SPRING LAKE
PUBLIC SCHOOLS

Bid Documents
For

Spring Lake Public Schools

HIGH SCHOOL DATA CABLING

Spring Lake Public Schools
345 Hammond St
Spring Lake, MI 49456

Distributed by:

CommtechDesign
Contact Bret Emerson
616-863-8132
bret@commtechdesign.com

January 22, 2023

SECTION 28 0500 – FRONT END

PART 1 - GENERAL

1.01 INTRODUCTION

A. Spring Lake Public Schools invites qualified contractors to provide proposals for a High School Data Cabling Project. This work includes:

a. The base bid is the cost for the installation of all the data cabling and fiber cabling including all equipment, labor, installation and testing.

B. The Contractor shall pay all costs of the Work including, but not limited to, labor, materials, equipment, tools, transportation, freight, taxes, royalties, patent fees, support facilities, construction equipment, water, heat, utilities, supervision, overhead, and all other items necessary for the proper execution and completion of the Work.

1.02 CONTACTS

A. The contact for all questions and any addendums during bidding shall be:

Commtech Design
Bret Emerson
616-863-8132
bret@commtechdesign.com

B. The owner as referred to in this bid is:

Spring Lake Public Schools
345 Hammond Street
Spring Lake, MI 49456

1.03 BID RESPONSE DUE DATES

A. Bids responses are due and shall be received no later than February 28th, 2024 at 3:00PM sharp.

1. Emailed copies of the bid responses shall be sent to the following Email addresses:
   a. bidsubmit@springlakeschools.org
   b. Owner representative: Brent Gustafson
   c. Physical copies of the bid responses will ***NOT*** be accepted.

B. A pre-bid video conference call will be held on January 26 @ 2:00, There will not be an on-site pre-bid meeting.
Login to the video call at:

Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 237 709 056 193
Passcode: hVjCmB
Download Teams | Join on the web
Or call in (audio only)
+1 906-748-9457,,694089366# United States, Sault Ste Marie
Phone Conference ID: 694 089 366#

C. All questions shall be submitted to the owner no later than January 29, 2024 at 3:00PM. All questions shall be sent via email to Bret Emerson and Joni Hodson of Commtech Design

- Bret Emerson bret@Commtechdesign.com
- Joni Hodsdon joni@commtechdesign.com

1.04 BUILDING SITES

A. Work to be completed as part of this bid will be done at the sites as detailed in the drawings and specifications:

B. Access to the sites shall be from 7:30 AM to 5:00 PM Monday thru Friday.

1. Arrangements can be made for additional time on site during each day as scheduled with the owner.
2. All work in the classrooms or hallway shall be completed during the summer or during non-school hours.
3. No work activity shall disrupt the regular school day schedule or in any way intrude upon the teaching and administration of students.

1.05 OWNERS RIGHTS

A. The owner reserves the right to waive any formalities to bid, to reject any or all bids and to accept the bid that is most favorable to the Owner.

B. The owner does not incur any responsibility for Bidder's costs in preparing the bid proposal.

C. Bidder recognizes that the owner is subject to the Freedom of Information Act. Per formal request the owner will make bid documents available for public review following contract with a successful bidder.

1.06 BID RESPONSE FORMAT -EMAIL PDF

A. The owner requires that all responses be a PDF document emailed to the following people:

a. Spring Lake bidsubmit@springlakeschoolw.org
b. Commtech Design at bids@Commtechdesign.com

B. Bid response email format shall be:

1. Email shall be titled: *Client Name -Project Name - Bidder Name* – **Response**
2. Attach to the email a single PDF document that is all inclusive of your bid response. This document shall be considered your entire bid response.
3. Send a second email with no attachment titled: *Client Name -Project Name - Bidder Name* – **Verification Email**
   a. **This will be used in case there were any issues with receiving the PDF file with the Response Email.**

C. Bid response PDF Format shall be:

1. All bid responses shall be submitted on a combined PDF document. Document shall contain:
   a. First Page shall be cover page with project name and your company logo.
   b. Include fully filled out and signed Bid Form.
   c. Single-page synopsis of your bid.
   d. Familial Disclosure Form
   e. Iran Form
   f. Bid Bond (If supplying a check include a copy of the Cashier's Check. Owner may ask for physical check after the bid due date.
   g. Any other forms required in the RFP,
   h. Spreadsheet listing products being proposed.
   i. Description of the bidder's response and the services they will provide.
   j. Any information the bidder wishes to include that was not specifically required.
   k. Personnel that will be working on the project including:
      A) Project Manager. The direct client contact. Include a resume.
      B) List of proposed subcontractors and a scope of their work.

1.07 DOCUMENTS

A. The following drawings are part of the bid package.

1. Refer to the table below to determine which drawings are included in each bid category. Some drawings refer to multiple bid categories.

DWG.	Drawing Name
TC101	DATA CABLING DETAILS
TC102	DATA CABLING DETAILS
TC103	DATA CABLING DETAILS
TC104	DATA CABLING DETAILS
TC201	HIGH SCHOOL ADMIN FIRST & SECOND FLOOR CABLING FLOORPLANS
TC202	HIGH SCHOOL OVERALL CABLING FLOORPLAN
TC203A	FIELDHOUSE MAIN LEVEL-A CABLING FLOORPLAN
TC203B	FIELDHOUSE MAIN LEVEL-B CABLING FLOORPLAN
TC204A	FIELDHOUSE MEZZANINE-A CABLING FLOORPLAN
TC204B	FIELDHOUSE MEZZANINE-B CABLING FLOORPLAN
TR301	RACEWAY DETAILS
TR401	FIELDHOUSE MAIN LEVEL-A RACEWAY FLOORPLAN
TR402	FIELDHOUSE MAIN LEVEL-B RACEWAY FLOORPLAN
TR403	FIELDHOUSE MEZZANINE-A RACEWAY FLOORPLAN
TR404	FIELDHOUSE MEZZANINE-B RACEWAY FLOORPLAN
TR301	RACEWAY DETAILS
TR801	ADMIN OFFICE FIRST AND SECOND LEVEL RACEWAY FLOORPLAN

B. The following specifications are part of the bid package.

1. The following specifications are part of the bid package.
2. Refer to the table below to determine which specification sections are included in each bid category. Some sections refer to all bid categories.

Specification	
28 0000	Coversheet
28 0500	Front End
	Bid Form
	Familial Disclosure
	Iran Form
28 1000	Technology Overview
28 1100	Communications Room
28 1150	Communications Grounding
28 1500	Fiber Cabling
28 1600	Cat-6 Cabling
28 7200	Technology Submittals
28 7600	Technology Labeling
28 7700	Technology Testing
28 7750	Technology Training
28 7800	Technology Warranty

PART 2 - PERSONNEL

2.01 BIDDER

A. Minimum Bidder Qualifications:

1. Bidder must be fully licensed and insured.
2. Bidder must be fully authorized by the manufacturer being proposed to install and configure the equipment.

3. Shall have technicians that are fully certified to install and configure the equipment being provided as part of the bid.

B. Bidder shall address each item in this package as specified. All required labor and equipment must be quoted. Any exception must be noted and explained. All bids must include the entire section bid to be considered.

C. The Contractor can withdraw their bid at any time prior to opening the bids.

D. Work shall be coordinated with the owner's technology coordinator, architect, construction manager and the technology designer

2.02 PERSONNEL

A. All personnel working on the project shall be certified by the manufacturer to install, configure and connect the equipment as per the owner's requirements and the manufacturer's specifications.

B. The contractor shall assign a Project Manager to the project who will have ultimate authority to make decisions, schedule work and fix or repair any non-conforming equipment.

1. Provide a list of the projects of similar size and scope to the work they will be doing as part of this project. Include examples of three projects with similar scope that the PM has worked on in the last three years.
2. The project manager will be the primary contact for this project
3. The project manager shall attend all project meetings and be fully aware of all work going on as part of the project.

2.03 BACKGROUND CHECKS

A. Contractor's staff may be required to pass a security clearance check conducted by the Owner.

B. The Contractor shall authorize the investigation of its personnel proposed to have access to facilities and systems on a case-by-case basis.

1. The scope of the background check is at the discretion of the owner and the results will be used to determine Contractor's personnel eligibility for working within the facilities and systems.
2. Such investigations will include Michigan State Police Background checks (ICHAT) and may include the National Crime Information Center (NCIC) Finger Prints.
3. Proposed Contractor personnel may be required to complete and submit an RI-8 Fingerprint Card for the NCIC Finger Print Check.
4. Any request for background checks will be initiated by the owner or construction manager and will be reasonably related to the type of work requested.

PART 3 - WORK REQUIREMENTS

3.01 DOCUMENTS

A. The contractor shall review all bid documents including specifications and the drawings. The specifications and documents and any addenda detail the requirements of the chosen contractor.

B. It is mandatory that items of material and equipment conform to the Contract Documents and meet the quality standards in every respect.

C. Where any specifications or drawings are not in agreement the higher value or more stringent requirement shall apply, and shall be included in the bid pricing.

3.02 PRODUCTS

A. All products shall be of the latest manufacture. No remanufactured or used equipment shall be provided as part of the bid.

B. All equipment shall be provided in the manufacturers shipping container. Provide copy of the shipping lists as part of the project documentation.

3.03 PRODUCT DELIVERY AND LIABILITY

A. The contractor shall be responsible for the complete installation of new and un-damaged products.

B. The contractor shall be liable for all equipment until it is formally accepted by the owner in writing. This shall include the equipment when it is in the contractor's facility and when it is in the owner's facility until it is formally accepted.

3.04 DAMAGE

A. The contractor shall be responsible for all damage made to the building or any of the buildings contents during their work as part of this project.

B. The contractor shall not disturb any hazardous material or materials that they are not authorized to work with.

3.05 INCIDENTAL WORK AND PERMITS

A. The contractor shall be responsible for requesting, obtaining and paying for any and all permits required for their work by the local, county, state and federal authorities having jurisdiction (AHJ) over the work being performed.

B. Provide any and all work or equipment required by the Authority Having Jurisdiction (AHJ) that may or may not be specifically noted in these documents.

3.06 INSPECTION OF THE WORK

A. The contractor shall keep up to date as-builts on site for the duration of the project. The engineer may request to see the as-built documents at any time.

B. The Contractor shall promptly facilitate inspection and testing of the Work regardless of expense as necessary or as requested by the Owner, regardless of whether or not the Work in question is his own or that of a subcontractor.

C. If such tests or inspections reveal deficiencies as measured by Construction documents or an independent consultant/testing agency or the owner/engineer, the Contractor shall bear all costs incurred to correct such deficiencies, and the cost to reconstruct any work to meet the contract documents.

D. Contractor shall schedule any and all permit inspections required by the AHJ. Schedule these to support the owner occupancy date required by the owner.

3.07 PROJECT MEETINGS

A. The contractor shall attend project meeting as designated by the owner or engineer. Attendance is mandatory.

B. Meetings are a minimum of every two weeks onsite. Include these costs for attending project meetings with your bid.

C. Contractor will be required to attend additional meetings onsite or virtually when project timelines require.

PART 4 - WORK SCHEDULES

4.01 PROJECT SCHEDULE

A. It is the intention of the owner to take possession of the Work by the established completion date or earlier, within the shortest time possible consistent with good construction practices.

B. The Completion Date Shall be June 30, 2025.

C. Upon award of the contract the contractor shall provide a complete schedule for their work. This shall reference dates in the document and be coordinated with the schedule of any other contractors.
   1. Include start date
   2. Products installed
   3. Punch list work complete
   4. Substantial Completion
   5. Final Completion after system has been working for 30 days with no outages or failures

D. If the work is delayed through the fault of the owner (or of any separate contractor employed by the owner)
   1. The Contractor shall notify the owner, in writing, of any condition or situation that in the Contractor's opinion warrants an extension of Contract Time.

2. The Contractor shall not be entitled to additional compensation or damages due to delays, interference's or interruptions to the Work or the Project, but shall be entitled only to an appropriate extension of time in accord with the General Conditions of the Contract for Construction.

