL [®]	Underwriters Laboratory
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VoIP	Voice over Internet Protocol
WAO	Work Area Outlet
WAN	Wide Area Network

1.6 DEFINITIONS

Advanced System Warranty – an extended warranty held either by the connectivity or cabling manufacturer directly with the Owner for this project that guarantees product and performance of the entire cabling system for the warranty period

Building Backbone Cabling –Building backbone cabling carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling includes fiber optic and copper cabling.

Building Distributor (BD) – Termination point from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF There is one BD for each building and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet).

Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling

almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

Category 6 (Cat 6) – A category of transmission performance that specifies electrical properties up to 250 MHz. Refer to ANSI/TIA/568 family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements.

Category 6A – A category of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to ANSI/TIA/568 family of standards for more information on Category 6

Certification – The testing and documentation of the transmission performance (e.g., Category 6) of a permanent link or channel, based on sweep frequency testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of installation.

Conduit - A raceway of circular cross-section.

Conveniently Accessible - being capable of being reached from floor or use of 8' step ladder without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work

Entrance Facility (EF) – Termination point of service provider cables that have entered the building and location of service demarcation point and interconnection point to the network.

Entrance Room – A space in which the joining of campus and building telecommunications backbone facilities takes place

Equipment Room – An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate crossconnect, as well as video surveillance and security equipment

Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.

Lead Telecommunications Installer –the project manager for the Telecommunications Subcontractor for all telecommunications work in the construction documents (Power & Signal Drawings and specification Section 27), who shall be on-site at all times while Division 27 work is being performed. This individual shall attend all construction project meetings.

Listed Communications Cable – A cable listed by the Underwriters Laboratory (UL[®]) and accepted by the local authority having jurisdiction as having met appropriate designated standards or has been tested and found suitable for installation in specific spaces. Refer to NEC[®] Section 800 for listing

types and additional requirements.

MDF – Main Distribution Frame, also known as the Main Equipment Room.

Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept is based on the assumption that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed and the electrical characteristics of the permanent link will remain unaltered.

Owner – Fern Ridge School District

Owner’s Representative – An entity assigned to represent the Owner in all matters pertaining to this project. Used synonymously with “Owner”.

Plenum -A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

Plenum-rated – listed by the Underwriters Laboratory as being suitable for installation into a plenum space. Communications cabling routed through plenum-rated space shall be plenum-rated and identified as Type CMP

Point of Entrance (Building Entrance) - The point within a building at which the Outside Plant (OSP) communications wire or cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit (Type RMC) or an intermediate metal conduit (Type IMC) connected by a grounding conductor to an electrode in accordance with the NEC®.

Raceway - Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

Subcontractor, Telecommunications – entity responsible for all telecommunications work in the construction documents (Power & Signal Drawings and specification sections 27 0000 through 27 5313)

Telecommunications – in general, telecommunications refers to infrastructure/equipment needed for the voice, data, and video communications and transport systems.

Telecommunications Room - An environmentally enclosed architectural space designed to contain telecommunications equipment, cable terminations, or crossconnect cabling. The Main Equipment Room may also be known as the MDF, and may be co-located with the building’s Entrance Room and Equipment Room. Telecommunications Rooms will also house equipment for additional systems, such as security, cable television, and audio/video.

1.7 PROJECT DRAWINGS

- A. General Drawing Specifications: Detail and elevation Drawings shall be D size (24” x 36”) with a minimum scale of 1/4” = 1’0” or larger. ER, TR and other enlarged detail floor plan Drawings shall

be D size (24" x 36") with a minimum scale of 1/4" = 1'0" or larger. Building composite floor plan Drawings shall be D size (24" x 36") with a minimum scale of 1/8" = 1' 0".

- B. Building composite floor plans: Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations. Identify WAO/WAPs's that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for Owners Representative's consideration.
- C. Telecommunications space plans/elevations: Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.
- D. Logical Drawings: Provide logical riser or schematic Drawings for all systems. Include schematic symbol key.

1.8 QUALITY ASSURANCE

A. Telecommunications Subcontractor Qualifications

1. Company Requirements

- a. The Telecommunications Subcontractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications.
- b. Telecommunications Systems specified shall be assembled and installed under the direction of a qualified Telecommunications Subcontractor. Qualification requirements shall include submittal by the Telecommunications Subcontractor to the Architect of the following:
- c. List of previous projects of this scope and nature, including names and sizes of projects (to include square footage and construction cost – overall and that of the Telecommunications Subcontractor), description of work, times of completion, and names of contact persons for reference.
- d. Installers shall certify that they are manufacturer-authorized or trained for work to be performed.

2. Lead Telecommunications Installer Requirements:

- a. Lead Communications Installer shall be a current member of BICSI in good standing and have completed (at a minimum) BICSI ITS Installer 2 Training (for both copper and fiber).
- b. Submit certificate of ITS Installer 2 Training (or higher) with bid and preconstruction submittal package.
- c. Advanced training from connectivity manufacturer may be submitted in lieu of BICSI ITS Installer 2 Training. Submit manufacturer training certificates for review by

Owner as substitution request as part of Pre- Bid questions. This training must be by the same manufacturer that will hold the Advanced System Warranty.

3. General Telecommunications Installer Requirements:

- a. For all work associated with Specification Sections 27 all installers are to have a minimum of BICSI ITS Installer 1 Training or equivalent training from the connectivity manufacturer.
 - b. Submit a list with bid of names of all installers and appropriate copies of certificates verifying training with pre-construction submittal package.
- B. When articles, materials, operations or methods related to execution of communications work are noted, specified, or described in the specifications or are indicated or reasonably implied on Drawings and schedules, execute work as required or appropriate to provide complete and proper function, operation and installation.
- C. The Drawings utilize symbols and schematic diagrams to indicate items of work. These symbols and diagrams will not typically identify dimensions nor will they identify inclusion of specific accessories, appurtenances and related items necessary and appropriate for a complete and proper installation and operation. The Telecommunications Subcontractor shall install work complete and ready for proper operation, including related items not specifically identified, shown, indicated or specified. The work shall be installed, in accordance with the intent diagrammatically expressed on the Drawings, and in conformity with the dimensions indicated on architectural Drawings and on shop Drawings approved by the Owner.
- D. The Drawings include details for various items, which are specific with regard to the dimensions and positioning of the work. These details are intended only for the purpose of establishing general feasibility; they do not obviate field coordination for the indicated work. Work shall not proceed until actual field conditions and requirements are verified by the Telecommunications Subcontractor.
- E. The Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions.

1.9 WARRANTY

- A. Warranty Requirements: Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other 27xxx sections for specific additional warranty requirements that exceed or are in addition to those of this section.
- B. Contractor warranty: Provide all services, materials and equipment necessary for successful operation of entire SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, and configuration required to maintain a complete and operable system. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date

Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period.

The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty.

C. Project Warranty

1. Equipment and materials required for installation under these specifications shall be the current model and new (less than one year from date of manufacture), unused and without blemish or defect, and are to be guaranteed to be free from defect.
2. When a defect or problem is observed within the first year after substantial completion, the Owner will notify the governing subcontractor through the proper channels. The appropriate Subcontractor then has 48 hours to fix the defect or furnish and install a replacement part/system, all at no cost to the project or Owner.

D. Advanced System Warranty for Telecommunications (Copper and Fiber Systems)

1. Beyond the initial one year project warranty, the Telecommunications Systems shall be warranted for a minimum of 20 years by a national and reputable connectivity or cabling manufacturer.
 - a. This warranty shall cover any material defect, as well as the performance of the cabling system. (Example: A Category 6A cabling system is to deliver 10,000BASE-T speed, or 10 "Gig" performance for the entire length of the warranty period.)
 - b. This warranty shall cover both material and labor for the full length of the warranty period.
2. The Telecommunications Subcontract shall be certified by this manufacturer.
3. The following manufacturers are conditionally approved to provide the system warranties (subject to specific project requirements):
 - a. Copper Connectivity Manufacturers
 - b. TE/AMP
 - c. CommScope (Systimax® or Uniprise®)
 - d. Panduit
 - e. Fiber Connectivity Manufacturers
 - f. TE/AMP
 - g. CommScope (Systimax® or Uniprise®)
 - h. Panduit
 - i. Cabling Manufacturers
 - j. TE/AMP
 - k. CommScope (Systimax® or Uniprise®)
 - l. Belden

m. General (for Panduit product Set)

E. Owner's rights: This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.

1.10 SUBSTITUTIONS

A. Substitution requests: Substitution requests will be considered only if submitted to Owner's Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner's Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner's Representative.

B. Rejection: For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner's Representative to reject proposed substitution requests and submissions of alternates without review or justification.

1.11 SUBMITTALS

A. General Requirements

1. Owner is to review all submittals related to Division 27 work. This includes, but is not limited to, relevant:

- a. Pre-bid questions
- b. Contractor and personnel qualifications with bid
- c. Voluntary alternates and unit pricings with bid
- d. Pre-construction product submittals and shop Drawings
- e. Change order requests, requests for information (RFIs), design change directives (DCDs), and any other changes as directed by the architect/engineer.

2. Allow a minimum of one week (five working days) for the Owner to review.

B. The following submittals are due at the Pre-Bid deadline for questions:

1. Requests for product substitution shall be in accordance with this document.
2. All products seeking approval either as "approved equivalent" or otherwise, shall be submitted as a product substitution request prior to bid. Failure to submit product substitution request in a timely manner (before pre-bid questions are due) may preclude product from being utilized on the project. Requests made with bid or post-bid will not be considered without a significant cost savings realized to the Owner.
3. The burden of proof is on the contractor to provide documentation that equivalent product meets the specifications and project requirements. Include in substitution request:
4. Product being replaced

5. Reason for product substitution
6. Full manufacturer specification sheet clearly indicating that all requirements in project documents have been met
7. Failure to meet these requirements will result in the product substitution request being returned without review.
8. All product substitution requests are to be reviewed and approved by the Owner. Not all requests will be approved, and all decisions are final, without recourse.

C. The following submittals are due with the Bid:

1. Proof of Telecommunications Subcontractor and personnel qualifications
 - a. Provide a typed list with the following information:
 - b. Company name of Telecommunications Subcontractor
 - c. List of connectivity or cabling manufacturers that the Telecommunications Subcontractor is certified to install and provide advanced warranty for.
 - d. List of previous projects (minimum of 3) of this scope and nature, including:
 - 1) Project name and date of completion
 - 2) Project size (square feet of building, total construction cost, total cost of telecommunications scope)
 - 3) Name and contact information for building owner or IT Manager
 - 4) Name and contact information for Lead Telecommunications Installer
 - 5) Provide certificates or letter(s) from BICSI and / or manufacturers verifying by name these qualifications have been met.
 - 6) Refer to Quality Assurance subsection in this specification section for additional requirements and qualifications.
2. Voluntary alternatives (that realize substantial cost savings)
3. Unit pricing for the following items:
 - a. All unit pricing relating to Division 27 as identified in these documents and accompanying T series Drawings.

D. The following submittals are due at the Pre-Construction Phase (to be delivered to the Owner):

1. General Requirements:
 - a. Follow submission guidelines as outlined in this section.
 - b. Strictly electronic submission to Owner is acceptable.
 - c. Ensure a cover page with Project Title, Telecommunication Subcontractor Company, and point of contact is included for all physical submittals.
 - d. Updated Personnel Qualifications
 - e. Provide a list of names of all telecommunications installers with appropriate certificates from BICSI or the manufacturer.

2. Product Information, divided by Specification Section and in order as listed in specification. Identify the start of each specification section.
 - a. Provide manufacturer's product information cutsheet or specifications sheet with the specific product number identified or filled out.
 - b. Submitted cutsheets without specific product identified will result in the whole submittal being returned without review.
 - c. No product substitutions will be considered post bid without a significant cost savings to the project to be realized by the owner – a minimum of \$1000, either in material or labor savings. For any product substitution requests post-bid, Telecommunications Subcontractor shall submit an RFI through the proper channels with the requested documentation from the Pre-bid requirements above. Also, include realized cost savings. The project team may issue a change order (or its equivalent) for the product change at their discretion.
 - 1) One exception to this is if the specified product goes out of production and is unavailable before submitted shop Drawings are approved. Telecommunications or Subcontractor is to submit an RFI explaining the situation and recommending an equivalent product with the same features at no cost change to the project or Owner.
 - 2) Other exceptions may be considered. Telecommunications Subcontractor is to submit an RFI explaining the situation.
3. Shop Drawings
 - a. Generate electronic shop Drawings in AutoCAD®, dwg file format, version 2004 (or newer), saved to disk (CD-R or DVD+/-R) or USB Flash Drive with project name and number clearly indicated [or uploaded to project website]. Shop Drawings shall include Telecommunications or Subcontractor title block and included readily printable Plot/Drawing tabs with mview-window at a scale to not be less than 1/8"=1'-0" unless otherwise noted. The scale shall also be indicated on the Drawings.
 - b. Acceptable electronic shop drawing sizes include:
 - 1) 8.5"x11"
 - 3) 11"x17"
 - 4) 22"x34" or
 - 5) 24"x36".
 - c. Refer to individual sections for additional requirements.
 - d. Communications pathways
 - e. Hangers and Supports – indicate proposed routing of all cabling supported by J-hooks.
 - f. Cable Trays - indicate size and proposed routing of all communications cable trays; should any of those locations or sizes differ from the construction Drawings due to minor coordination issues, cloud the affected area and note why the change is necessary. (For major coordination issues, please submit an RFI.)

Drawings or contained in specifications. Comply with all contract documents, specifications, Drawings, manufacturer's instructions, and Owner and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify owner's representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from owner's representative.

1.13 DELIVERY STORAGE AND HANDLING

- A. General: Owner will, at Contractor's request, provide appropriate space on site for Contractor trailer or job box; however, Contractor shall be responsible for the deliveries, storing and handling of all materials relative to the SCS systems, including materials supplied by others that are part of the SCS installation contract. Material shall be stored and protected according to manufacturer's instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

1.14 PERMITS AND INSPECTIONS

- A. General: All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.
- B. Contractor shall obtain and pay for all licenses, permits, and inspection fees required by local agencies and/or other agencies having jurisdiction. Copies of all permits shall be delivered electronically to the Owner.
- C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.
- D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to Owner prior to request for Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations.
- E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.
- F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the National Electrical Code and other applicable sections of the National Fire Code, as published by the National Fire Protection Association (NFPA).
- G. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).

- H. All work shall comply with the TIA Standards listed in this document.

1.15 EXAMINATION

- A. General: Prior to submitting a proposal, Contractor shall examine site, review Project Drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.
- B. Bidders' questions: Should bidders have questions as to intent of Drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to the Owner in manner dictated by the Owner. All answers and clarifications to Drawings and specifications will be issued in writing.
- C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.16 ADDITIONAL COSTS

- A. General: Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.
- B. Inspections and testing: For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by Owner or Architect/Engineer to verify Project compliance for same material or equipment, Owner reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions. Owner will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. Owner reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.
- C. Exclusions: Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.
- B. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer and part number.
- C. All products and materials shall be new and unused prior to their installation as part of this project. Refurbished items are not allowed.

PART 3 - EXECUTION

1 GENERAL

- A. Coordinate with all other trades prior to installation.
 - 1. Telecommunications Subcontractor shall meet with Electrical, Mechanical, and General Contractors prior to construction to identify pathway and infrastructure space requirements.
 - a. At a minimum, the following items shall be discussed:
 - b. Cable tray locations and clearance space above (12" if possible, with proper coordination)
 - c. Placement for sleeving and wall penetrations
 - d. In-ceiling projection screens and other audio/video equipment
 - e. Failure to coordinate sufficient space for telecommunications infrastructure shall result in relocation of various systems by the contractor at no additional cost to owner.
 - 2. Prior to the start of work, the Telecommunications Subcontractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where Division 27 work may properly commence. Start of work indicates acceptance of conditions.
 - 3. Coordinate location of equipment and conduit with other trades to minimize interference.
 - a. Holes through concrete and masonry structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base building.
 - b. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the General Contractor as required by limited working space.
 - c. Holes shall be located so as not to affect structural sections such as ribs or beams.
 - d. Holes shall be laid out in advance. The General Contractor shall be advised prior to drilling through structural sections, for determination of proper layout.

- e. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors, provide an effective barrier against the spread of fire, smoke and gases.
- B. Follow all manufacturers' instructions and install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.
1. In the event of discrepancy, immediately notify the Owner through the proper channels. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.
- C. Protection of Systems and Equipment
1. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.
 2. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on sides with securely fastened protective rigid or flexible waterproof coverings.
 3. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum-cleaned both inside (as appropriate) and outside before testing, operating or painting.
- D. As determined by the Owner, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Owner shall be final.
- E. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.
- F. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.
- G. Access to Equipment
1. Equipment shall be installed as per the scaled detail on the Power & Signal Drawings.
 2. Working spaces shall be not less than specified in the National Electrical Code® for voltages specified.
 3. Where the Owner determines that the Telecommunications Subcontractor has installed equipment not "conveniently accessible" for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Owner, at no additional cost to the Owner.
- H. Cleaning
1. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

2. Remove dust and debris from interiors and exteriors of telecommunications equipment (including electrical rough-in). Clean accessible current carrying elements prior to being energized.

I. Completion

1. General:
 - a. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.
2. Results Expected:
 - a. Systems shall be complete and operational.
 - b. Cleaning work shall be complete.
3. Testing and Verification – General Requirements
 - a. Refer to individual sections for additional testing and verification requirements.
 - b. The Telecommunications Subcontractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.
 - c. Verification by Inspection: Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the specifications.
 - d. Verification by Test and Demonstration: The Telecommunications Subcontractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Communications Subcontractor shall demonstrate that the communications systems components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test".
 - e. Perform system operation tests after full enclosure of walls.
 - f. System Operation Tests Conducted Upon Completion of Work: Upon completion of the Telecommunications Subcontractor's Work, subject the system to functional and operational tests. When required corrections determined by initial test results have been completed, fully retest the system. The Owner shall be notified in writing not less than seven days in advance of date of proposed final testing and inspection. The advance notice shall include certification that the installation is complete and operable and that the Telecommunications Subcontractor has satisfactorily performed the final tests specified herein.
 - g. The acceptance testing and final inspection shall be accomplished in the presence of the Owner. At least 10 days prior to scheduled system completion, the Telecommunications Subcontractor shall submit, for approval by Owner, a test plan to completely test the telecommunications system. The Telecommunications Subcontractor shall include in test plan, for acceptance by the Owner, a complete and detailed final acceptance test check-off list ("punch list"). The list shall be a complete representation of specified functions and conditions.

4. Commissioning

- a. There shall be three phases of commissioning:
- b. Rough-in inspection
- c. Above-ceiling inspection (after cables are placed)
- d. Final inspection
- e. At a minimum, the Owner shall check the following items:
- f. Accurate location and height above finished floor for all outlet boxes
- g. Accurate dimensions (particularly depth) of all outlet boxes and diameter of in-wall conduit serving outlet boxes
- h. Cable tray size, location, and clearance
- i. Location and size of all other communications conduits or pathways
- j. That power receptacles within the communications rooms meet the design requirements
- k. The Owner is then to issue a written report to the Architect identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed.
- l. This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.
- m. Once all communication cabling has been installed and properly supported and walls have been painted, but prior to the installation of ceiling tiles/material, the Owner shall schedule a time to be on-site to conduct above-ceiling inspection. At a minimum, the Owner shall check the following items:
 - n. That all items from the previous inspection have been corrected
 - o. That communications cabling is routed correctly and adequately supported
 - p. That communications cabling is not painted or over sprayed
 - q. That the installed communications cabling matches what was specified / submitted
 - r. That there are no kinks, splices, or other damage to the installed communications cabling
- s. The Owner is then to issue a written report to the General Contractor identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed. This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.
- t. Once all communications work has been completed, contractor shall request final inspection. This request shall be made 3 weeks before substantial completion. The Owner shall then schedule a time to be on-site to conduct this inspection. At a minimum, the Owner shall check the following items:
 - u. That all items from the previous inspections have been corrected
 - v. That all faceplates are installed, with the correct modules, quantity of modules, and approved labeling scheme
- w. That all equipment and cabling within communications rooms is installed per the contract documents, including all patch panels and wall blocks (with specified spare

capacity), horizontal and backbone cabling labeling, and telecommunications grounding.