PART 5 - DEFICIENT WORK

5.01 PRODUCT AND INSTALLATION DEFICIENCIES

A. The Contractor shall expediently correct all deficiencies brought to his attention in writing or verbally by the owner. If, in the opinion of the owner and the technology design or construction manager, the Contractor fails to correct deficiencies, or fails to act expeditiously to correct deficiencies, the owner may:
   1. Accept the deficiencies in the Work, and reduce the Contract Sum of the Contractor at fault by a unilateral Change Order issued and signed by the ownert in an amount to be determined by the owner.
   2. Have the deficiencies removed in any reasonable manner available to the Owner, and charge the Contractor at fault for the costs incurred, or reduce that Contractor's Contract Sum by a unilateral Change Order issued by the Owner for the costs incurred.

B. The Contractor shall pay all costs of the Work including, but not limited to, labor, materials, equipment, tools, transportation, freight, taxes, royalties, patent fees, support facilities, construction equipment, water, heat, utilities, supervision, overhead, and all other items necessary for the proper execution and completion of the Work.

PART 6 - GENERAL

6.01 LEGAL REQUIREMENTS

A. The Contractor shall comply fully with all laws, statutes, ordinances, rules, regulations, codes, and lawful orders applicable to their work, including employment regulations, unless specifically exempted from compliance by the Contract Documents. Where local codes differ from codes of broader jurisdictions, the more stringent code shall apply. The Contractor shall promptly notify the Owner in writing of items in the plans or specifications for this project that violate any applicable codes.

6.02 CLEAN SITE

A. The contractor shall clean the site daily.
B. The contractor shall be responsible for disposal and removal from the site any and all waste and debris generated from their work.
C. All dust or ceiling debris generated as part of the work shall be cleaned each day.

6.03 PREVAILING WAGE

~~A.~~ This project is not subject to the Prevailing Wage Law; Michigan Public Act 166 of 1965.

6.04 TAXES

A. The bidder is responsible to apply all tax information within their proposal. Contractor is responsible for applying such tax with each request for payment and complying with Federal, State and local laws.
B. All tax costs shall be included in the base bid price.

6.05 PAYMENTS

A. The contractor shall submit an invoice on the AIA form G702/G703 each month. The invoice shall include only work completed at the time of submission.
B. The contractor can be paid for equipment in storage at the owner's site if the following criteria are met:
   1. Note on the AIA invoice form that equipment invoice is for stored material.
   2. Provide a listing of all equipment that is being invoiced for and the quantity of each item.
   3. Provide pictures of the equipment/boxes that are being invoiced.

4. Provide proof of insurance on the building and equipment where the equipment is stored and that the owner is listed as additionally insured. Provide an Accord Form listing the owner as additionally insured.

C. The owner will provide payment on the invoice within 30 days of a signed invoice by the engineer and contractor.

D. The owner will retain 10% of the total cost of the project until the system is considered finally complete as detailed in the project documents.

PART 7 - REVIEW OF BIDS

7.01 OWNER REVIEW

A. The Owner reserves the right to waive any formalities to bid, to reject any or all bids, or to accept the bid that is most favorable to the Owner. The Owner does not incur any responsibility for Bidder's costs in preparing the bid proposal.

7.02 BID BOND

A. Provide with the bid response a 5% Bid Bond which is required for all proposals. The bond must be in the form of a certified check or a bond executed by a surety company authorized by the State of Michigan. The amount of the bond shall be forfeited if the Contractor, after being awarded the bid, fails to enter into an appropriate contract with the Owner within (30) days.

7.03 PERFORMANCE BOND

A. Successful bidders, for work valued at $50,000 or more, will be required to secure Performance, Labor and Material Bonds issued for the full amount (100% value) of the contract by a company licensed to do business in the State of Michigan and having an A.M. Best rating of A- or better. The cost of these bonds is to be included in the proposal amount.

7.04 INSURANCE

A. Contractors must have the proper insurance forms submitted prior to start of their Work. The required insurance shall be written for not less than the limits shown below, or greater if required by law. Contractors will require all subcontractors to maintain similar coverage limits. The Contractor shall name the Owner as additional insured.

1. Standard Workers Compensation and Employers Liability Employers Liability
   a. $500,000 Bodily Injury by Accident—each accident
   b. $500,000 Bodily Injury by Disease—each employee
   c. $500,000 Bodily Injury by Disease—policy limit
2. General Liability Combined Single Limit Liability
   a. $1,000,000 each occurrence
   b. Or Split Limit Liability
   c. $500,000 Bodily Injury—each occurrence
   d. $500,000 Property Damage—each occurrence
3. Aggregates
   a. $1,000,000 General Aggregate
   b. $1,000,000 Products-completed operations
   c. Automobile Liability Combined Single Limit Liability
   d. $500,000 each accident

   Or
   e. Split Income Liability
   f. $500,000 Bodily injury—each person
   g. $500,000 Bodily injury—each accident
   h. $500,000 Property Damage—each accident
4. Umbrella Insurance
   a. $2,000,000 Limit over primary insurance

7.05 REVIEW OF BIDS

A. Bids will be reviewed based on the following criteria:

1. Compliance with bidding documents

2. Price
3. Responsiveness to owner's requirements
4. Experience and references with similar projects
5. Manufacturers relationships and personnel that are certified in the manufacturer's equipment.
6. Any on-going costs associated with the equipment or installation.
7. The owner reserves the right to make any decision which they deem to be in their best interest regardless of price or experience of the bidders.

PART 8 - USF FUNDING REQUIREMENTS

8.01 IDENTIFICATION NUMBER

A. The service provider's USF Service Provider Identification Number (SPIN) *must* be included in the Bid. Direct all questions regarding the USF requirements in this RFP to the Universal Service Administrative Company (USAC), Schools and Library Division (SLD) at (888) 203-8100.

8.02 FY2024 FUNDING REQUESTS

A. The specified products and/or services are to be provided for FY2024-25 and must qualify for universal service discounts under the FY2024 universal service support mechanism, E-Rate. The *E-rate Modernization Order* permits applicants to seek support for Category 2 eligible non-recurring services purchased on or after April 1, three months prior to the start of the funding year on July 1.

8.03 UNIVERSAL SERVICE DISCOUNTS

A. The service provider contract is conditional upon the District receiving universal service discounts under the FY2024 universal service support mechanism, E-Rate. The District reserves the unrestricted right to reduce the contract amount by reducing the amount of services and/or products in order to meet budget requirements in the event the level of the universal service discounts is reduced. Any such reductions to the contract amount will be taken prior to the start of the specific work being reduced or eliminated on a given building and/or project.

8.04 UNIVERSAL SERVICE DISCOUNT IMPLEMENTATION

A. The District reserves the unrestricted right to specify the filing option for the universal service discounts for each product and/or service offered within a Bid: Billed Entity Applicant Reimbursement (BEAR) *or* Service Provider Invoice (SPI).

8.05 ELIGIBLE PRODUCTS AND SERVICES

A. The USF eligible products and/or services identified on the USAC FY2024 Eligible Services List, which is incorporated herein by reference, must be identified separately from any and all "ineligible" products and/or services in the Bid.

8.06 PROJECT FUNDING REQUIREMENTS

A. This project is entirely conditional upon receiving written notification in the form of a Funding Commitment Decision Letter from the USAC/SLD that the District has been approved for E-Rate Funding. If the District receives less than the full E-Rate Funding for which it applies, the District has the unrestricted right to reduce the number of units and services in the accepted Bid. In the event that E-Rate Funding is not available for the accepted Bid, District, in its discretion, may cancel and/or modify the Scope of Work (SOW) and subsequent purchases requested in this RFP.

8.07 LOWEST CORRESPONDING PRICE

A. Lowest Corresponding Price (LCP) is defined as the lowest price that a service provider charges to non-residential customers who are similarly situated to a particular E-rate applicant for similar services. Service Providers cannot charge E-rate applicants a price above the Lowest Corresponding Price (LCP) and must actually charge the rate that is the LCP, not just offer the LCP in the Bid. In addition, promotional rates offered by a Service Provider for a

period of more than 90 days must be included among the comparable rates upon which the LCP is determined.

END OF SECTION

BID FORM

Spring Lake Public Schools
High School Cabling

Spring Lake High School Cabling

TO: Spring Lake Public Schools
345 Hammond St.
Spring Lake, MI 49456

Company Name: _____

hereinafter called "Contractor", does agree to provide equipment and labor as described in the specifications and drawings.

Total Base Bid : $ _____ (in numbers)

The base bid is the cost to provide and install all the data cabling, fiber cabling, comm room equipment and associated equipment
Work shall include all equipment, labor, installation, configuration, warranty and testing.

Authorized Signature: _____

Name (printed): _____

Date: _____

Email: _____

Telephone: _____

Addenda

The Contractor acknowledges receipt of the following addenda and has included their costs in the Total Base Bid price shown above.

Addendum # _____ Dated: _____ Addendum # _____ Dated: _____

Contractor Address: _____ Phone: _____

_____ Fax: _____

_____ E-mail: _____

BID FORM

Spring Lake Public Schools
High School Cabling

Voluntary Alternates:
Voluntary alternates are allowed and may be considered at the discretion of the owner. For each voluntary alternate, provide a brief written description and attach additional information as requried to fully describe intent. All alternates shall be completely inclusive and shall not require any additional work by other trades.

1. _____
Descripton

Add / Deduct (circle one) $ _____

2. _____
Descripton

Add / Deduct (circle one) $ _____

Unit Costs:
Provide pricing for the described work or the described product as a single unit cost. The unit cost shall include any travel, equipment labor, overhead and tax required for purchase and installation of the product or service.

1 Provide, install and test one (1) CAT-6 cable and modular jack. This shall be for a cable that is 225' long. Include one port modular plate and labels.

Unit Cost: $ _____

2 Provide, install and test one (1) CAT-6A cable and modular jack. This shall be for a cable that is 225' long. Include one port modular plate and labels.

Unit Cost: $ _____

Breakout Pricing:
Include pricing on a school by school basis.
clarification #1
clarification #1

1 High School Cost: $ _____

2 Fieldhouse Cost: $ _____

STATEMENT REGARDING FAMILIAL RELATIONSHIP

AFFIDAVIT OF _____
(name of affiant)

STATE OF MICHIGAN

COUNTY OF _____

_____makes this Affidavit under oath and states as follows:

1. I am a/the
   - President
   - Vice-President
   - Chief Executive Officer
   - Member
   - Partner
   - Owner
   - Other (please specify) _____

Of _____, a bidder on a construction project for
(insert name of contractor)

_____ that involves, at least in part, construction
(insert name of school district)

of a new school building or an addition to or repair or renovation of an existing school building.

2. I have personal knowledge and/or I have personally verified that the following are all of the familial relationships existing between the owner(s) and employees(s) of the aforementioned contractor and the school district's superintendent and/or board members

_____

_____

3. I have authority to bind the aforementioned contractor with the representations contained herein, and I am fully aware that the school district will rely on my representations in evaluating bids for the construction project.

4. I declare the above information to be true to the best of my knowledge, information and belief. I could completely and accurately testify regarding the information contained in this affidavit if requested to do so.

_____
(signature of affiant)

Dated _____

Subscribed and sworn before me in _____County,

Michigan, on the _____day of _____, 200__

_____(signature)

_____(printed)

Notary public, State of Michigan, County of _____

My commission expires on _____

Acting in the County of _____

Iran Economic Sanctions Act Certification

I am the _____ of _____, or I am
(title) (Bidder Company)
bidding in my individual capacity ("Bidder"), with authority to submit a binding bid for the High School Cabling to Spring Lake Public Schools. I have personal knowledge of the matters described in this Certification, and I am familiar with the Iran Economic Sanctions Act, MCL 129.311, *et seq.* ("Act"). I am fully aware that the school district will rely on my representations in evaluating bids.

I certify that Bidder is not an Iran-linked business, as that term is defined in the Act. I understand that submission of a false certification may result in contract termination, ineligibility to bid for three (3) years, and a civil penalty of $250,000 or twice the bid amount, whichever is greater, plus related investigation and legal costs.

_____
(signature)

_____
(printed)

_____
(date)

SECTION 28 1000 – TECHNOLOGY OVERVIEW

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides a project overview and general project and Contractor requirements for technology work.

B. The “Contractor” as referred to in these specifications, shall be the bidder whose bid is eventually chosen as the winner.

C. The “Engineer” as referred to in these specifications, shall be Commtech Design and its representative on this project.

D. The “Owner” as referred to in these specifications, shall be Spring Lake Public Schools and its representatives.

E. In the detailed specifications and on the contract drawings, the phrases “or equivalent,” “approved equivalent,” “approved equal,” “or equal” and “engineer approved equivalent” shall be used interchangeably and shall mean the same thing.

F. All equals, equivalents, or alternates shall be approved by the Engineer prior to ordering or installation. Without approval, deviation from the products listed in the specifications and on the drawings, shall be presumed to be nonconforming and shall be removed and replaced at the direction of the Engineer and at the Contractor’s expense.

1.02 DESCRIPTION OF PROJECT

A. Cabling and communications infrastructure.

1. The communications portion of the project encompasses communications cabling and termination equipment. The work shall include but not be limited to:
    a. Communications room racks and cabinets.
    b. Communications Cabling and Termination Equipment:
    a. User UTP Plenum rated CAT-6 and CAT-6A cabling.
    b. Fiber optic cabling and termination.
        1) Terminate and test each fiber strand. Terminate into panels at each end.
2. All cables shall be labeled according to the drawings and the specifications.
3. All cables shall be terminated and tested as per the specifications.
4. Contractor shall provide personnel and equipment for full training and commissioning of the system.
2. All cables shall be supported by J-hooks or cable tray/ladder.
3. Label all cables.
4. Test all cables.
5. The extent of the work shall be as shown on the drawing and detailed in these specifications.

B. Post installation documentation

1. Each contractor shall provide post-installation documentation as per the specifications. Shall include but not be limited to:
    a. Red-lined as-built drawings
    b. As-built detailed connectivity of AV and Network Systems
    c. As-built cable locations and cable labels at each location.
    d. Mark all splice locations
    e. Update of all access control locations and equipment at each door
    f. Camera locations and camera numbers.
    g. Spreadsheet (hard copy and Excel file) for all network, Wireless, telephones and cameras detailing:
        A) Mfg. Part number
        B) IP Address
        C) MAC Address
        D) Device number (Camera #, Telephone # etc)

1.03 CONSTRUCTION SCHEDULE

A. The fieldhouse is a new building and the Admin offices are an addition to the High School.
B. Contractor shall coordinate the installation schedule with their work installing cabling.
C. Fieldhouse rough Schedule for Construction
    1. Construction begins 6/2024
    2. Floor poured 10/2024
    3. Conduit installed 12/2024
    4. Technology Install January 2024 thru final completion.
    5. Building Completion (tentative) 6/2025
D. Admin office rough Schedule for Construction
    1. Construction begins 6/2024
    2. Floor poured 10/2024
    3. Conduit installed 12/2024
    4. Technology Install January 2024 thru final completion.
    5. Building Completion (tentative) 6/2022

1.04 STORAGE OF MATERIALS
A. All materials shall be secured when not in use by the Contractor.
B. It shall be the Contractor's responsibility to secure all equipment including all material to be installed as part of the contract. No changes shall be made to the contract due to loss or theft of equipment and materials not officially accepted by the Owner.

1.05 PERMITS
A. The State of Michigan requires that the Contractor apply for and obtain permits for data telecommunication installation.
B. This is required under State of Michigan Public Act 230. The inspector at the State of Michigan states that the code never exempted data telecommunications from permits and previous rules had overstepped their bounds. Only exemptions to the permit requirements are found in Public Act 230 MCL125.1528a.
    1. There is not a license required to apply for a permit per Public Act 407 MCL339.5737(3)(o).
C. The Permit is required under Public Act 230. The permit is under 2017 Michigan Electrical Code rules Part 8.
D. People who can obtain the permit include the Owner of the building or a company representing the owner. See Public Act 230 MCL125.1510.
    1. Contractor shall be required to apply for and obtain the permit.
    2. Contractor shall be required to install the data telecommunications system to fully meet all code requirements and requirements of the Inspector and Authority Having Jurisdiction (AHJ)
E. State inspector has noted that the inspection process for data telecommunications is the same as any other inspection.
    1. Do not cover or conceal any wiring without approval.
    2. Electrical Inspectors will be conducting the inspections.
    3. Contractor shall be responsible for scheduling the inspections and attending the inspections with the inspector.
F. State inspector has noted that the inspectors will be inspecting for code compliance including manufacture's installation instructions for the cables and terminations.
G. An installation may not pass inspection if there is any Non-compliance with the code.

1.06 REFERENCE SPECIFICATIONS-CABLING
A. All work applicable shall conform to the following standards:
B. ANSI/TIA-568-C.0, "*Generic Telecommunications* Cabling *for Customer Premises*",
C. ANSI/TIA-568-C.1, "*Commercial Building Telecommunications Cabling Standard*",
D. ANSI/TIA-568-C.2, "*Balanced Twisted-Pair Telecommunication Cabling and Components Standard*", ANSI/TIA-568-C.3, "*Optical Fiber Cabling Components Standard*",
E. ANSI/TIA-568-C.4, "*Broadband Coaxial Cabling and Components Standard*",

F. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
G. IA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings including all Updates and Addenda.
H. TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
I. EIA-472 General Specification for Fiber Optic Cable
J. EIA-472A Sectional Specification for Fiber Optic Communication Cables for Outside Aerial
K. EIA-472B Sectional Specification for Fiber Optic Communication Cables for Underground and Buried Use
L. EIA-472C Sectional Specification for Fiber Optic Communication Cables for Indoor Use
M. EIA-472D Sectional Specification for Fiber Optic Communication Cables for Outside Telephone Plant Use
N. NEC, 2015, or latest edition available
O. IEEE 802.3af PoE • Ratified in 2003 • 15.4W at the PSE, with min of 12.95W available to the PD
P. IEEE 802.3at PoE+ • Ratified in 2009 • 34.2W at the PSE, with min of 25.5W available to the PD
Q. IEEE 802.3bt-2018 - IEEE Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 pairs

1.07 REERENCE STANDARDS NETWORKING
A. EE 802.3™: Ethernet
B. IEEE 802.11™: Wireless Lans
C. IEEE 802.22™: Wireless Regional Area Networks
D. TIA/EIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
E. IEEE 802.3af PoE • Ratified in 2003 • 15.4W at the PSE, with min of 12.95W available to the PD
F. IEEE 802.3at PoE+ • Ratified in 2009 • 34.2W at the PSE, with min of 25.5W available to the PD
G. IEEE 802.3bt-2018 - IEEE Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 pairs

1.08 CONTRACTOR-ALL
A. Each contractor shall be responsible for inspecting their own work and ensuring it meets the project requirements.
B. Contractor shall have a project manager who will be responsible for all work, workers, equipment, cabling and project management for their work. The project manager shall have the authority to make decisions for the contractor and schedule all workers.
C. Contractor shall attend all project meetings throughout the project.
D. All work on the project shall meet all applicable state, federal, local and industry codes and be installed according to the requirements of he Authority Having Jurisdiction (AHJ).

1.09 CONTRACTOR -CABLING
A. The Contractor shall have a BICSI certified Registered Communications Distribution Designer (RCDD) identified that will be responsible for all aspects of the installation. (This person does not have to be a direct employee of the bidder but must inspect the work to ensure that it is done based on standards)
1. The resume of the RCDD, and a list of past projects the RCDD has worked on, shall be submitted with the submittal package. The Engineer reserves the right to reject the RCDD, and require the Contractor to assign another if the RCDD is found not to have sufficient experience in projects of relatively the same scope.
2. If during the course of the work, the Contractor changes the RCDD assigned to the project, the Contractor shall provide the resume of the new RCDD and a list of projects of similar scope the new RCDD has worked on.

B. The Contractor shall show proof of an existing contractual relationship with the approved equipment manufacturer of the horizontal cabling system, and shall pass through the manufacturer's certification and warranty to purchaser.
C. All faceplates and termination hardware shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.
D. The Contractor shall accept complete responsibility for the installation, certification, and support of the cabling system. Contractor must show proof that he has the certifying manufacturer's support on all of these issues.
E. All work shall be performed and supervised by Telecommunications Technicians and Project Managers who are qualified to install voice, data, and image cabling systems, and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.
F. The Telecommunications Technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the vendor is a current Certified Installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling for the building.
G. The Contractor (including Subcontractor(s) if any) shall have a proven track record in cabling projects. This must be shown by the inclusion of details of at least 3 projects involving Category 6 or better cabling and optical fiber, which have been completed by the vendor in the last 2 years. Names, addresses, and phone numbers of references for the 3 projects shall be included.

PART 2 - PRODUCTS

2.01 FIRESTOPPING
A. Each contractor shall be responsible for firestopping around their cables and the raceways.
B. Shall be completed inside and around all conduits after cable installation.
C. Firestop for the area between the cable and the edge of the conduit shall be Nelson No. FSP, CLK or LBS+. Contractor shall install the best firestop for each individual installation.
    1. Firestop shall be installed with regard to local and national building codes.
    2. The firestop shall be a putty like substance that expands under heat and will not allow flame to pass for a designated period of time.
    3. Firestop shall conform to all NEC, NFPA, and UL requirements.
    4. Some wall pass-thru' s are shown on the drawings. The Contractor shall utilize these where possible.
    5. Where the contractor must install cables through a wall where there is no pass-thru already provided, the Contractor shall be responsible for installing a fire-rated pass-thru and fire-stopping the conduit after cable installation.
D. Firestopping is required at all riser conduits and all pass thru's.
    1. Each cable tray penetration of a wall shall be firestopped after cable installation. Use pillow type firestop to allow additional cables to be installed in the future.
    2. Where riser conduits pass through floors, the area between the concrete and the conduit shall be firestopped. This shall be completed with a putty or liquid firestop product. Fill in the space with mineral wool, and then install the firestop on top. All firestop shall be of sufficient thickness to secure the rating required by code.
    3. After final cable installation, install a putty firestop around all cables where they enter and exit conduit pass thru's and conduit risers.
    4. All firestop shall be installed to provide the fire rating as described by local fire code.
    5. It shall be the responsibility of the Contractor to verify that all conduits, walls, and raceways required to be firestopped have been firestopped.
E. Contractor shall provide a label at each penetration and firestop location detailing the UL rated fireproofing solution that was used in the specific application.
    1. Apply sticker to the wall near the firestopped conduit.
    2. Provide a sample of the label to the designer for review as part of the submittals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall be familiar with the location(s) where the work will be done. No additional compensation will be made for items the Contractor claims he was not aware of during bidding.

B. Work Area:

1. All work areas shall be cleaned at the end of each day. All debris shall be cleaned and removed from the site and disposed of in the approved container for the site.
2. All equipment shall be moved out of common areas and stored in the Contractor's lay down area, or in other approved storage locations on site.
3. Any work that is low hanging, or may otherwise impede the general use of the space, and cannot be removed, shall be flagged and cordoned off by the Contractor.

C. All equipment and parts shall be installed in a neat and workmanlike manner. Good installation principles shall be used throughout the project.

D. All cables routed above the drop ceiling or in the ceiling area shall be installed square to the building. Diagonal cable runs are not permissible.

E. All cut edges of conduits, boxes, raceway, etc., shall be trimmed and filed so that no burrs or rough edges will damage cable as it is installed.

F. All surface raceways, including conduits in exposed areas shall be painted to match the existing colors of the surrounding area.

G. If, in the course of the work, the Contractor damages, marks, or misplaces any ceiling tiles, the Contractor shall repair, and/or replace the ceiling tile to the original condition.

1. The Engineer shall decide if ceiling tiles have been damaged. Based on the Contractors proposed fixes, the Engineer shall decide the best course of action to repair any damage done by the Contractor to the ceiling tiles.