- x. And all other items necessary to guarantee contract documents are met and complete and functioning communications systems are installed.
- y. The Owner is then to issue a written report to the Architect identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed prior to substantial completion. This report is not necessarily all-inclusive; should issues be discovered within one year after substantial completion, the appropriate communications subcontractor is still responsible for corrections/repairs.

END OF SECTION 270000

SECTION 270500 – COMMON RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B. This section and all related sections shall be performed by a qualified contractor as outlined in the specifications.

1.2 SECTION INCLUDES

- A. General Requirements
- B. Summary
- C. Environmental Considerations
- D. Site Specific Requirements

1.3 RELATED SECTIONS

- A. Section 270000 – Communications
- B. Section 270513 – Communications Services
- C. Section 270528 – Pathways for Communications Systems
- D. Section 270528.29 - Hangers and Supports for Communications Systems
- E. Section 270528.39 - Surface Raceways for Communications Systems
- F. Section 270553 – Identification for Communication Systems
- G. Section 270800 – Commissioning of Communications
- H. Section 271119 – Communications Terminations Blocks and Patch panels
- I. Section 271123 – Communications Cable Management and Ladder Rack
- J. Section 271513 – Communications Copper Horizontal Cabling
- K. Section 271643 – Communications Faceplates and Connectors

1.4 GENERAL REQUIREMENTS

- A. Fern Ridge School District is a tobacco free environment. Tobacco in any form whatsoever is not permitted in this school or on the property owned by the District.
- B. Fern Ridge School District is providing new telecommunications cable and infrastructure for identified areas within the Capital Center. This contract will be responsible for all aspects of telecommunications cabling and supporting infrastructure required for functional systems, specifically:
 - 1. Pathways as per Section 270528 and as called out on drawings
 - 2. Installation of new category 6 horizontal cabling system and related components as per Sections 271513 and 271543
 - 3. Testing of fiber and copper cabling systems in accordance with ANSI/TIA-568
 - 4. Creation of as-built documentation, both electronically and printed, in AutoCAD® format. Drawing base(s) will be provided electronically in dwg format
- C. All major work outlined in these documents and on the accompanying Drawings must be completed between June 20th and August 15th, 2016, specifically:
 - 1. All construction in Telecommunications Rooms
 - 2. All raceway, conduits, and junction boxes required for telecommunications pathways
 - 3. All electrical raceway and electrical circuits as per Drawings
 - 4. All other construction activities that may interrupt normal school operations due to noise or presence of construction equipment
 - 5. Installation and testing of all telecommunications cabling to allow District to install active electronics and bring complete systems live.

1.5 SUMMARY

- A. The intent of the Division 27 Specifications and the accompanying Drawings is to provide a complete and workable system as shown, specified and required by applicable codes and the Authority Having Jurisdiction (AHJ). Include all work as specified in Division 27 and shown on the accompanying Drawings, including appurtenances, to provide a complete and functional system.
- B. The Division 27 Specifications and accompanying Drawings are complementary and what is called for in one shall be as binding as if called for in both. Items shown on the Drawings are not necessarily included in or called out in the Specifications and vice versa. Specifications shall supersede Drawings in the case of a conflict.
- C. Imperative language is frequently used in the Division 27 Specifications. Except as otherwise noted, such requirements are to be performed by the Contractor or a Sub-contractor directly responsible to the Prime Contractor performing the Division 27 work.
- D. The Drawings accompanying Division 27 (Power & Signal) are diagrammatic. They do not show every component of a complete telecommunications premises distribution system which may be

required to accommodate unique building construction features or materials installed by other trades. The Drawings are to be followed as closely as practical while making necessary adjustments in the placement of cable to facilitate the overall construction of the building without additional cost to the Owner. The right is reserved to make any reasonable changes in Telecommunications Outlet locations prior to roughing-in.

1.6 ENVIRONMENTAL CONSIDERATION

- A. When at all possible, equipment and materials are to be assembled at Distributors or Contractors location and delivered to construction site without packaging or shipping material. Exceptions are granted for protection of delicate components in transit.
- B. Except as noted for purposes of recycling, all construction related debris; packaging and waste materials will be removed from the job site each day and disposed of by the Contractor.

1.7 SITE SPECIFIC REQUIREMENTS

- A. There is a remodel effort involving significant demolition of existing structure and construction of new areas. Contractor must conform to schedule prescribed by General Contractor in affected areas.
- B. Site details are shown on the accompanying drawings.

1.8 DEVICE LOCATIONS

- A. Telecommunications Rooms locations as per the Drawings
- B. WAP locations (WAP) will be as per the Drawings. Owner reserves the right to make slight modifications in placement of the WAP. Coordinate with Owner for final approval of WAP prior to cover.

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PRODUCTS (Not Used)

EXECUTION (Not Used)

END OF SECTION 270500

SECTION 270513 – COMMUNICATIONS SERVICES

GENERAL REQUIREMENTS

PART 1 - GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.1 SECTION INCLUDES

- A. Basic Communication Requirements
- B. Administrative Requirements
- C. Site Specific Requirements
- D. Project Management and Quality Assurance Requirements
- E. Documentation System

1.2 RELATED SECTIONS

- A. Section 270000 - Communications
- B. Section 270500 – Common Results for Communications
- C. Section 270528 – Pathways for Communications Systems
- D. Section 270528.29 - Hangers and Supports for Communications Systems
- E. Section 270528.39 - Surface Raceways for Communications Systems
- F. Section 270553 – Identification for Communication Systems
- G. Section 270800 – Commissioning of Communications
- H. Section 271119 – Communications Terminations Blocks and Patch panels
- I. Section 271513 – Communications Copper Horizontal Cabling
- J. Section 271619 – Communications Patch and Station Cords

1.3 BASIC COMMUNICATION REQUIREMENTS

- A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and materials shall carry Underwriters Laboratory certification if required by local, state or national codes.
- B. The Contractor shall provide, install, and test the entire cable infrastructure as described under this contract.
- C. The Contractor shall call attention to the Owner's Representative any error, conflict, or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until a resolution or clarification has been made. Supplemental Plans and Specifications may be supplied as required and shall become part of the Contract Documents.
- D. The Contractor shall coordinate all other work and crafts employed on this project.
- E. The Contractor shall arrange work to reduce interruption on any existing service to a minimum. When interruptions are unavoidable, consult the Owner's Representative and agree to a mutually satisfactory time and duration. Submit in writing to the Owner's Representative the time and duration agreed upon. All equipment and materials 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. Specifications are based upon the acceptable manufacturers listed. Where "approved equal" is stated, product shall be equivalent in every way to that specified and subject to approval. It is the responsibility of the contractor to prove the submitted project is "equal" to that product which is specified.
- F. All equipment and materials 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. Specifications are based upon the acceptable manufacturers listed. Where "approved equal" is stated, product shall be equivalent in every way to that specified and subject to approval. It is the responsibility of the contractor to prove the submitted project is "equal" to that product which is specified.

1.4 CONTRACT DOCUMENTS

- A. The contract documents, such as drawings, schedules and specifications are used to describe the required work.
- B. The work to be performed under the contract documents includes furnishing all labor, materials, equipment and services necessary, whether listed in the specifications or not, to construct and install the complete communications infrastructure as shown on contract drawings and specifications.
- C. The drawings and schedules depict, in general, application-dependent data while the narrative/specifications, in general, define broader requirements, such as overall quality.

- D. The Owner's Representative will provide the low voltage Contractor with a schedule and timeline.
- E. The Contractor shall follow all specifications herein. In case of conflict between drawings and specifications, the latter shall prevail unless authorized in writing by the Owner's Representative.
- F. Supplementary Details and Plans may be supplied as required. They shall be issued as addendum and shall become a part of the Contract Documents.

1.5 QUALITY ASSURANCE

- A. All cable and equipment 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.
- B. 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 or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.
- C. Strictly adhere to all Telecommunications Industry Association (TIA), and Building Industry Consulting Service International (BICSI) recommended installation practices and manufacturer's guidelines when installing communications components.

1.6 MANUFACTURER'S WARRANTY CERTIFICATION

- A. The manufacturer's certification must be supported by Contractor's successful completion of an installation class recognized by an independent organization (such as BICSI or an accredited school). A written test is strongly preferred.

1.7 TECHNICAL QUALIFICATIONS

- A. Contractor must be certified installation contractor and must be able to provide a 20 year manufacturer's warranty certificate.
- B. A minimum of three references demonstrating Contractor's past installation experience in Certified Category 6 systems in similar facilities with a minimum of 500 nodes shall be submitted. The Contractor must supply a one year warranty upon completion of the job.
- C. At least 50% of the technicians, to include all on-site Journeymen Electricians, must have successfully completed the manufacturer's warranty certification class.
- D. All Journeymen are to possess a current Oregon License.

- E. All Apprentices are to be actively enrolled in an Oregon State approved electrical apprenticeship program.
- F. All Equipment/Telecommunication Room and Telecommunications Outlet equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of the manufacturer's training course, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.
- G. Verification of the above requirements must be submitted in writing with bid.

1.8 CERTIFICATES

- A. Contractor must be eligible to provide evidence of ability to provide a Manufacturer's Certificate of Warranty for the system bid.
- B. Contractor must provide Technician Certificate(s) for the 50% mentioned above.