H. It shall be the responsibility of the Contractor to repair any damage done to the structure or finishes in the building by the Contractor. The building shall be returned to its original condition prior to final sign off of the project.

I. Firestop shall be installed to meet national and local codes.

3.02 DOCUMENTS

A. The Contractor shall fully read the contract documents including the detailed specifications, and the detailed drawings.

B. No additional compensation shall be made for any portion of the project which the Contractor did not know of or understand prior to providing the bid response.

C. In the case of any discrepancies between the detailed drawings and the detailed specifications, the Contractor shall provide the higher quality or more stringent requirement.

3.03 WORK PLAN-POST BID (CHOSEN CONTRACTOR ONLY)

A. Along with the submittals the Contractor shall provide a work plan for the implementation of the system they are installing. The plan shall include scheduled dates for major milestones, and all phases required for completion prior to final cutover.

B. The work plan shall list all items that must be completed by the Contractor or Owner to provide a smooth install of the system. The Contractor shall be responsible for all costs associated with the planning and cutover. The Owners only responsibility is to act as a liaison between the Contractor and the users.

C. The work plans shall include a time-line and a cutover date for the systems within each building. Contractor shall be responsible for all aspects of scheduling the work, including notification of the users, the administration, and the telephone service provider.

D. The work shall commence within 10 days of award of the contract. The Contractor shall be responsible for attending weekly project meetings at the Owner's site to report on progress and keep the project team informed of the work being done

E. The work plan will be reviewed at each project meeting for compliance and updates.

F. Work shall immediately begin on site surveys to determine the existing infrastructure, conduit and raceway placement and determining placement of new system equipment. The Contractor shall be responsible for moving, relocating, and reconnecting any and all existing equipment required for the installation of the new systems.

G. After work plan and system approval by the Engineer the Contractor can begin work on infrastructure work that does not impede users.

H. The Contractor shall be responsible for working with the Owner's Information Technology staff and administrators.

PART 4 - USF FUNDING REQUIREMENTS

4.01 IDENTIFICATION NUMBER

A. The service provider's USF Service Provider Identification Number (SPIN) *must* be included in the Bid. Direct all questions regarding the USF requirements in this RFP to the Universal Service Administrative Company (USAC), Schools and Library Division (SLD) at (888) 203-8100.

4.02 FY2024 FUNDING REQUESTS

A. The specified products and/or services are to be provided for FY2024-25 and must qualify for universal service discounts under the FY2024 universal service support mechanism, E-Rate. The *E-rate Modernization Order* permits applicants to seek support for Category 2 eligible non-recurring services purchased on or after April 1, three months prior to the start of the funding year on July 1.

4.03 UNIVERSAL SERVICE DISCOUNTS

A. The service provider contract is conditional upon the District receiving universal service discounts under the FY2024 universal service support mechanism, E-Rate. The District reserves the unrestricted right to reduce the contract amount by reducing the amount of services and/or products in order to meet budget requirements in the event the level of the universal service discounts is reduced. Any such reductions to the contract amount will be taken prior to the start of the specific work being reduced or eliminated on a given building and/or project.

4.04 UNIVERSAL SERVICE DISCOUNT IMPLEMENTATION

A. The District reserves the unrestricted right to specify the filing option for the universal service discounts for each product and/or service offered within a Bid: Billed Entity Applicant Reimbursement (BEAR) *or* Service Provider Invoice (SPI).

4.05 ELIGIBLE PRODUCTS AND SERVICES

A. The USF eligible products and/or services identified on the USAC FY2024 Eligible Services List, which is incorporated herein by reference, must be identified separately from any and all "ineligible" products and/or services in the Bid.

4.06 PROJECT FUNDING REQUIREMENTS

A. This project is entirely conditional upon receiving written notification in the form of a Funding Commitment Decision Letter from the USAC/SLD that the District has been approved for E-Rate Funding. If the District receives less than the full E-Rate Funding for which it applies, the District has the unrestricted right to reduce the number of units and services in the accepted Bid. In the event that E-Rate Funding is not available for the accepted Bid, District, in its discretion, may cancel and/or modify the Scope of Work (SOW) and subsequent purchases requested in this RFP.

4.07 LOWEST CORRESPONDING PRICE

A. Lowest Corresponding Price (LCP) is defined as the lowest price that a service provider charges to non-residential customers who are similarly situated to a particular E-rate applicant for similar services. Service Providers cannot charge E-rate applicants a price above the Lowest Corresponding Price (LCP) and must actually charge the rate that is the LCP, not just offer the LCP in the Bid. In addition, promotional rates offered by a Service Provider for a

period of more than 90 days must be included among the comparable rates upon which the LCP is determined.

END OF SECTION

SECTION 28 1100 – COMMUNICATIONS ROOM

PART 1 - GENERAL

1.01 SECTION INCLUDES
- A. Parts and equipment required for equipment in the communications room (Comm Room)

1.02 SYSTEM DESCRIPTION
- A. All equipment in the communications room shall be installed so that access is provided to all components, mechanical and electrical.
- B. All components of the communications room shall work together to form a cohesive and complete communications infrastructure.

1.03 COORDINATION
- A. Coordinate rack/cabinet work with the Electrical Contractor for placement of electrical connections.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Approved Equals for Racks and Cable Ladder Hardware:
  1. Panduit.
  2. Great Lakes Case and Cabinet.
  3. Middle Atlantic.
  4. Hoffman

2.02 COMMUNICATIONS RACKS
- A. Two Post Communications rack, 19 inches wide, 84 inches high. Black in color with 45 rack mounting units (1.75 inches per RU), self-supporting.
  1. Rack shall have holes to attach 6 inch wide vertical organizers.
  2. Base shall have holes for attaching to the floor.
  3. The rack shall be Panduit #R2P or approved equal.
  4. Equip with 6” wide vertical organizers between each rack
  5. Vertical Organizers for installation between and on each side of a rack shall be Panduit # PR2VPD06 or equal
- B. Four-post adjustable rack with front and back mounting rails.
  1. Rack shall be adjustable for depths between 21 inches and 32 inches. Adjustment shall be in increments of 1/2 inch.
  2. Rack shall have universal mounting holes on the front and back rack rails
  3. Rack shall be black in color.
  4. Rack shall be Panduit # ARAPCN or equal. stamped holes with cage nuts
  5. Equip with 6” vertical organizers as shown on the drawings

2.03 POWER STRIPS:
- A. 15 AMP vertical power strip
  1. Single circuit 120 Volt, 15 AMP
  2. Receptacles shall be NEMA 5-150R
  3. Plug shall be NEMA 5-15P with 6’ minimum cord
  4. Surge protection with on/off switch
  5. Raceway and all components shall be UL listed. The base and cover shall be black in color and shall be attached to the cable ladder of the rack system.
  6. Electrical outlet strip shall have 12 receptacles.
  7. Provide all attachment hardware required to securely attach the outlet strip to the back of the vertical cable ladder or side of rack. Refer to detailed drawings for location.
  8. Coordinate with electrician to verify plug and outlet in the wall connectivity.

9. Install and test all outlets prior to project completion.
10. Shall be Panduit #P16B07M equal

2.04 CABLE LADDER

A. Equip communication racks with cable ladder system for cable support and routing. Refer to Figure 28 110-A below.
   1. All cable ladders shall be custom cut to fit.
   2. Install cable ladder vertically behind each vertical organizer.
   3. Center the cable ladder on the vertical organizer so that when additional racks are added, the cable ladder can be used to serve both racks, and will not interfere with the components mounted in the rack.

B. Cable Ladder - Black and cut to length.
   1. 12” wide, 10’ long cable ladder with channels. Hubbell #hsls1012B or equal.
   2. Equip with the following as required for a full installation as per the details and specifications:
      a. Relay Rack Mounting Kit, Hubbell #HLMPK19 or equal
      b. Wall support angle bracket, Hubbell #HLTSB12B or equal
      c. Corner clamp for connecting horizontal ladder on the top to the cable ladder that attaches to the wall. Hubbell #HLTK or equal.
      d. Wall saddle for attaching horizontal cable ladder section to the wall. Equipped with “J” bolts. Hubbell #HLX0612 or equal
      e. Cable Radius Drop for dropping cables down to vertical cable ladder between and to the side of each rack, Hubbell #HLCD12 or equal
      f. Foot Kit for Cable ladder at back of rack, Hubbell #HLRF or equal
      g. Butt Splice Kit, Hubbell #HSBSK or equal
      h. Swivel Splice kit, Hubbell #HLSSK or equal
      i. When mounting cable ladder along the wall, install supports to the wall, Hubbell #HLVWBK or equal
      j. Attach all cable ladders to the rack with unistrut and unistruts “L” and “T” connectors.
      k. Approved equals, Newton and Hubbell.

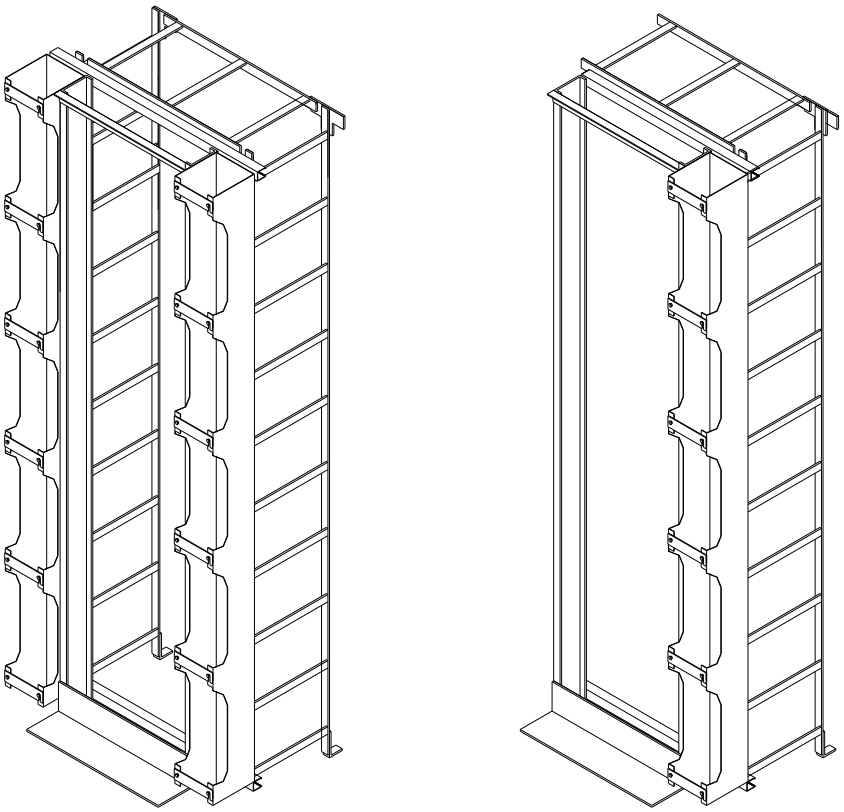


Figure 28 1100-A – Isometric View of Communications Racks

2.05 COMMUNICATIONS ROOM EQUIPMENT

A. Patch Cord Organizers:
   1. Patch cords organizers shall be steel and shall allow routing of patch cables from electronics to the patch panels.
   2. Single rack unit organizer shall be Hubbell #HS13C with cover. Refer to PCO-1 on detailed drawings.
   3. Approved equals, Ortronics and Great Lakes Case and Cabinet.

B. Tie Wraps:
   1. Tie wraps shall be used on exterior cables only.
   2. Tie wraps should not be used above the drop ceiling or in cable tray. The pathway shall support the cables without the use of extra tie wraps.
   3. Tie wraps shall never be used to support cables from building structure, electrical conduits, or lighting systems.
   4. Panduit No. PLT2S-C or equal standard tie wrap. For use in general locations that are not plenum rated.
   5. Panduit No. PLT2S-C702 or equal plenum rated tie wrap. Use only this type of tie wrap in plenum rated areas.
   6. Panduit No. PLT2H-L00 or equal ultraviolet rated outside plant tie wrap. Use only this type of tie wrap for outside uses.

C. Hook and Loop Wraps:
   1. Hook and Loop wraps shall be used on the cable ladder of the rack systems to bundle the cables as they pass along the cable ladder. Cables shall be bundled in groups of no more than 24 cables.
   2. Hook and Loop wraps should not be used above the drop ceiling or in cable tray except in limited circumstances. The pathway shall support the cables without the use of extra tie wraps.

3. Wraps shall never be used to support cables from building structure, electrical conduits, or lighting systems.
4. Panduit HLT2I or equal.

D. Grounding and bonding of racks and cable ladder
1. Bond each rack and all parts of the cable ladder as 1 ground system.
2. Use Erico Eriflex woven copper grounding braids to attach racks and ladder.
3. Erico # 556700 or other lengths as required.

2.06 WALLFIELD EQUIPMENT

A. Plywood for Wallfields:
1. Plywood shall be American Plywood Association (APA), Grade A-C at minimum. Meaning that the “A” side is smooth and paintable, neat repairs are permissible. “C” side allows knotholes to 1 inch and limited splits are permitted. “A” side is used for mounting; “C” side is installed towards the wall.
2. Plywood shall be 3/4-inch-thick and shall come in 4 foot x 8 foot sheets with a quantity of sheets installed as per the detailed drawings.
3. All plywood used for wallfields shall be fire-retardant plywood and shall be stamped as such.
a. Shall have a Flame-spread rating of 25 or less,
4. Each piece of plywood with one coat of white paint. Paint all edges.
a. Do not paint over one of the Fireproof stamps on the plywood. Leave this so that the owner can identify that the plywood installed is fire-retardant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Location of the communications infrastructure shall be finalized in the communications room prior to installation.

B. Locate all equipment to be installed, and make certain that space is available for maintenance and service during the life of the system.

C. If any changes from the drawings are required, the Contractor shall submit a proposed layout of the communications room to the Engineer for approval prior to installation.

3.02 PREPARATION

A. Clean floor prior to installation of the communications racks.

B. Coordinate with all other Contractors and ensure that the locations of all cable tray and conduits are correct and will feed the rack system adequately.

3.03 INSTALLATION OF RACKS

A. All racks shall be square to the walls and installed in a straight line.
1. Use only 3/8 inch bolts and connectors when constructing the racks and associated cable ladder.
2. Install vertical cable ladder to the back of each vertical organizer of each rack. When multiple racks are side by side, 1 section of vertical cable ladder can serve both racks.
3. Install the vertical cable ladder in the center of the vertical organizer. This allows cables to be routed down each side for use by both racks.
4. Install horizontal sections of cable ladder along the top of the rack. Attach the horizontal sections to the vertical sections as well as the horizontal section of the next rack.
5. Contact the Engineer prior to final placement of the racks.
6. After approval of the placement of the racks, secure racks to the floor with anchors. Racks shall be secure after installation.
7. Use 6 inch vertical organizers as spacers for racks. Attach racks to both sides of the vertical organizer, where multiple racks are required.
8. Install unistrut “L” brackets to the bottom of the vertical cable ladder to secure the cable ladder to the floor.
9. Each rack shall have an engraved phenolic label. The label shall be self-adhesive, black with white letters. The label shall be affixed to the front and top of the rack so it

is visible while standing in front of the racks. Label shall correspond with the designated rack label as shown in the detailed drawings.

10. Install woven ground braids between racks and cable ladder for eventual connection to the Telecommunications Ground Bar (TGB).
11. Remove paint from rack where ground braid is attached to the rack or cable ladder. Use star washers for all ground connections.

3.04 INSTALLATION OF COMM ROOM EQUIPMENT

A. Patch cord organizers shall be installed between all patch panels and electronics.
   1. Horizontal organizers shall be used for routing fiber and copper patch cords between patch panels and electronics.
   2. Refer to Rack layouts on detailed drawings for quantity of organizers to provide.
   3. Organizers shall be installed side by side where multiple racks are installed.
   4. If changes in the rack layout are required, contact the Engineer and get changes approved prior to installation.

B. Tie wraps shall be used sparingly in the overall installation.
   1. Tie wraps shall not be used in the cable tray or above the drop ceiling for support of cables. All cables shall utilize J-hooks, conduits, cable ladder, or cable tray for support in the ceiling area.
   2. Tie wraps can be used to group cables on the cable ladder of the rack systems. Group cables in bundles of no more than 24 cables.
   3. Trim all tie wraps so that the cut edge is smooth.

C. Hook and Loop shall be used sparingly in the overall installation.
   1. Hook and Loop should not be used in the cable tray or above the drop ceiling for support of cables. All cables shall utilize J-hooks, conduits, cable ladder, or cable tray for support in the ceiling area.
   2. Hook and Loop can be used to group cables on the cable ladder of the rack systems. Group cables in bundles of no more than 24 cables.

D. Power strips shall be installed so that they do not interfere with the cable routing, or the installation of components into the rack.
   1. Modular plug for the outlet strip shall be installed at the bottom of the outlet strip.
   2. The outlet strip shall plug into 1 of 2 duplex receptacles installed at the bottom of the rack. Refer to the detailed drawings for receptacle locations.
   3. Coil any extra cord from the outlet strip and tie wrap it to the bottom of the vertical cable ladder.
   4. Securely attach the outlet strips to the back edge of the vertical cable ladder.
   5. Electrical outlets are installed by others. Communications Contractor shall be responsible for connecting power strip to the outlets.

E. Shelves and blank panels
   1. Install in the rack where required and/or where shown on the drawings.

3.05 WALLFIELD EQUIPMENT

A. Paint plywood with prior to installation on the wall.
   1. Plywood shall be installed from 12 inches AFF to 7 feet above the floor or as noted on the drawings.
   2. Mount plywood to the wall with screws attached to studs in the wall. Contractor is responsible for securely mounting the plywood to the wall.
   3. Grade “A” side of the plywood shall be used for mounting all communications components.
   4. If the plywood will cover an electrical receptacle, the Contractor shall cut the plywood to allow access to the receptacle.

B. When 110 blocks are used, they shall be mounted neatly and squarely on the plywood.
   1. Cables shall be routed behind the 110 blocks and through the holes provided prior to being terminated. See manufacturer for details on cable routing.
   2. Provide adequate room between the 110 blocks for routing cross connect wire.
   3. Install C-4 and C-5 clips for all cables. 4 pair circuits require C-4 clips, while all other voice tie cables require C-5 clips.

4. When installing multiple pair cables for use as 4 pair circuits, the purple/slate pair of each binder group shall not be terminated.
5. Each pair of cables or each 4-pair circuit shall be labeled and shall have a unique identifying label. The labels shall be inserted into plastic label holders. All labels shall be laser-printed. Handwritten labels are not acceptable.

C. Vertical organizers shall match the height of the 110-tower installed.
1. Organizers shall be installed on each side of each 110 blocks.

END OF SECTION

SECTION 28 1150 – COMMUNICATIONS GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES
- A. This section includes parts and equipment required for a communications grounding system installation.

1.02 SYSTEM DESCRIPTION
- A. The grounding system from the ground bar in each communications room to the electrical ground shall be installed by the Electrical Contractor.
  - 1. This shall include connection of the ground bar in each communications room to the electrical ground. Shall also include:
    - a. Connection of ground cables in the cable tray,
    - b. Ground connections to electrical panels,
    - c. Grounding of any riser conduits.
- B. Telecommunications grounding systems shall be connected to the electrical ground at the Main Distribution panel.

1.03 INSTALL BASED ON STANDARDS INCLUDING:
- A. NFPA 70-99,
- B. National Electrical Code (latest edition adopted by AHJ)
- C. TIA-607-C Generic Telecommunications Bonding and Grounding

1.04 COORDINATION
- A. Coordinate ground connections to ground bar with Electrical Engineer and Contractor.
- B. Coordinate the location of ground bars in the communications room with the Electrical Contractor prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Approved equals for ground components are:
  - 1. Newton.
  - 2. Erico
  - 3. Hubbell

2.02 MATERIALS
- A. Ground Bar shall be Panduit # GB4B0612TPI-1 or equal
- B. Compression (crimp) type ground lugs for connection of ground cables shall be Burndy No. YCA series or equivalent.
  - 1. Use only manufacturer approved crimp tools with all crimp lugs.
- C. Ground wire shall be No. 6 AWG for all ground connections from the equipment to the ground bar. Ground wire in plenum areas shall be bare with no insulation. All other ground wires shall have green insulation.
  - 1. Approved ground cable vendors are Southwire, The Okonite Company, and Pirelli or equal.

PART 3 - EXECUTION

3.01 EXAMINATION
- A. Location of the ground bar shall be finalized in the communications room prior to installation.
- B. Locate and note all equipment to be connected to the ground system. Routes for ground cables shall be planned prior to final location of the ground bar.
- C. Identify location of racks, cabinets, and all electronic equipment. Connections from the ground bar to these are required for a complete ground system.
- D. Connect the cable ladder to the ground bar in each communications room. Connect with a #6 AWG ground cable.

3.02 PREPARATION

A. Plan routes of all ground cables.

B. For components that are to be connected to the ground system, remove paint from the connecting point and attach to the ground cable with a star washer.

C. Ground cables shall be connected from the ground bar in each communications room with a No. 6 AWG ground cable. Items to be connected by the Communications contractor include, but are not limited to:

1. Each individual rack and cabinet
2. Cable ladder.
3. Cable tray.
4. Audio Video Systems
5. Protected entrance terminals (PET).
6. Splice cases.
7. Video and audio systems.
8. Access Control Panels

3.03 INSTALLATION

A. Cabling Contractor shall Install the ground bar to the wallfield.

1. Coordinate location with other systems.
2. Work with Electrical contractor to have them connect the ground bar to the electrical service panel and building steel.

B. Ground connections shall meet all applicable codes, and shall be located such that they are accessible for maintenance.

1. All grounding conductors shall be continuous without splice.
2. Metal boxes, cabinets and fittings, or noncurrent carrying metal parts of other fixed equipment, if metallically connected to grounded cable armor or metal raceway, are considered to be grounded by such connection. If not connected, they shall be grounded in 1 of the following ways:
   a. By a grounding conductor run with circuit conductors, this conductor may be uninsulated. But if it is provided with an individual covering, the covering should be finished to show a green color.
   b. By a separate grounding conductor installed the same as grounding conductor for conduit and the like.
3. Metal raceways, cable armor, cable sheath, enclosures, frames, fittings, and other metal noncurrent carrying parts that are to serve as grounding conductors shall be effectively bonded where necessary to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them.
   a. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary.
4. Continuity of metal raceway or metallic sheathed cable shall be assured throughout the system.
5. National electrical code shall be used as guide for grounding in hazardous areas.

C. Ground cables shall be installed in a neat and workmanlike manner.

1. All cables shall be supported or routed against a wall and attached to the wall. No free-floating cables between components will be allowed.
2. Fully support ground cable so that it does not sag between connections.
3. There shall be no sharp bends in the ground cables.

D. Terminate and connect all ground cables with crimp type connectors.

1. Use star washers on all connections of ground cables to ground bars and racks and equipment.

E. Ground systems shall be tested after installation to ensure proper installation and connectivity.

1. Test procedures shall be fully spelled out. They shall minimally include, the time and date of the test, name of tester, device used to test ground potential, and test results.

2. The Contractor shall provide test results, to the Engineer for final approval and sign off.
3. Ground connections shall be tested at each rack in each communications room. The system shall not be considered complete until the ground tests have been completed and acceptable results are provided.

END OF SECTION

SECTION 28 1500 – FIBER CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination and testing of a fiber optic cable backbone.

1.02 SYSTEM DESCRIPTION

A. The fiber optic backbone shall include all components of the system from the patch panels to the backbone fiber and everything in between.

1.03 CONTRACTOR

A. Contractor company shall have a minimum of 3 years' experience installing and testing fiber optic cabling systems.
   1. Unless otherwise specified, multimode and single mode fiber cable must meet the transmission performance parameters as specified in ANSI/TIA/EIA-568-B.3.
   2. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years' experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
   3. Test equipment shall be capable of measuring relative or absolute optical power in accordance with TIA/EIA-526-14A, "Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant," and TIA/EIA-526-7 Method A, "Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant, Insertion Loss Using An Optical Power Meter."
   4. Traces and records shall be provided to the Engineer and Owner in hard (paper) and soft (disk) copy.