1.9 REFERENCE STANDARDS

- A. This section references the latest revisions of the following documents. In case of conflict between the requirements of this section and those of the listed documents, the more stringent shall prevail.

<u>Reference</u>	<u>Title</u>
1. ANSI/IEEE 802.3 Layer Specifications	CSMA/CD Access Method and Physical
2. ANSI/IEEE 802.3i-x 10/100/1000Mbps Transmission over Twisted Pair Cable	Physical Layer Specifications for
3. ANSI/TIA-568-C.0-3 Standards	Building Telecommunications Wiring
4. ANSI/TIA-569-C Telecommunications Pathways and Spaces	Commercial Building Standard for
5. EIA RS-310-C	Racks, Panels, and Associated Equipment
6. UL [®] 94 and Parts in Devices and Appliances	Tests for Flammability of Plastic Materials
7. ANSI-TIA-607-B Grounding (Earthing) for Customer Premises	Generic Telecommunications Bonding and
8. UL1863 Accessories	Standard for Communication Circuit

1.10 LAWS AND REGULATIONS

- A. This section references the latest revisions of the following documents. In case of conflict between the requirements of this section and those listed documents, the requirements of the listed documents shall prevail.

<u>1.</u>	<u>Reference</u>	<u>Title</u>
2.	NFPA-70	National Electric Code (NEC) plus all Oregon State Electrical Code plus local County and City Amendments
3.	IBC	International Building Code
4.	UL®	Underwriters Laboratories Inc.

1.11 UNDERWRITERS LABORATORIES LISTING

- A. Unless otherwise specified, electrical equipment and material shall be listed and labeled by Underwriters Laboratories (UL®) for the purpose for which it is used. This requirement may be waived only if a UL® listing is not available for this type of product. Telecommunications cables are acceptable if UL® recognized.

1.12 PERMITS, LICENSES AND TAXES

- A. Contractor shall obtain and pay for permits, inspections, licenses and taxes applicable to this work. Copies of all permits and inspections are to be prominently displayed at each site. Copies of all inspection reports are to be presented to Owner upon closeout of project.

1.13 SUBMITTALS

A. GENERAL

1. Owner must approve all submittals before the start of fabrication (or shipment, for stock items) of any equipment requiring submittals.

B. DRAWINGS

1. The Contractor shall submit shop drawings for any modification or new product installation not previously identified in bid documents.
2. The drawing must be submitted not less than five (5) days (weekends and national holidays excluded) before the scheduled work begins.
3. The Contractor shall proceed with the installation only after approval from the Owner.

C. MATERIALS LIST

1. The Contractor shall submit a list of all materials for the proposed work.

D. FIRESTOPPING

1. The Contractor shall comply with all requirements of Section 07 8400 – Fire Stopping

E. SOUND DEADENING MATERIALS

1. The Contractor shall submit a list of acoustic separation products and procedures. The submittal shall include the manufacturer's technical data for each product including product description, specifications (including labeling or listing by an agency acceptable to the Owner), and storage requirements.

F. MATERIAL SAFETY DATA SHEETS

1. Supply Material Safety Data Sheets (MSDS) to Owner for all material accompanied by such

G. TEST PLANS

1. The Contractor shall submit a plan for the testing the installed network.
2. The test plan shall include test equipment to be used, procedure and report structure.

H. CERTIFICATES

1. Low Voltage Electrical Permit
2. The Contractor shall post a copy of the permit and email or fax a copy to the Owner.
3. The Contractor shall provide copy of approved permit to the Owner certifying that the work has been inspected and that the work conforms to the requirements of the Authority Having Jurisdiction.

I. PRODUCT WARRANTY

1. A manufacturer's warranty is required for this work in addition; Contractor shall provide no-cost warranty on the installed work for a period of one year.
- 2.
3. Owner's Representative must approve all submittals before the start of fabrication (or shipment, for stock items) of any equipment requiring submittals.

J. DRAWINGS

1. The Contractor shall submit shop drawings for any modification or new product installation not previously identified in bid documents. This includes any changes in cable pathway or route.
2. The drawing must be submitted not less than five (5) days (weekends and national holidays excluded) before the scheduled work begins.
3. The Contractor shall proceed with the installation only after approval from the Owner's Representative.

K. MATERIALS LIST

1. The Contractor shall submit a list of all materials for the proposed network.
2. The submittals shall include all factory test information, technical data sheet, and catalog information showing dimension, colors and configuration (if applicable).

L. FIRESTOPPING

1. The Contractor shall submit a list of firestopping products and procedures. The submittal shall include:
2. The manufacturer's technical data for each product including product description, specifications (including labeling or listing by an agency acceptable to the Owner's Representative), and storage requirements.
3. The firestop design documentation shall include type of each penetration, type of building construction being penetrated, the hourly resistance rating of floor, wall, or other partition of building construction and firestop device or system proposed for use.
4. The manufacturers Installation Procedure sheets that outlines how and which specific products are to be used.

M. SOUND DEADENING MATERIALS

1. The Contractor shall submit a list of acoustic separation products and procedures. The submittal shall include the manufacturer's technical data for each product including product description, specifications (including labeling or listing by an agency acceptable to the Owner's Representative), and storage requirements.

N. MATERIAL SAFETY DATA SHEETS

1. Supply Material Safety Data Sheets (MSDS) to Owner's Representative for all material accompanied by such.

O. TEST PLANS

1. The Contractor shall submit a plan for the testing the installed network.
2. The test plan shall include test equipment to be used, procedure and report structure.

P. CERTIFICATES

1. Electrical Permit
2. The Contractor shall post a copy of the electrical permit and email a copy to the Owner's Representative before commencing work where such is required for the product set being installed.
3. The Contractor shall provide copy of approved electrical permit to the Owner Representative certifying that the work has been inspected and that the work conforms to the minimum requirements of the applicable AHJ.

Q. PRODUCT WARRANTY

1. A manufacturer's warranty is required for this work in addition; Contractor shall provide no-cost warranty on the installed work for a period of one year.

1.14 REQUEST FOR SUBSTITUTION

- A. Substitution of items shown in the contract documents must be requested in writing.
- B. Approval shall be by written addendum or change order. Substitutions made without prior written approval will be reversed and all costs related to reversal will be the responsibility of the Contractor.
- C. Contractor shall be responsible for any design changes and costs related to substitution approval.
- D. The functions and features specified are vital to the operation of this facility, therefore the acceptance of alternate manufacturers does not release Contractor from strict compliance with the requirements of the specification.

1.15 ENVIRONMENTAL REQUIREMENTS

- A. This is an existing building. Power and lighting, and parking spaces for standard installer's trucks shall be provided by the Owner.
- B. Job site trailer, if required, shall be coordinated with the Owner's Representative prior to placement. Secured storage is the responsibility of the Contractor.

1.16 PROGRESS DRAWINGS AND SCHEDULES

- A. All drawings shall be revised as necessary during the course of the work.
- B. The Contractor shall maintain on-site, one neatly and legibly marked (redlined) set of full-size Drawings accurately depicting as-built locations, changes, and repairs made during the work.
 - 1. Marking of the Drawings shall be kept current.
 - 2. Drawings shall be delivered to the Owner's Representative prior to final progress payments.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.
- B. Quantities are to be determined by Contractor unless specified.
- C. Products shall be UL® listed for the purpose they are to be used.

2.2 PRE-APPROVED PRODUCT SETS

- A. The following product sets are pre-approved for this project. All others will require a substitution request to be completed and approved as per these documents. The District will not consider product sets that have not been pre-approved or accepted as per the substitution request process.
1. Pre-Approved Structured Cable Systems:
 - a. TE/AMP - all category 6 and 6A components, i.e., jacks, patch panels and fiber optic components
 - b. CommScope (Systimax® or Uniprise®) - all category 6 and 6A components, i.e., jacks, patch panels and fiber optic components.
 - c. Panduit - all category 6 and 6A components, i.e., jacks, patch panels and fiber optic components.
 2. Racks, cabinets, frames and associated fastening devices
 - a. Chatsworth Products Incorporated (CPI)

2.3 FIRESTOPPING

- A. Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.
- B. Firestopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits and cables.

2.4 ACOUSTIC SEPARATION

- A. Acceptable products for 2” through 4” penetrations are as follows
1. STI EasyPath™
 2. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
 3. Or approved substitution
- B. Acceptable products for less than 2” penetrations are as follows
1. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
 2. Or approved substitution

PART 3 - EXECUTION

3.1 GENERAL

- A. Manufacturer's installation instructions and requirements shall be strictly adhered to in the telecommunications equipment installation, fabrication and testing process.
- B. Where conflicts arise between the requirements of this Specification and the manufacturer's installation instructions, the Authorized Representative shall be consulted for resolution.
- C. All twisted pair wiring systems shall be installed according to manufacturers' installation guidelines, and according to related standards for such implementation as may be listed within ANSI/TIA-568-C.
- D. All installed cables shall be kept free from nicking, abrading, or cutting during storage and during the installation process.
- E. Cable shall be installed into conduits after conduit installation is complete and appropriate bushings or couplers have been installed. Manufacturers' recommendations for maximum pulling tensions and minimum bend radii for all cables must not be exceeded.
- F. If pulling compound is used use only UL®-listed compound, compatible with the cable outer jacket and with the raceway involved. Bushings must be fitted on all conduit bushings prior to cable installation.
- G. Care shall be exercised in wiring to avoid damage to wiring and equipment.
- H. Connections shall be made with approved mechanical connectors.
- I. All wiring and connectors shall be installed in strict adherence to standard communications installation practices and to federal, state or local applicable codes.
- J. Equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads.
- K. Open areas requiring suspension for cables will employ properly rated support mechanisms and devices to accommodate future addition of cable.
- L. Cable ties will be used in concealed areas only as mandated by code or ANSI/TIA-568. Cable ties shall bear the same rating as the cable when installed in plenum areas.
- M. Cable running in exposed areas will be bundled using Velcro® or similar hook and loop material. Such material will be used exclusively in the ER. Cable ties are permitted in the ER for temporary cable dressing only and shall be removed prior to substantial completion.
- N. The installation must conform to OSHA standards and comply with state and local safety codes.