1.04 COORDINATION

A. Coordinate work under provisions in Division 1 of these specifications.
B. All fiber cables shall be coordinated with the installation of the telecommunications raceways.
C. Coordinate location of the spare coiled fiber cables with Engineer prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for fiber cable are:
   1. Optical Cable Corporation.
   2. General Cable.
   3. Berk-Tek.
   4. Corning
   5. Hubbell

B. Approved vendors for fiber termination equipment are:
   1. Hubbell.
   2. Panduit.
   3. Optical Cable Corporation
   4. Corning

2.02 FIBER CABLE

A. All fiber cables shall be of tight buffered construction. A tight buffered optical fiber shall consist of a central glass optical fiber surrounded by a primary polymer buffer and an optional tight fitting secondary buffer.
   1. The outer jacket of each fiber strand shall be colored according to the fiber color code in TIA 598-B.
   2. Individual multimode fiber strands shall be 50/125μm for the core/cladding measurements.

3. Individual singlemode fiber strands shall be 9/125μm for the core/cladding measurements.
4. All fiber strands shall be surrounded by synthetic yarn for added strength and crush resistance.
5. All fiber installed in plenum rated areas shall be UL listed OFNP.
6. The outer jacket of the cable shall be surface printed with the manufacturer's identification and required UL markings.
7. All fibers shall be subjected to a minimum fireproof stress of 0.7 GPa (100 kpsi).
8. The minimum bend radius of the cable under full rated tensile load shall be no larger than 15 times the outside diameter of the cable and no more than 10 times the outside diameter of the cable with no load on the cable.
9. Optical and mechanical performance shall not be degraded and the cable shall not be damaged in any way by immersion in ground water.
10. The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-STD-RS-455.
    a. Fiber dimensions.
    b. Attenuation.
    c. Bandwidth.
    d. Numerical aperture.
    e. Fiber proof test.
    f. Cable bending.
    g. Tensile load
    h. Impact resistance.
    i. Crush resistance.
    j. Attenuation vs. temperature.
11. Manufacturer shall provide ISO 9001 certification.
12. The cable shall withstand an impact force 1500 times per ANSI/TIA/EIA-RS-455 (FOTP-25A).
13. The cable shall withstand compression load of 1800 N/cm per ANSI/TIA/EIA-RS-455 (FOTP-41A).
14. Fiber shall be indoor/outdoor rated based on the areas in which the fibers will be installed. Do not install riser rated fiber through a plenum rated area unless the fiber is inside an EMT conduit.

B. Indoor and outdoor rated, Plenum rated fiber.
1. The multi-fiber sub-cables shall consist of tight buffered optical fibers surrounded by a synthetic yarn strength member and a color-coded flame retardant elastomeric polymer jacket. The strength member shall be composed of individually and precisely tensioned elements such that tensile loads are equally shared by each element.
2. Single-mode indoor/outdoor, plenum rated fiber cable
    a. Wavelength: 1310/1550nm
    b. Industry Standard: ITU-T G.652.D
    c. 1 Gigabit Ethernet Distance: 5 km
    d. 10 Gigabit Ethernet Distance: 10 km
    e. Max Attenuation: .5/.5 dB/km
    f. Singlemode, indoor/outdoor, Plenum rated Yellow jacket: OCC # DX012TSLX9YP
3. Hybrid fiber cables with both multimode and singlemode strands in the same sheath are allowed.

C. Indoor or outdoor Armored fiber cable.
1. The multi-fiber sub-cables shall consist of tight buffered optical fibers surrounded by a synthetic yarn strength member and a color-coded flame-retardant elastomeric polymer jacket. The strength member shall be composed of individually and precisely tensioned elements such that tensile loads are equally shared by each element.
2. Single-mode indoor/outdoor fiber cable
    a. Wavelength: 1310/1550nm

b. Industry Standard: ITU-T G.652.D
c. 1 Gigabit Ethernet Distance: 5 km
d. 10 Gigabit Ethernet Distance: 10 km
e. Max Attenuation: .5/.5 dB/km
f. Plenum Rated Armored
A) 12-strand Singlemode, OCC # DZ012TSLX9YP18

2.03 RACK MOUNT FIBER PATCH PANELS

A. 12-36 port, rack mount fiber patch panels.
1. Rack mount fiber patch panels shall be modular in design. Mounting brackets shall be provided for 12 pack adapters. Adapter packs shall sit horizontally in the panel.
2. Panels shall mount into standard 19-inch relay racks.
3. Panels shall be no more than 1-3/4 inch or 1 rack unit high.
4. Provide splice tray and splice shelf or splice cassettes for termination of all fiber strands.
5. Fiber panel shall be Panduit #FRMEIU or equal
a. Equip with Splice trays as required.
b. Equip with Label Kit,
6. Provide Panduit Fiber Splice cassettes or pigtails and panels for splicing and termination of all fiber strands. See Below:

2.04 FIBER PIGTAIL SPLICE CONNECTORS

A. All fiber cables shall be terminated with spliced pigtails matching the fiber cable that was installed.
B. LC Style Connectors pigtails
1. Singlemode connectors shall be LC style.
2. Provide 1-meter, pre-connectorized pigtails for fusion splicing to each fiber strand.
3. Singlemode Pigtails shall be Yellow in color
4. All spicing shall be Fusion splicing. Mechanical splicing is not allowed.
5. Match the size of the glass in the pigtail to the size of the glass in the fiber.
6. Work with fiber cable manufacturer on specifying pigtails that exactly match the fiber cable being terminated.
7. Singlemode LC terminated single strand, fiber pigtails
C. Provide Hubbell FSP panels as required for termination of all fiber strands
1. 12 port LC for Singlemode shall be Yellow, Panduit or equal

2.05 FIBER PATCH PANEL ACCESSORIES

A. Fiber stowage ring
1. Install a ring on the wall near the racks for stowage of 30’ of spare fiber or as noted on the drawings.
2. Fiber stowage ring shall be Leviton # 48900-OFR.
3. Label the fiber at the stowage ring with both termination points. Install label Panduit PST-FO or equal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of fiber cable.
B. Identify location of racks, and position of fiber patch panels prior to fiber installation.
C. Inspect fiber cable prior to installation for damage during shipping. The Contractor shall be responsible for all damaged or nonfunctional fiber cables. If any strands of a fiber cable are not working, the Engineer has the right to order the complete replacement of the entire fiber cable.

3.02 PREPARATION

A. Contractor shall designate the location of the spare coil of fiber at each end of the run prior to installation.

3.03 INSTALLATION

A. Installation of fiber cable shall be by a trained installer.
   1. All fiber, if not installed inside cable tray, shall be attached to the building structure with conduit clamps or supports a minimum of every 5 feet.
   2. Fiber shall be continuous from end to end, no splices are allowed unless specifically noted.
   3. At each termination point of the fiber, the Contractor shall provide a service coil consisting of a minimum of 30 feet of fiber cable.
   4. Contractor shall adhere to all manufacturer's recommended pull tensions during installation.
   5. As part of the as-built drawings, provide the actual footage of each fiber cable installed. Mark this on the drawings.
   6. Any fiber strands that do not pass a sufficient signal light signal will be identified as noncompliant, and the Engineer has the right to order the complete replacement of the fiber cable by the Contractor.
   7. Where fiber cable passes vertically through a building, the fiber cable shall be supported against the wall or from the ceiling a minimum of every 5 feet.
   8. Do not exceed recommended bend radius of fiber cable during or after installation.

B. Fiber patch panels shall be located at the top of the relay rack or cabinet at which they are installed. Install on wall or inside cabinet where shown for wall mounted fiber panels.
   1. Provide patch panels as described on the contract drawings or additional panels as required to terminate all fiber strands of all fiber cables.
   2. Install fiber panels in the top of the rack where possible
   3. If a splice shelf is required for splicing of fibers, install the shelf directly below the associated patch panel.
      a. Provide and install splice panels as required for splicing of all pigtails to terminate the fiber strands.
   4. Route fiber cable into side of the panel. Provide a wrap-around label at this location to identify the fiber cable as it enters the fiber panel.
      a. Label the fiber cable just outside of the fiber panel with a yellow fiber optic cable label, Panduit No. PST-FO.
   5. The sheath of the fiber cable shall extend to the side of the panel. Individual fibers or subgroups shall not be seen outside of the panel, except for the single mode bundles.
   6. Fibers shall be installed in the adapter packs in color code order. For vertical mounted 12 pack adapters, top to bottom then left to right. In panels where the couplers are horizontally mounted, left to right for each 12 pack, then top to bottom. Contact the Engineer with any questions.
   7. All individual fiber strands shall be neatly installed in the back of the panel after termination. Provide a minimum of 4 feet of spare fiber in the back of each panel. This spare shall be coiled in a Figure 8.
   8. Secure the fiber to the entrance of the patch panel with tie wraps.
   9. After installation and termination of the fiber cable, install labels on the patch panel showing what strand each connector is connected to, and where the overall fiber cable is terminated at the other end.
   10. Attach a self-adhesive clear plastic sleeve to the inside of the Plexiglass cover of the rack mount panel. Slide in a laser printed label showing all information about the fiber cable.
   11. Label door of wall mount panels to detail the fiber cable type, strand count and termination locations

C. Fiber cables shall be terminated with fusion spliced Pigtails.
   1. All Singlemode and multimode fiber cables shall be terminated with a pre-terminated fiber optic pigtail which matches the diameter and type of fiber being installed.

2. Fusion splice all pigtails to the fiber cables. Terminate each strand of the fiber cable.
3. Each strand shall be thoroughly cleaned and all coverings shall be removed prior to splicing
4. To cleave the fiber, use the method and equipment recommended by the manufacturer of the fusion splicer that will be used.
5. Fibers shall be properly aligned prior to splicing.
6. The splicer used shall be able to inject light directly into the fiber just after it is spliced, and provide an estimate of the loss through the splice.
7. After splicing, a heat shrink tube with a rigid skeleton shall be used to protect the splice. Coordinate this heat shrink tube with the splice tray to be installed in the splice shelf. Heat shrink tubes shall fit into the grooves in the splice tray.
8. Loss through the splice shall be no more than .15dB.
9. Fiber pigtails shall be labeled with a self-laminating, laser printed, wrap around label at the connector. The label shall detail the strand count of the fiber cable, the buildings and rooms in which the fiber is terminated and the color and strand number the pigtail is spliced to.

24MM/12SM
WRT#234-OLS #021
Brown Fiber # 16

END OF SECTION

SECTION 28 1600 – CAT-6 CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination, and testing of user communications cables.

1.02 SYSTEM DESCRIPTION

A. The horizontal cabling consists of all systems from the user faceplate, to the patch panel in the communications room, and all connections in between.

B. Products and installation detailed in this section shall comply with all applicable requirements.

1. ANSI/TIA-568-C.0, "*Generic Telecommunications* Cabling *for Customer Premises*",
2. ANSI/TIA-568-C.1, "*Commercial Building Telecommunications Cabling Standard*",
3. ANSI/TIA-568-C.2, "*Balanced Twisted-Pair Telecommunication Cabling and Components Standard*", ANSI/TIA-568-C.3, "*Optical Fiber Cabling Components Standard*",
4. ANSI/TIA-568-C.4, "*Broadband Coaxial Cabling and Components Standard*",
5. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
6. IA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings including all Updates and Addenda.
7. TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
8. IEEE 802.3af PoE • Ratified in 2003 • Type #1, 15.4W at the PSE, with min of 12.95W available to the PD
9. IEEE 802.3at PoE+ • Ratified in 2009 • Type #2, 34.2W at the PSE, with min of 25.5W available to the PD
10. IEEE 802.3at PoE+ • Ratified in 2009 • Type #3, 60W at the PSE, with min of 51W available to the PD
11. IEEE 802.3at PoE+ • Ratified in 2009 • Type #4, 99.9W at the PSE, with min of 71.3W available to the PD
12. IEEE 802.3bt -Amendment 2. Ratified in 2018 PoE standards powering all 4 pairs:

1.03 COORDINATION

A. All cables shall be coordinated with the installation of the telecommunications raceways.

B. Coordinate all user cables with the furniture to be installed in the building. Make any adjustments prior to cable being installed.

C. Contractor shall walk the site during construction and shall verify all raceways are being installed as required to install the user data cables. Walk the site prior to drywall being installed or floors being installed when Floor boxes are being installed.

1.04 STANDARDS

A. Cabling shall be installed in accordance with NEC code for grouping/bundling of cables in relation to Type 3 and Type 4 PoE

B. Install as per NEC 725.144 in reference to bundling cables:

AWG	Numberof 4-Pair Cables in a Bundle																				
	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2.0	2.0	2.0	1.0	1.4	1.6	0.8	1.0	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3.0	3.0	3.0	1.4	1.8	2.1	1.0	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.7	0.8	0.5	0.6	0.7

C. Cables shall be installed with no more than 24 cables in a single J-hook. Install additional J-hooks as required.
D. If cables are to be bundled/grouped in larger bundles then the cable shall be LP listed per UL.
E. All cables shall be no smaller than 23 AWG.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved vendors for copper user cables are:
   1. Panduit
   2. Hubbell
   3. Belden
   4. General Cable
   5. CommScope
   6. Mohawk
   7. Superior Essex
   8. Paige

B. Approved vendors for CAT-6 termination equipment are:
   1. Hubbell.
   2. Panduit
   3. Belden
   4. CommScope

2.02 CAT-6 CABLING

A. All UTP user/cabling installed shall be CAT-6 rated or above.
   1. Category 6 cabling shall consist of 4 pairs of unshielded twisted pair, 23 AWG cables.
   2. All CAT-6 cables shall be installed in cable tray or supported by J-Hooks.
   3. Individual pair shall be marked in the standard 4 pair color code of blue/blue-white, orange/orange-white, green/green-white, and brown/brown-white.
   4. Each cable shall be marked sequentially with the footage of the cable. Each cable shall also be marked with the manufacturer of the cable and the type of cable installed or the cable part number.
   5. Cable and all connectors and patch panels shall meet or exceed the following electrical and physical requirements:

DC RESISTANCE (max)	23 AWG
Ohms/100m @ 20°C	9.38ohms
DC RESISTANCE UNBALANCED (max)	
Individual Pair %	5%

CHARACTERISTIC IMPEDANCE	
Frequency (f)	Ohms
1-500 Mhz	100 ±15

DELAY SKEW (max)	
ns/100m	45

NOMINAL VELOCITY OF PROPAGATION (NVP)	
% Speed of light	72

INPUT IMPEDANCE	
Frequency (f)	Ohms
1.0-100 Mhz	100 ±15
100-350 Mhz	100 ±20
350-500 Mhz	100 ±25

REFERENCE ELECTRICAL CHARACTERISTICS

FREQ (MHz)	INSERTION LOSS (dB/100m)		NEXT (dB/100m)		ACR (dB/100m)	PS-NEXT (dB/100m)		PS-ACR (dB/100m)	ELFEXT (dB/100m)	PS-ELFEXT (dB/100m)	RL (dB)
	avg	max	avg	min	min	avg	min	min	min	min	min
.772	1.7	1.8	82	76.0	74.2	77	74.0	72.2	–	–	–
1.0	1.9	2.0	80	74.3	72.3	75	72.3	70.3	67.8	64.8	20.0
4.0	3.6	3.8	71	65.3	61.5	66	63.3	59.5	55.8	52.8	23.0
8.0	5.1	5.3	67	60.8	55.5	62	58.8	53.5	49.7	46.7	24.5
10.0	5.7	6.0	65	59.3	53.3	60	57.3	51.3	47.8	44.8	25.0
16.0	7.3	7.6	62	56.2	48.6	57	54.2	46.6	43.7	40.7	25.0
20.0	8.1	8.5	61	54.8	46.3	56	52.8	44.3	41.8	38.8	25.0
25.0	9.1	9.5	59	53.3	43.8	54	51.3	41.8	39.8	36.8	24.3
31.25	10.2	10.7	58	51.9	41.2	53	49.9	39.2	37.9	34.9	23.6
62.5	14.8	15.4	53	47.4	32.0	48	45.4	30.0	31.9	28.9	21.5
100.0	19.0	19.8	50	44.3	24.5	45	42.3	22.5	27.8	24.8	20.1
155.0	24.2	25.2	47	41.4	16.3	42	39.4	14.3	24.0	21.0	18.8
200.0	27.8	29.0	46	39.8	10.8	41	37.8	8.8	21.8	18.8	18.0
250.0	31.5	32.8	44	38.3	5.5	39	36.3	3.5	19.8	16.8	17.3
300.0	35.0	36.4	43	37.1	0.7	38	35.1	--	18.3	15.3	16.8
350.0	38.2	39.8	42	36.1	--	37	34.1	--	16.9	13.9	16.3
400.0	41.3	43.0	41	35.3	--	36	33.3	--	15.8	12.8	15.9
500.0	47.0	48.9	40	33.8	--	35	31.8	--	13.8	10.8	15.2
550.0	49.7	51.8	39	33.2	--	34	31.2	--	13.0	10.0	14.9

6. All cables installed above a drop ceiling or fixed ceiling shall be Plenum Rated
7. CAT-6, 4 pair cabling shall be plenum rated unless specifically noted.

Cable Use	Manufacturer	Color	Part number	Rating
Data Cabling	General	Blue	7131800	Data Cabling
Security Camera	General	Green	7131806	Cameras
Wireless AP	General	Yellow	7131802	Wireless AP
Video	General	Red	7131804	Video
Backbone	General	Purple	7131809	Backbone
USB	General	Orange	7131805	USB
Paging -MDOC	Mohawk	Brown	M58756	Plenum
Underground	Mohawk	Black	M58772	Underground

8. Ensure that cable passes all CAT-6 tests after installation.

2.03 CAT-6A CABLE -STANDARD DIAMETER

A. Unshielded Twisted Pair (UTP) CAT-6A cable

B. Shall meet standards:

1. ANSI/TIA-568-C AND ISO/IEC 11801: ED 2.2
2. ANSI/TIA-568-C.2 AND ISO/IEC 11801:2002 CATEGORY 6A ELECTRICAL CHARACTERISTICS.

C. Cable shall consist of:

1. 23 AWG solid bare copper insulated conductors, assembled into four tightly twisted pairs, utilizing a core separator, alien crosstalk barrier and ripcord,
2. Jacket shall include footage markers
3. The cable shall be plenum rated for use in air handling ducts and spaces in accordance with article 725 of the National electrical code (NEC).
4. Shall be US Listed for this application by passing NFPA 262 (ft6 or previously UL 910 steiner tunnel) test.
5. Supported Applications
   a. IEEE 802.3an 10gbase-t (10 gigabit Ethernet),
   b. 1000base-t (gigabit Ethernet),
   c. 100base-t (fast Ethernet),
   d. IEEE 802.3 10base-t (Ethernet),
   e. IEEE 802.3af power over Ethernet for VoIP,
   f. 550 MHz broadband video, 10g Wi-Fi
   g. Access points and PoE / PoE+.

D. Physical Characteristics
1. Bending radius: 1.1" (28 mm) min (4 x cable od)
2. Pulling tension: 40 lbf (175 n) max
3. Operating temp.: -20°c to +90°c (-4°f to +194°f)
4. Storage temp.: -20°c to +90°c (-4°f to +194°f)
5. Installation temp.: +5°c to +50°c (+41°f to +122°f)

E. Shall meet or exceed following testing parameters.

REFERENCE ELECTRICAL CHARACTERISTICS

FREQ	INSERTION LOSS	NEXT	PS NEXT	ACRF	PS ACRF	RETURN LOSS	PROP. DELAY	ALIEN CROSSTALK		
								PS ANEXT	PS AACRN	PS AACRF
(MHz)	(dB/100m)	(dB/100m)	(dB/100m)	(dB/100m)	(dB/100m)	(dB)	(ns/100m)	(dB/100m)	(dB/100m)	(dB/100m)
	max	min	min	min	min	min	max	min	min	min
1.0	2.1	75.3	73.3	71.8	68.8	20.0	570.0	74.5	72.4	74.5
4.0	3.8	66.3	64.3	59.8	56.8	23.0	552.0	74.5	70.7	73.7
8.0	5.3	61.8	59.8	53.7	50.7	24.5	546.7	74.5	69.2	67.6
10.0	5.9	60.3	58.3	51.8	48.8	25.0	545.4	74.5	68.6	65.7
16.0	7.5	57.2	55.2	47.7	44.7	25.0	543.0	74.5	67.0	61.6
20.0	8.4	55.8	53.8	45.8	42.8	25.0	542.0	74.5	66.1	59.7
25.0	9.4	54.3	52.3	43.8	40.8	24.3	541.2	74.5	65.1	57.7
31.25	10.5	52.9	50.9	41.9	38.9	23.6	540.4	74.5	64.0	55.8
62.5	14.9	48.4	46.4	35.9	32.9	21.5	538.6	73.1	58.2	49.8
100.0	19.0	45.3	43.3	31.8	28.8	20.1	537.6	70.0	51.0	45.7
200.0	27.4	40.8	38.8	25.8	22.8	18.0	536.9	65.5	38.1	39.7
250.0	30.8	39.3	37.3	23.8	20.8	17.3	536.5	64.0	33.2	37.7
300.0	34.0	38.1	36.1	22.3	19.3	16.8	536.3	62.8	28.8	36.2
350.0	36.9	37.1	35.1	20.9	17.9	16.3	536.1	61.8	24.9	34.8
400.0	39.7	36.3	34.3	19.8	16.8	15.9	535.9	61.0	21.3	33.7
450.0	42.3	35.5	33.5	18.7	15.7	15.5	535.8	60.2	17.9	32.6
500.0	44.8	34.8	32.8	17.8	14.8	15.2	535.6	59.5	14.7	31.7
550.0	47.2	34.2	32.2	17.0	14.0	14.9	--	58.9	11.7	30.9
600.0	49.5	33.6	31.6	16.2	13.2	14.7	--	58.3	8.8	30.1
650.0	51.7	33.4	31.1	15.5	12.5	14.4	--	57.8	6.1	29.4
750.0	56.0	32.2	30.2	14.3	11.3	14.0	--	56.9	0.9	28.2

SWEEP TESTED TO 750 MHz; VALUES ABOVE 500 MHz ARE FOR ENGINEERING INFORMATION ONLY.

F. CAT-6A, 4 pair cabling shall be plenum rated unless specifically noted.

Cable Use	Manufacturer	Color	Part number	Rating
Data Cabling	General	Blue	7151849	Data Cabling
Security Camera	General	Green	7151853	Cameras
Wireless AP	General	Yellow	7151852	Wireless AP
Video	General	Red	7151854	Video
Backbone	General	Purple	7151855	Backbone
USB	General	Orange	7151856	USB
Underground	General	Black	M58772	Underground

2.04 LONG DISTANCE UTP CABLE.

A. At locations inside and outside a building where the CAT-6 cable will be longer than 300ft the contractor shall supply and install an “Extended Distance” UTP, 4-pair Ethernet Cable.