- O. Applicable fire codes will be strictly adhered to in regards to plenum ratings for cable and associated cable ties. Fire stopping will be the responsibility of this contract in areas penetrated as a part of this project.
- P. Installation shall be neat, well organized, and professional.
- Q. Installation shall be conducted as to maintain consistency between color-coding, labeling and documentation.
- R. Splicing of any unshielded twisted pair or fiber optic is not acceptable, unless directed to by specifications, addendum, drawings or other written communication with owner or authorized representative.
- S. Any discrepancies, conflicts or issues must be brought to the attention of the Owner's Representative before installation or as soon as possible thereafter.
- T. The Contractor shall clean up the work area at the end of each day. At the end of the project all material removed or left over, and/or not being used shall be removed from the project site unless other arrangements have been made. A final clean up shall be made before final payment is made.
- U. All wall and floor penetrations shall be fire stopped at or before substantial completion.

3.2 PREPARATION

- A. Before installation of cabling and/or equipment in the ER or TR, the Contractor shall field-investigate the facility and ascertain if the physical and electrical conditions within the facility shall permit commencement of the Contractor's work.
- B. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of the Owner's Representative.

3.3 DOCUMENTATION

A. GENERAL

- 1. All hard copy documentation must be neat and legible.

B. TEST REPORTS

- 1. The Contractor shall compile test results into the forms that contain all applicable test data. Hard copy output indicating successful testing of every location is not required.
- 2. A CD or USB thumb drive containing all test data and the appropriate application to display such in a Windows-based environment shall be provided.

3.4 AS BUILTS

- A. Prior to acceptance of system the Contractor shall provide the Owner with reproducible plans and other documentation showing system layout and connections.

3.5 TELECOMMUNICATION OUTLETS

- A. All locations shall be annotated with information that duplicates the labeling on the jack.

END OF SECTION 270513

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 DESCRIPTION OF WORK

- A. This contract shall be responsible for all hangers and support mechanisms required to properly support all telecommunications cables to satisfy the local Authority Having Jurisdiction.
- B. This contract shall be responsible for all pathways as called out on Drawings, specifically:
 - 1. Various conduits and “J-Boxes” as detailed on Power & Signal Drawings to accommodate Wireless Access Points (WAP) locations. Any necessary penetrations shall accommodate a minimum of a Trade Size 1 EMT conduit.
 - 2. Surface mounted raceway, as per Section 270528.39
- C. The Contractor shall coordinate with all other trades (if applicable) prior to final placement of telecommunications pathways. Placement shall be such that pathway will be accessible for future additions requiring placement of telecommunications cable.
- D. The Contractor shall provide all labor, equipment and supplies to furnish and install the communications pathway, hangers and supports.
- E. Installation shall include the actual physical installation of the hardware and/or support structure, firestopping, testing and documentation.

1.3 RELATED SECTIONS

- A. Section 260529 – Hangers and Supports for Electrical Systems
- B. Section 270528.29 - Hangers and Supports for Communications Systems
- C. Section 270528.36 - Cable Trays for Communications Systems
- D. Section 270528.39 - Surface Raceways for Communications Systems

1.4 REFERENCES

- A. ANSI/NFPA 70/250 - National Electric Code – Ground and Bonding
- B. ANSI/NFPA 70/318 – National Electric Code – Cable Trays
- C. ANSI/NFPA 70/645 – National Electric Code – Information Technology Equipment
- D. ANSI/NFPA 70/770 – National Electric Code – Optical Fiber Cables and Raceways
- E. ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- F. ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3
- G. ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
- H. ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
- I. ANSI/TIA/568-C Series - Commercial Building Telecommunications Cabling Standard
- J. ANSI/TIA/569-B Commercial Building Standard for Telecommunications Pathways and Spaces
- K. NEMA VE 2-2006 Cable Tray Installation Guidelines
- L. NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems
- M. UL[®] E209183
- N. ANSI C80.1 Rigid Steel Conduit - Zinc Coated
- O. ANSI C80.4 Fittings for Rigid Metal Conduit
- P. BICSI Electronic Safety and Security Reference Manual (ESSDRM)
- Q. BICSI Information Transport Systems Installation Methods Manual (ITSIM)
- R. BICSI Network Design Reference Manual (NDRM)
- S. BICSI Telecommunications Distribution Methods Manual (TDMM)
- T. BICSI Wireless Design Reference Manual (WDRM)

1.5 QUALITY ASSURANCE

- A. All cable and equipment 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. 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 Building Industry Consulting Service International (BICSI) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.
- C. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

1.6 SUBMITTALS

- A. The following information shall be provided:
 - 1. Manufacturer's literature and catalog cuts indicating:
 - a. Physical dimensions, including dimensions (if appropriate)
 - b. Materials of construction

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and material shall carry Underwriters Laboratory certification if required by local, state or national codes. Products are to be from the acceptable manufacturer listed below or an approved alternate. In no case will field fabrication or “shop built” cable support products be acceptable.

2.2 SURFACE MOUNTED RACEWAY

- A. Surface Mounted Raceway (SMR) shall be provided as per Section 27 05 28.39 with all fittings including but not limited to mounting clips and straps, couplings, flat, bend limiting internal and external elbows, cover clips, bushings, device boxes and other incidental and miscellaneous hardware required for a complete SMR system.

2.3 ADJUSTABLE CABLE SUPPORT SYSTEM

- A. Cable support system shall be a factory produced assembly and sized to accommodate 100 percent expansion, i.e., rated to hold double the number of initially installed cables.
- B. Acceptable product is: CADDY® CABLECAT Adjustable Cable Support

2.4 ROD MOUNTED CABLE SUPPORT SYSTEMS

- A. Acceptable product is: CADDY® CAT-CM Cable Support System

2.5 FIRESTOPPING SYSTEMS FOR TELECOM RACEWAYS

- A. Acceptable products for 2” through 4” penetrations are as follows
 - 1. STI EasyPath™
 - 2. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
- B. Acceptable products for less than 2” penetrations are as follows
 - 1. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer’s instruction per weight loading.
- B. All conduits shall be installed stacked and attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits side-by-side supported with 3/8” rod attached to building structure utilizing UniStrut® channel to form a trapeze. Double nut the top and bottom at the UniStrut®. Utilize conduit clamp to secure conduits to UniStrut®.
- C. Install in accordance with directions given in Section 27 05 28.39
- D. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.
- E. Do not exceed load ratings specified by manufacturer.
- F. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

- G. SMR shall be securely supported using mechanical fasteners at intervals not exceeding 10 feet or in accordance with manufacturer's installation instructions.
- H. The path of the SMR shall minimize impact on molding, tack boards and other architectural elements. Vertical runs of raceway from the ceiling to outlets shall be installed on walls near corners wherever possible. Raceway may be installed horizontally at the same height as the outlets or near to the ceiling. Entrance end fittings will be supplied at the ends of raceway runs to transition to conduit sleeves through walls, ceilings or floors. SMR shall be installed parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- I. Metal components shall be bonded and grounded in accordance with applicable code and ANSI/TIA-607-B.
- J. J-hooks are to be supported by dedicated wires or rods installed by this contract. In no case will ceiling grid wires be used to support J-hooks. J-hooks will be attached to ceiling grid wires (where applicable) to satisfy seismic bracing requirements and to prevent swinging.
- K. Adjustable cable support systems are to be securely attached to building structure and loaded as per manufacturer's instruction.
- L. Fire Rated wall and floor penetrations shall be fire-stopped in accordance with the manufacturer's instructions using the product set referenced in 2.5 above.

END OF SECTION 270528

SECTION 270528.29 – HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Contractor to provide all hangers and supports necessary for a complete system.
- B. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- C. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 SUMMARY

- A. Section includes discrete J-Hooks, slings and related accessories for supporting low voltage cable bundles above accessible.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)
 - 1. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
 - 2. ANSI/TIA -569-C Standard for Telecommunications Pathways and Spaces for Commercial Building
 - 3. ANSI/NFPA 70 National Electrical Code (*NEC*®)
- B. Underwriters Laboratories, Inc. (UL®)
 - 1. UL® 2043 Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
 - 2. UL® 2239 Conduit, Tubing and Cable Support Hardware

1.4 DEFINITIONS

UTP - Unshielded twisted pair

Pathway - A series of supports and accessories for placement of low voltage systems cables

Main Pathway - A low voltage systems pathway where the cable count exceeds 30 cables

1.5 SUBMITTALS

- A. Provide submittal information in accordance with Section 270500 - Common Work Results for Communications and supplementary requirements described in this specification.
- B. Product Data: Submit product data on all cable support devices and accessories. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
- C. Closeout Submittals
 - 1. As-built Drawings: Provide marked up as-built drawings of main pathways

1.6 QUALITY ASSURANCE

- A. Low voltage system cable supports and accessories shall be listed to Underwriters Laboratories, Inc. Standard 2239.
- B. Low voltage system cable supports and accessories shall have the manufacturers name and part number stamped on the part for identification.
- C. Pre-Installation Meetings: Contractor shall set up a pre-installation meeting to discuss low voltage cable support layout work and installation guidelines. Attendees shall include Owner contractor, and appropriate subcontractors. Purpose of meeting shall be to coordinate work between the parties to have a consistent layout for all low voltage system cables, minimize interferences and to make cable system accessibility for future Owner modifications and maintenance high priority issue for all installers.

1.7 COORDINATION

- A. Coordinate layout and installation of low voltage cable bundle supports with other construction elements to ensure adequate headroom, working clearance and access. Revise locations and elevations for those indicated as required to suit field conditions and as approved by Owner.

PART 2 - - PRODUCTS

2.1 NON-CONTINUOUS CABLE SUPPORT SYSTEMS (J-HOOKS)

- A. Shall be constructed of galvanized steel, stainless steel, or hot dipped zinc
- B. Fastener is to be installed using dedicated wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments. Product is to be UL[®] Listed for the application.
 - 1. Non-Continuous Cable Supports
 - a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL[®] Listed.

- b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
 - c. Non-continuous cable supports sized 1 - 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
 - d. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
 - e. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
 - f. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal
 - g. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal.
2. Adjustable non-continuous cable support sling
 - a. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425, 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5e and higher cable, or optical fiber cable; UL® Listed.
 - b. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
 - c. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
 - d. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
 - e. Acceptable products: ERICO CADDY® CableCat™ CAT425; or approved equal.
 3. Multi-tiered non-continuous cable support assemblies
 - a. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; UL® Listed.
 - b. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
 - c. The multi-tiered support bracket shall consist of ERICO CADDY® CATHBA and CableCat™ J-Hooks with screws; or approved equal.
 4. Non-continuous cable support assemblies from tee bar
 - a. Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.

- b. Acceptable products: ERICO CADDY® CAT12TS, CAT21528, CAT32528; or approved equal.
5. Non-continuous cable support assemblies from drop wire/ceiling
 - a. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
 - b. Acceptable products: ERICO CADDY® CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34 or CAT326Z34; or approved equal.
6. Non-continuous cable support assemblies from beam, flange
 - a. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY® beam clamps and CADDY® flange clips; or approved equal.
7. Non-continuous cable support assemblies from C & Z Purlin
 - a. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY® Purlin hangers; or approved equal.
8. Non-continuous cable support assemblies from wall, concrete, or joist
 - a. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY® angle bracket; or approved equal.
9. Non-continuous cable support assemblies from threaded rod
 - a. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, UL® Listed.
 - b. The multi-tiered support bracket shall have a static load limit of 300 lbs.
 - c. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
 - d. Acceptable products: ERICO CableCat™ J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY® CATHBA series; CAT-CM™ Double J-hook CAT100CM, CAT-CM™ Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series; or approved equal.
10. Cantilever-Mounted cable supports
 - a. U-hook shall be able to be assembled to a wide variety of wall mount brackets.
 - b. Spacing of individual U-hooks as needed, max of 4' to 5' apart.
 - c. U-hooks may have the optional attachment of a cable roller for ease in pulling cables.

- d. Acceptable products: ERICO CAT-CMTM U-hooks CAT200CMLN, CAT300CMLN; CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket; or approved equal.

PART 3 - - EXECUTION

3.1 INSTALLATION

- A. Cable installation and supports shall comply with applicable provisions of ANSI/TIA/569-C and NFPA 70
- B. All low voltage systems cables shall be supported. Provide supports along entire Pathway.
- C. Space supports a maximum of 60 inches apart and at each change of direction of the cables. In areas covered by dropped ceiling, tiles shall be left open to allow inspection by Owner.
- D. Hang cable supports from 3/8" all thread rods, dedicated #8 galvanized ceiling drop wire or wall brackets connected directly to structure. Do not support from the ceiling grid or ceiling wire system.
- E. Where main pathways are indicated on the Drawings, contractor shall follow the indicated pathways as closely as possible according to field conditions. Where pathways are not indicated on the drawings, Contractor shall coordinate pathways with Owner. Pathways for smaller cable counts shall be designed and documented on the as-built drawings by the contractor. .
- F. Where practical, pathway for ceiling cabling should terminate in the same MDF/IDF as existing Work Area Outlets.
- G. Install support wires, brackets or rods to route cables parallel and perpendicular to building lines.
- H. Provide multiple hooks or slings at each hanger location as required by cable count and cable segregation requirements.
- I. Fill supports with cabling to 50% or less of the manufacturer's recommended fill. Provide multiple supports where required cable count exceeds 50% fill.
- J. Install low voltage cable support system above accessible ceilings only.
- K. Elevation of Cable Supports: Contractor shall coordinate the allocation of ceiling space and the mounting elevations to allow maintenance and accessibility for future modifications. Telecommunications cable supports shall be as close to the ceiling as possible while allowing ceiling tiles to be removed. Supports shall be located to avoid interference with maintenance access to other equipment.

END OF SECTION 270528.29

SECTION 270528.39 - SURFACE MOUNT RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - - GENERAL

1.1 GENERAL REQUIREMENTS

- A Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 SECTION INCLUDES

- A. Surface mounted raceways.

1.3 RELATED SECTIONS

- A. Section 270528 – Pathways for Communications Systems
- B. Section 270528.29 - Hangers and Supports for Communications Systems
- C. Section 270528.33 - Conduits and Backboxes for Communications Systems
- D. Section 270528.36 - Cable Trays for Communications Systems

1.4 SUBMITTALS

- A. Submit under provisions of Section 270513
- B. Samples: If other than specified product is bid, Contractor must submit a 24-inch lengths of proposed product. Show finished detail with boxes, faceplate, connectors, angles and transitions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms regularly engaged in manufacturer of raceway systems, boxes and fittings of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years. Provide fittings and boxes produced by a manufacturer listed in this section.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver raceways and distribution systems in factory labeled packages.

- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- C. Protect from damage due to weather, excessive temperature, and construction operations.

PART 2 - - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Provide surface mount raceway distribution components as manufactured by Panduit (TG70 Series), or approved alternate.
- B. SMR shall be manufactured by Panduit (TG70 or equal). All fittings and transitions pieces are to be of the same manufacturer; however, low voltage receptacles may be from a different manufacturer so long as the product is designed to be an integral part of the completed system.

2.2 SURFACE MOUNTED RACEWAYS AND FITTINGS

- A. General:
 - 1. System: Surface raceway systems shall consist of bases, covers, appropriate fittings, mounting brackets, workstation boxes / enclosures and device mounting brackets and fasteners necessary for a complete installation.
 - 2. Surface Mounted Raceways shall be square or rectangular design with removable covers or solid construction, 2 inch by 2 inch raceway; or 2 inch by 4 inch raceway for backbone runs; 1 inch (or 1/2 inch) by 1 inch raceway for vertical user drops, constructed of shatter-proof thermoplastic (or similar) raceway, utilizing elbows, couplings, and connectors of the same material.
 - 3. Mounting Brackets: Surface Mounted Raceway (SMR) shall be secured to wall using properly rated anchors or mounting brackets. Brackets shall provide un-obscured inspection of fastening bolts at point of wall penetration. In no case whatsoever will drywall screws be used to attach SMR
 - 4. Fittings: Fittings shall include flat, internal and external elbows, tees, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Provide full capacity corner elbows and fittings to maintain a controlled 2-inch cable bend radius, meeting the specification for Fiber Optic and UTP cabling and exceeding the ANSI/TIA -569-C requirements for communications pathways.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions under which raceways, boxes, distribution systems, accessories, and fittings are to be installed and substrate that will support raceways. Notify the Owner in writing of conditions

detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Strictly comply with manufacturer's installation instructions and recommendations and approved installation practices. Care should be taken to prevent “over tightening” of fastening devices.
- B. The SMR shall be surface mounted on the wall using properly rated anchors or brackets. The top edge of the SMR shall be horizontally level below the suspended ceiling line or the true ceiling line, whichever is lower, shall be installed to permit visually inspection to verify the physical integrity of the raceway for its entire run, shall not block doorways or access to emergency exits, shall not inhibit the operation of windows, and shall not run across windows.
 - 1. Support: SMR shall be supported by properly rated anchors or mounting brackets at intervals not to exceed 5 feet or in accordance with manufacturer's installation sheets.
 - 2. Accessories: Provide accessories as required for a complete installation.

3.3 FINAL FINISH

- A. All surfaces are to be left completely smooth and finished. No cut edges are to be exposed. In the event a metallic product is used, all rough edges are to be dressed and covered with appropriate fittings that prevent any access whatsoever with sharp edges

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.
- B. Protect raceways and boxes until acceptance.

END OF SECTION

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.3 SCOPE

- A. This section includes all telecommunications cables and the associated infrastructure in the telecommunications rooms and telecommunications cabinets.

1.4 SUMMARY

- A. Administration of the telecommunications infrastructure includes documentation of cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, Telecommunications Rooms, and other telecommunications spaces. All facilities shall apply and maintain a system for documenting and administering the telecommunications infrastructure.
- B. The Owner desires to implement and maintain a district wide labeling scheme for telecommunications outlets and patch panels.
- C. Industry Labeling Standards and Conventions shall be used unless otherwise stated in the bid documents or by the Owner's Representative.
- D. Installer shall maintain accurate, up-to-date construction drawings. At a minimum, the construction drawings shall show pathway locations and routing, configuration of telecommunications spaces including backboard and equipment rack configurations, and wiring details including identifier assignments.
- E. Installer shall provide a complete and accurate set of as-built drawings. The as-built drawings shall record the identifiers for major infrastructure components including; the pathways, spaces, and

wiring portions of the infrastructure which may each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings

1.5 QUALITY ASSURANCE

- A. All labels shall be installed in a neat and workmanlike manner. All methods of labeling that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- B. Labels shall be of the quality and manufacture indicated. The labels and labeling equipment specified are 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.
- C. Strictly adhere to all Telecommunications Industry Association (TIA) and BICSI recommended installation practices when installing communications/data labeling.
- D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
 - 1. ANSI/TIA/606-B Administration Standards
 - 2. ANSI/TIA/569-C Pathway and Spaces
 - 3. ANSI/TIA/568-C.0-C.3 Telecommunications Cabling StandardS
 - 4. BICSI Telecommunications Distribution Methods Manual
 - 5. UL 969 – UL® Standard for Safety for Marking and Labeling Systems

1.6 SUBMITTALS

- A. Provide product data for the following:
 - 1. Manufacturers cut sheets
 - 2. Specifications and installation instructions for all products (submit with bid)

1.7 COORDINATION

- A. Confirm labeling scheme with Owner prior to printing.
- B. Coordinate installation of labels with other trades.
- C. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store materials in original cartons and in a clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 - - PRODUCTS

2.1 LABEL TAGS

- A. The labels shall be machine generated
- B. Shall meet the legibility, defacement, exposure and adhesion requirements of UL[®] 969
- C. Shall be preprinted or computer printed type. Hand written labels are not acceptable
- D. Where insert type labels are used provide clear plastic cover over label
- E. Outside plant labels shall be totally waterproof even when submerged
- F. Equipment Room copper and fiber backbone cable labels:
 - 1. Panduit Part#LS7-75NL-1 or Brady#WML-1231-292
- G. Equipment Room horizontal cable labels:
 - 1. Panduit Part#LS7-75NL-1 or Brady#WML-317-292
- H. Work Area Outlet faceplate labels
 - 1. Panduit Part#LS7-75NL-1 or Brady #WML-317-292
- I. Patch panel labels
 - 1. Panduit Part #LS7-38-1 or Brady #CL-111-619

PART 3 - - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. All horizontal (station) cables and outlets in which they terminate shall be identified by the Contractor at both ends of the wiring run. The standard nomenclature for the labeling is Frame.Patch Panel.Port Number, hereafter known as FR. PP.NN.
 - 2. All fiber tie cables shall be labeled at each end. The standard nomenclature for labeling is “From <Frame-1> to <Frame-2>”, where “Frame-1” is the originating location and “Frame-2” is the destination.

- B. Telecommunication Room and Telecom Enclosures shall be identified as (Frame x) where x shall be the Frame Number.
- C. Horizontal (Station) Cables
 - 1. All cables will be labeled the same at both ends. The tag shall be secured to the sheath no more than 4 inches from the end of the cable. Each end of the UTP horizontal cables shall be labeled with the nomenclature 'FX.PP.NN'. Where FX indicates the Frame Number, PP indicates the patch panel number, and NN indicates the port number.
- D. Work Area Outlets (WAO)
- E. Each WAO shall be labeled at the top of the modular jack enclosure with the Telecommunication Room ID (Frame Number) of the room where the cables are terminated, patch panel and the port number ('FX. PP.NN-nn') where the cable is being terminated.
- F. In addition, where WAPs are placed above drop in ceiling the grid below the outlet shall be labeled with bold ½" minimum font height.

END OF SECTION

SECTION 270800 - COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - - GENERAL REQUIREMENT

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.
- B. Provide complete end-to-end testing of all copper and fiber optic cabling installed by this contract.

1.2 TESTING, IDENTIFICATION AND ADMINISTRATION

- A. All cables and termination points will be tested and labeled per specifications.
- B. Testing is required for this project for all copper telecommunications cables. Fiber optic testing will be as detailed below.
- C. All test results shall be forwarded to the Owner's Representative for certification. Any results observed to be outside stated performance parameters shall be used by the Contractor for immediate correction.

1.3 POST INSTALLATION SERVICES

- A. The Contractor shall provide on-site service as part of the warranty in the event of the failure of any installed components.
- B. The contractor will provide support and warranty for installed cabling.
 - 1. The Contractor will be the first contact point and will interface between manufacture and Owner for warranty issues.
 - 2. The Contractor will provide the owner with contact information of the manufacture for warranty coverage prior to cable acceptance.

1.4 QUALITY ASSURANCE

- A. See Section 270513

PART 2 - - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all tools and instruments used to test the installed telecommunications signal cabling.
- B. Test instruments used by the Contractor shall be suitable for the purpose at hand, and shall be of industry-recognized manufacture. Note that copper testing parameters are written for Fluke DTX-1800 or newer tester.
- C. Tools leased by the Contractor are acceptable, provided the operator of the test instrument(s) has a sufficient degree of operational awareness to use the rented instrument(s) correctly and obtain test data that is both, accurate and relevant.

2.2 WARRANTY

- A. All telecommunications cable installed as part of a manufacturer's certified system shall carry the manufacturer's warranty for a minimum of 20 years.
- B. The manufacturer shall provide certification attesting to on-site service as part of the warranty in the event of the failure of any installed balanced twisted pair cables, fiber-optic cables, telecommunications room terminations, telecommunications outlet terminations, or cross-connect cables.
- C. Such service shall be free of charge to the Owner and shall commence from the date of project acceptance and terminate not earlier than the twenty year anniversary of that date as a minimum.

PART 3 - - EXECUTION

3.1 GENERAL REQUIREMENTS - COPPER

- A. The basic link shall be tested.
- B. All test results observed shall be used by the Contractor to determine any polarity and noise anomalies for immediate correction.
- C. Test results shall be used jointly by the Contractor and the Owner's Representative to determine the viability of each cable for transmission in accordance with the specifications of the cable manufacturer, and the requirements imposed by the transmission system. This shall form part of the acceptance procedure for the cable plant.

- D. All results obtained by use of pair-scanner testing shall be collated by TO number and presented to the Owner's Representative at the conclusion of the testing. Test compilation shall be initialed and dated by the Contractor's technician performing the test.
- E. Hard copy output indicating successful testing of every location is not required; rather a diskette containing test data and the appropriate application to display such in a Windows base environment is preferred.

3.2 GENERAL TESTING PARAMETERS - COPPER

- A. Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein, and shall be tested according to test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all of electrical parameters as specified in Paragraph D below. All cables and termination hardware shall be 100 percent tested under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested according to contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced in order to ensure 100 percent useable conductors in all cables installed, at no additional cost to Owner.
- B. Categories of balanced twisted pair cable:
 - 1. Unless otherwise designated, all station cable shall be category 6.
 - 2. If so noted on drawings, selected cables shall be category 6A.
- C. Balanced twisted pair testing shall provide certification and summary for all locations.
- D. All "category" cable paths shall be tested at each jack for the following parameters and meet the requirements imposed by the ANSI/TIA-568-C.2 and the manufacture's written specification.

Category 6

Wire Map
Cable Length
Pair-to-pair NEXT
Power Sum NEXT
Attenuation
Pair-to-Pair ELFEXT
Power Sum ELFEXT
Return Loss
Propagation Delay
Delay Skew

Category 6A

Wire Map
Cable Length
Insertion Loss
Next Loss
PS Next Loss
ACR-F Loss
PS ACR-F Loss
Return Loss
Propagation Delay
Delay Skew

3.3 ADDITIONAL CATEGORY 6A TESTING PARAMETERS

- A. In addition to testing the “In-link” performance parameters detailed in A.1 above, Alien Crosstalk testing or “Between-link” testing shall be carried out in accordance with Section 4.7 of ANSI/TIA-1152. Alien crosstalk testing includes the PS ANEXT and PS AACR-F (Power sum alien attenuation-to-crosstalk ratio from the far end) performance parameters. The standards refer to the link-under-test for Alien Crosstalk as the disturbed link.
- B. PS ANEXT and PS AACR-F shall meet or exceed the limits defined in Section 6 of the TIA Category 6A Standard.
 - 1. Selection of disturbed (victim) links:
 - Installation size (No. of total links)
 - 3 – 33
 - 34 – 3,200
 - 3,201 – 35,000
 - 35,001 – 150,000
 - 150,001 – 500,000
 - 2. Choose short, medium and long links equally.
 - 3. Selection of disturber links. Select all of the links that are in the same cable bundle and the most consistently positioned relative to the disturbed link as disturbing links.
- C. If the margin of PS NEXT and PS ACR-F exceeds 5 dB for the first three short, medium and long links (nine in total), further alien crosstalk testing can be discontinued.
- D. The installed twisted-pair horizontal links shall be tested from the telecommunications room to the telecommunication wall outlet in the work area for compliance with the “Permanent Link” performance specification as defined in the TIA Cat 6A Standard.
- E. One hundred percent of the installed cabling links must pass the requirements of the standards mentioned in above and as further detailed in Section 3.04 below. Any failing link must be

diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Section 3.05 below.

- F. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).
- G. The test equipment (tester) shall comply with the accuracy requirements for level IIIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of ANSI/TIA-1152 (Table 4 in this TIA document also specifies the accuracy requirements for the Channel configuration).
- H. The eight-pin modular (RJ45) test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.
- I. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
- J. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.
- K. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.
- L. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. To which extent '*' results shall determine approval or disapproval of the element under test shall be defined in the relevant detail specification, or agreed on as a part of a contractual specification.

3.4 PERFORMANCE TEST PARAMETERS FOR BALANCED TWISTED PAIR

- A. **Wire Map** - Report "Pass" if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

- B. **Length** - The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for Nominal Velocity of Propagation (NVP)¹. The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.

- C. **Insertion Loss (Attenuation)** - Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 250MHz for category 6 and 1 through 500 MHz for category 6A in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.

- D. **NEXT Loss** - Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 250MHz for category 6 and 1 through 500 MHz for category 6A. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair.

The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the standard as shown in Table 1. . Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

Frequency Range (MHz)	Maximum Step Size (MHz)
1 - 31.25	0.15
31.26 – 100	0.25
100 – 250	0.50

¹ Nominal Velocity of Propagation (NVP) expresses the speed of the electrical signals along the cabling link in relation to the speed of light in vacuum (3x10⁸ m/second). Insulation characteristics and twist rate of the wire pair influence NVP in minor ways. Typically, an ‘average’ value for NVP is published for all four wire-pairs in a data cable.

250 - 500	1.00
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Table - maximum frequency step size as defined in ANSI/TIA-1152

- E. **PS NEXT Loss** - Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 250MHz for category 6 and 1 through 500 MHz for category 6A and the step size may not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS NEXT. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- F. **ACR-F, pair-to-pair** - Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured from 1 through 250MHz for category 6 and 1 through 500 MHz for category 6A and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the standard as in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair combination that exhibits the worst value for ACR-F. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- G. **PS ACR-F Loss** - Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 500 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results):
1. Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- H. **Return Loss** - Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through 250 MHz for category 6 and 1 through 500 MHz for category 6A in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for Return Loss. These wire

pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

- I. **Propagation Delay** - Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
- J. **Delay Skew** [as defined in the TIA Cat 6A Standard; Section 6.2.19] - This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.
- K. **PS ANEXT** - Pair-to-pair Alien NEXT (ANEXT) contributions is measured by applying the stimulus signal at the near end to one wire pair of a disturbing link and measuring the coupled signal at the near end of a wire pair in a disturbed link. This process is repeated for every wire pair in a disturbing link. The PS ANEXT for each wire pair in a disturbed link is obtained by the power sum addition of all the pair-to-pair ANEXT results to that wire pair from all wire pairs in disturbing links. All the links that are bundles with the disturbed link need to be included as disturbing links. In addition, links that are terminated in adjacent positions in a patch panel or interconnect panel should also be included as disturbing links in this test.
- L. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS ANEXT. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- M. **PS AACR-F** - The pair-to-pair Alien Far End crosstalk (AFEXT) contributions is measured by applying the signal at the near end to one wire pair of a disturbing channel or permanent link and measuring the coupled signal at the far end of a wire pair in a disturbed channel or permanent link. This process is repeated for every wire pair in a disturbing link and for all links in close proximity. A normalization, which is dependent on the relative length of disturbing and disturbed link, is applied to each pair-to-pair alien FEXT measurement. Then the PS Alien Attenuation-to-Crosstalk Ratio from the Far end (PS AACR-F) for each wire pair in a disturbed channel or permanent link is obtained by the power sum addition of all the normalized pair-to-pair far end alien crosstalk results to that wire pair from all wire pairs in disturbing links in close proximity.
- N. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS AACR-F. If the link or channel connects two patch panels (data center), these wire pairs must be identified for the tests performed from both ends. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

3.5 TEST RESULT DOCUMENTATION

- A. The test results/measurements shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time.
- B. The database for the completed job shall be stored and delivered on magnetic media including the software tools required to view, inspect, and print any selection of test reports.
- C. Test results shall be provided that lists all the links that have been tested with the following summary information
 - 1. The identification of the link in accordance with the naming convention defined in the overall system documentation
 - 2. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number
 - 3. The date and time the test results were saved in the memory of the tester.
- D. General Information to be provided in the electronic data base with the test results information for each link:
 - 1. The identification of the customer site as specified by the end-user
 - 2. The identification of the link in accordance with the naming convention defined in the overall system documentation
 - 3. The overall Pass/Fail evaluation of the link-under-test
 - 4. The name of the standard selected to execute the stored test results
 - 5. The cable type and the value of NVP used for length calculations
 - 6. The date and time the test results were saved in the memory of the tester
 - 7. The brand name, model and serial number of the tester
 - 8. The identification of the tester interface
 - 9. The revision of the tester software and the revision of the test standards database in the tester
 - 10. The test results information must contain information on each of the required test parameters that are listed in Section 3.04 and as further detailed below under paragraph E & F.
- E. In-link (In-Channel) detailed test results. The detailed test results data to be provided in the electronic database for must contain the following information:

1. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. The PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.
 - a. Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m and the test limit value
 - b. Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value
 - c. Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value
 - d. Insertion Loss (Attenuation): Minimum test results documentation as explained in Section B for the worst pair
 - e. Return Loss: Minimum test results documentation as explained in Section B for the worst pair as measured from each end of the link
 - f. NEXT, ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link
 - g. PS NEXT and PS ACR-F: Minimum test results documentation as explained in Section B for the worst pair as measured from each end of the link

3.6 Between-Link (Between-Channel) Test Results Data

- A. A test report shall be provided for each disturbed link included in the Alien Crosstalk sample test. This test report must contain

1. PS ANEXT results at each frequency (See Table 1 above) for each wire pair in a victim link as well as the PS ANEXT results for the average of these four wire pairs. The worst case margin and the worst values shall be provided for each wire pair and the average of the four wire pairs. PS ANEXT shall be measured and tested from the end of the link or channel where all cables are terminated at a distribution panel. In case the cabling runs from panel to panel (data center) where the worst case PS ANEXT margin is less than 2 dB, the PS ANEXT test results for each disturbed link shall be collected and saved from both ends (both panels) of the disturbed link.
2. PS AACR-F results at each frequency tested (See Table 1) for each wire pair in a disturbed link as well as the PS AACR-F results for the average of the four wire pairs. The worst case margin and the worst values shall be provided for each wire pair and the average of the four wire pairs. PS AACR-F only needs to be measured and tested from one end of the link or channel. Connect the main DTX-1800 unit (measurement of PS AACR-F disturbance) to the disturbed link or channel at the end where all cabling links are terminated at a distribution panel. Select End 1 in the AxTalk Analyzer Software.

3.7 GENERAL TESTING REQUIREMENTS – FIBER OPTIC CABLES

- A. All multi-mode fiber cable paths (installed in data center) shall be tested utilizing a power meter to determine the following:
 1. Loss at both 850 and 1310 nanometers
 2. Cable length
- B. Test shall include fiber termination cassettes modules.
- C. Contractor shall provide results from power meter testing of fiber optic cable to attest to proper polarity and end-to-end performance of the installed fiber.
- D. Contractor shall provide for the Owner's Representative as part of the as-built documentation the factory test results indicating the actual length and the measured end-to-end loss.

END OF SECTION

SECTION 271119 - COMMUNICATIONS TERMINAL BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other Division 1 – General Requirements sections, apply to the work specified in this section

1.2 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment, including all support structure whether called out for or not, required for the complete installation of work called for in the Contract Documents
- B. Install modular, rack mounted patch panels, and all support structure in the Equipment and Telecommunication Rooms as outlined on drawings and specifications. The proposed schedule of patch panels and port counts are as follows:

IDFA	48 Port
IDFB	48 Port
IDF C	n/a
IDFD	24 Port
IDFE	48 Port
IDFF	48 Port
IDFG	48 Port

1.3 SECTION INCLUDES

- A. This Section addresses the termination of copper station cables which are to be placed between the Wireless Access Point locations (WAP) and either the Main Equipment Room (MDF) or the Telecommunications Rooms (IDFs) located throughout the building.

1.4 QUALITY ASSURANCE

- A. All equipment shall be installed in a neat and workmanlike manner.
- B. All materials shall be installed per manufacturer's specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products must be new and UL® Listed for their use.

2.2 PATCH PANELS

- A. 8-pin modular category 6, 24 or 48 port for Wireless Access Points (WAP).

PART 3 - EXECUTION

3.1 GENERAL

- A. All patch panels supporting the copper backbone cabling shall be installed in 7' x 19" equipment racks in the telecommunications rooms.

3.2 INSTALLATION

- A. A one RMU horizontal wire management panel shall be installed at the top of each rack. Additional horizontal wire management shall be installed at a rate of one RMU per each 24 port panel installed.

3.3 PATCH PANELS

- A. Patch panels shall be installed in racks as indicated on the drawings.
- B. Category 6 patch panels will be required to support WAPs shall be terminated sequentially with all Category 6 types of endpoints.

END OF SECTION 271119

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL REQUIREMENT

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.
- B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.2 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.
- B. Intent is to have new category 6 horizontal cable in areas outlined in drawings:
 - 1. Two category 6 cables at each WAP location identified in the drawings.
- C. Install horizontal cable as outlined on drawings and specifications. Includes sleeves for any ceiling or wall penetrations not provided by the Electrical Contractor; fire stopping as directed by the AHJ, or Owner; and all support structure needed to install the above components.
- D. Verify actual counts on prints and drop detail.

1.3 SCOPE OF WORK

- A. It is the intent of this section for the Contractor to provide a complete workable cabling system ready for the Owner's use in accordance with the latest current version of ANSI/TIA-568 standards to support high speed data applications up to 10Gbps including IEEE 802.3x system standards.

1.4 QUALITY ASSURANCE

- A. All cable shall be installed in a neat and workmanlike manner.
- B. Strictly adhere to all category 6 installation practices when installing horizontal cabling. Testing and certification for both systems shall be as detailed in Section 270800.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Please refer to Section 270513 for General Requirements.
- B. The horizontal balanced twisted pair cabling system shall be a combination of category 6 and category 6A warranted link systems, including the patch panels, cables, and telecommunications outlets/jacks.
- C. All four-pair balanced twisted pair cable shall be rated CMP.

2.2 COPPER CABLE

- A. Cable identified for Wireless Access Points (WAP) shall be; 4-Pair balanced twisted pair rated for category 6. With 2 cables per WAP location, first cable to color to be purple, second cable Color to be yellow.

PART 3 - - EXECUTION

3.1 GENERAL

- A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.
- B. The bend radius shall be no less than 4 times the outside cable jacket diameter for the cable.
- C. Only Velcro[®] type cable wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the Telecommunication Rooms.

3.2 PREPARATION

- A. Conduits
 - 1. All conduits and sleeves shall be inspected for bushings prior to cable installation.
 - 2. Missing bushings shall be brought to the attention of the owner or authorized representative.

3.3 INSTALLATION

- A. Copper Cables

1. Installation shall be in a manner to meet the specifications as outlined by the cable manufacturer for the product set being installed.
2. Copper horizontal cables shall be pulled from the Telecommunications Room to the workstation.
3. Service loops of
 - a. 10 feet minimum shall be left coiled high as high as possible in the TR.
 - b. 25 feet of slack shall be neatly coiled and secured with Velcro® at the telecommunications outlet (typically in the ceiling) used for Wireless Access Points
 - c. Placement of service loops subject to verification by Owner.
4. Location and label shall be annotated on the as built drawings.

END OF SECTION 271513

ELMIRA HIGH SCHOOL WAP WIRING PLAN

General Notes:

A. Locations are approximate.
Coordinate all final locations with owner prior to installation

Notes:

1. Area within dotted lines will be under active construction.
2. No new wiring to IDF C, runs should be directed to IDF H

Symbols:

⊖ WAP location. Provide 2 Cat 6 cables, field terminated per location.