B. Cable must be constructed with 4-pair copper conductors and can be unshielded or shielded with designated jacketing compounds to meet the installed environments — indoor or outdoor —as specified in the accompanying documentation. Performance requirements must meet or exceed the values listed on the data sheets in Section 2.4

C. Cable shall meet the following requirements:
   1. Shall extend 1 Gig Ethernet up to 200 Meters
   2. Shall provide for Type 4 PoE up to 200 Meters
   3. IEEE 802.3bt Compliant for Type 1 to Type 4 PoE
   4. Shall meet 90 Degree temperature rise requirements
   5. UL listed
   6. 22AWG solid copper conductors
   7. Shall be available in Riser, Plenum and outdoor ratings
   8. Use with CAT-6 terminations

D. Shall be Superior Essex PowerWise or Paige GameChanger

E. Paige Game Changer part numbers:
   1. Unshielded Twisted Pair, Riser Rated (CMR), # 258310333 -Yellow in Color
   2. Unshielded Twisted Pair, Plenum Rated (CMP), # 250300303 -Yellow in Color
   3. Unshielded Twisted Pair, Plenum Rated (CMP), # 258300309-Green in Color
   4. Unshielded Twisted Pair, Plenum Rated (CMP), # 258300310 -White in Color
   5. Unshielded Twisted Pair, Plenum Rated (CMP), # 258300336 -Blue in Color
   6. OSP Unshielded Twisted Pair, Direct Burial, # 258330804
   7. OSP Shielded Twisted Pair, CM Rated Shielded, # 248340804
   8. Hazardous Location Cable, ITC-HL Class 1 Division 1, Armored # 258802404

2.05 UTP JACKS

A. 8-position modular jacks for termination at user and at the patch panel. Match cable color except where noted on drawings.
   1. Jack housings shall be high impact 94 V-0 rated thermoplastic.
   2. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
   3. Modular jack contacts shall accept a minimum of 1000 mating cycles with 5.0 milliohm (maximum) increase over initial with the use of an FCC compliant plug.
   4. Modular jack contact wires shall be formed flat for increased surface contact with mated plugs.
   5. Modular jack contacts shall be constructed of beryllium copper for maximum spring force and resilience.
   6. Contact plating shall be a minimum of 50 micro inches of hard gold in the contact area over 50 micro inches of nickel.
   7. Jack termination shall follow the industry standard 110 IDC.
   8. Jacks shall have a designation indicating CAT-6 or CAT-6A as required.
   9. Jacks shall utilize a paired punch down sequence. Cable pair twist shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
   10. Jacks shall terminate 22-26 AWG stranded or solid conductors.
   11. Jacks shall terminate insulated conductors with outside diameters up to .050 inches.
   12. Jacks shall be compatible with EIA/TIA 606A color code labeling.
   13. Jacks shall accept snap on icons for identification or designation of applications.
   14. Jacks shall be marked for T568A and T568B wiring schemes. TIA 568B wiring shall be used in all terminations throughout the communications system.
   15. All CAT-6 modular jacks and panels shall meet or exceed the following transmission characteristics:
      a. Jacks shall be designed for 100 Ohm UTP cable termination.
      b. Jacks shall be UL verified for TIA/EIA Category 6 electrical performance.
      c. Jacks shall be UL listed 1863 and CSA certified.

d. Jacks shall be manufactured by an ISO 9002 registered manufacturer.

16. CAT-6, 8-pin modular jacks shall be:
    a. Data Jacks shall be Panduit # CJ688TGIW or equal. Office White.
    b. Data Jacks for Security Cameras shall be Panduit # CJ688TGGN -Green
    c. Data jacks for Wireless Access Points shall be Panduit # CJ688TGYL -Yellow
    d. Data jacks for backbone connectivity shall be Panduit # CJ688TGVL -Purple
    e. Data Jacks for IP/POE locks at doors shall be Panduit # CJ688TGWH -White
    f. Data Jacks for Audio and Video connections shall be Panduit # CJ688TGBL -Black
    g. Data Jacks for USB connections shall be Panduit # CJ688TGIOR -Orange
17. CAT-6A, 8-pin modular jacks shall be:
    a. Data Jacks shall be Panduit # CJ6X88TGIW or equal. Office White.
    b. Data Jacks for Security Cameras shall be Panduit # CJ6X88TGGN -Green
    c. Data jacks for Wireless Access Points shall be Panduit # CJ6X88TGYL -Yellow
    d. Data jacks for backbone connectivity shall be Panduit # CJ6X88TGVL -Purple
    e. Data Jacks for IP/POE locks at doors shall be Panduit # CJ6X88TGWH -White

2.06 FACEPLATES

A. Modular Standard flush mount faceplates shall support all the jacks and connectors required.
1. Faceplates shall be UL listed and CSA certified.
2. Faceplates shall be constructed of high impact thermoplastic or stainless steel. See drawings for specific requirements.
3. Faceplates shall be 2-3/4 inches wide x 4-1/2 inches high (69.8 mm x 114.3 mm) for single gang, and 4-1/2 inches x 4-1/2 inches (114.3 x 114.3 mm) for double gang.
4. Faceplates shall be available to mount 1, 2, 3, 4, or 6 jacks in a single gang and up to 12 jacks in a double gang configuration.
5. Faceplates shall provide for TIA/EIA 606 compliant station labeling.
6. Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
7. Each plate shall be fully configured with modular inserts. There shall be no open spaces in the faceplate.
8. Match the color of the modular inserts to the color of the faceplate. All faceplates and inserts shall be office white unless otherwise noted.
9. Single gang plastic faceplate shall be Panduit #CBEIWY.
10. Double gang plastic plate shall be Panduit #CBEIW-2GY
11. Each single gang plate has 3 faceplate units (FPU's) available to install inserts. Double gang plates have 2 sides, each with 3 FPU's.
12. Equip plates with the following parts as directed on the construction drawings.

FPU	ITEM	PART NUMBER
	Blank Jack	CMBBLIW
2/3	Blank	CHB2IW-X
1/3	Blank	CHB2MIW-X
1/3	1 Port Flat	CHFIMIW-X
1/3	2 Port Flat	CHF2MIW-X
1/2	2 Port Angled	CHS2IS-X
1/2	2 Port Angled-recessed	CHSRE2IW-X

B. Stainless Steel rear loading faceplates
1. Shall have 1, 2, 3, 4 and 6 opening holes
2. Shall have recessed space for labels and be equipped with clear laminated cover for labels.
3. UTP Jacks shall be flush with the front of the plate
4. Plates shall be
    a. 1-Port Hubbell #SSFL11
    b. 2-Port Hubbell #SSFL12

c. 3-Port Hubbell #SSFL13
d. 4-Port Hubbell #SSFL14
e. 6-Port Hubbell #SSFL16

C. Integrated furniture outlets, GFI (138 style) inserts and plates, and standard 106 style inserts and plates.
1. These may be required at some surface raceway location. Field verify prior to ordering.
2. The Contractors shall identify which type of outlet or frame is required at each location throughout the system.
3. Match the outlet with the faceplate required.
4. GFI, more commonly referred to as 138 style line inserts, are rectangular and fit in a rectangular plate used for GFI receptacles.
5. 106 style inserts are configured to fit in a common duplex electrical receptacle faceplate. The inserts hold 2 or 4 modular jacks.
6. Each type of modular furniture has certain requirements for its voice and data modules. The Contractor shall coordinate with the furniture installer and provide the correct faceplate and outlets to match the color and style of the furniture.
7. For all connections that do not have a faceplate with a location for a laser printed paper label, the Contractor shall provide an engraved lamacoid label detailing the location number of each cable.
8. GFI/Style line Stainless Steel Plates shall be:
   a. Single Gang, Hubbell #SS26
   b. Double Gang, Hubbell #SS262
   c. Three Gang, Hubbell #SS263
9. GFI/Style line Plastic plates without a Label Field shall be:
   a. Single Gang, Hubbell #NPJ26GY-Gray
   b. Double Gang, Hubbell # NPJ262GY-Gray
   c. Three Gang, Hubbell # NPJ263GY-Gray
10. GFI/Style line Plastic Plates with Label Field shall be:
   a. Single-Gang, Hubbell #IFP126OW -Office White
   b. Double-Gang, Hubbell #IMFP2OW -Office White
11. GFI/Style Line Inserts shall be:
   a. Provide an insert to support all Modular jacks that are to be installed.
   b. One Port Panduit #CFG1IW
   c. Two port, Panduit #CFG2IW
   d. Four port, Panduit #CFG4IW
   e. Six port, Panduit #CFG6IW.
12. 106 style inserts shall be:
   a. Two port, Panduit #CFIO62IW
   b. Four Port, Panduit #CFIO64IW
13. Examples


   a. 106 Style GFI/Style-Line

D. Brush opening plate
1. Where routing AV cables through an open backbox the contractor shall install a “brush” plate that covers the backbox and allows cable to pass thru
2. Provide a single or double gang cover plate with GFI openings.
3. Single-gang plates shall be Hubbell #SS26 with Leviton #41078-DBW, White in color or equal

4. Double-gang plates shall be Hubbell #SS262 with Two (2), Leviton #41078-DBW, White in color or equal

E. Wall mount phone plates shall be stainless steel.
   1. Each plate shall be equipped with a CAT-6, 8 port modular jack.
   2. Each plate shall be equipped with stainless steel studs for mounting a wall mount telephone to the plate.
   3. Single gang wall mount phone plate shall be Panduit #KWP6PY. Coordinate with owner prior to ordering.

2.07 SURFACE MOUNT BOXES

A. Provide surface mount boxes for termination of cables as shown on the drawings.
   1. Install a surface mount box at location for termination of the modular jacks.
   2. One port surface box shall be Panduit #CBXQ1IW-A.
   3. Two port surface box shall be Panduit #CBXQ2IW-A.
   4. Four Port Surface box shall be Panduit #CBXQ4IW-A.
   5. Where the box can be mounted to building steel, provide a magnet, Panduit #CQBM-x

2.08 CABLE SUPPORTS

A. All cables shall be supported in the ceiling a minimum of every 5 feet. Support can be provided by installing cable inside cable tray or conduit, or by installing J-hooks every 5 feet.
   1. J-hooks shall provide a smooth steel or plenum rated plastic, support for cables as they route through the ceiling.
   2. Steel supports shall have a galvanized finish.
   3. Steel, UL listed, ultimate static load limit 50 pounds rated to support Category 5e and higher cables, and optical fiber cables.
   4. If required, assemble to manufacturer recommended specialty fasteners, including beam clips and flange clips.
   5. Acceptable products shall be:
      a. CADDY #CAT HP series with retainer hooks.
      b. CADDY #CAT-CM SERIES
   6. Provide with interfaces and clamps required to support J-Hooks from the building structure.
   7. Provide threaded rod and associated hardware required to support all J-Hooks
   8. No more than 24 voice/data cables in each J-hook. Provide additional hooks as required.

2.09 RACK MOUNTED PATCH PANELS

A. Patch panels for termination of UTP cabling shall be provided to terminate all cables installed in the building.
B. All patch panels shall be installed into 19” racks and/or cabinets as shown on the drawings.
C. Provide panels to terminate all cables even if the panels are not specifically shown on the rack layout drawings.
   1. Provide the quantity and color of Modular jacks to match the color and quantity of all cables installed.
D. Panels shall be steel and shall allow mounting of all CAT-6 an CAT-6A jacks. Panels shall be blank panels that accept all modular jacks.
E. CAT-6 patch panels for mounting in a 19-inch rack or cabinet. Shall be;
   1. Panels shall be made of black anodized aluminum, in 24 and 48 port configurations.
   2. Panels shall accommodate 24 ports for each rack mount space or "U" (1U = 44.5 mm [1.75 inch]).
   3. Panels shall be manufactured with a rolled edge at the top and bottom for stiffness.
F. 24 port empty patch panels shall be Panduit #CFP24FMWBLY or equal
   1. Panels shall have rear cable support bar for strain relief which shall clip to the rear of the patch panel or to the rear of the rack rail.
   2. Each 24-port patch panel shall be equipped with one (1) rear cable organizer. Organizer shall be Panduit #SRB19BLY or equal.

3. Ports shall be marked 1-24 on top of the openings by factory.
4. Label all Panels for the panel, communications room and rack with a large laser-printed label.

2.10 PASS THRU'S

A. Where no pass-thru is provided by others the contractor shall install conduit or UL listed wall pass thru's sized as required to route all cables through all walls.
B. Pass thru's shall be EMT conduit or another UL listed rated device.
C. Install thru all drywall, block, concrete walls and through any floors required to be penetrated
D. Conduit shall be supported mechanically from the wall or floor structure. After installation, the raceway shall be firestopped to meet the requirements of the wall or floor.
E. Install a sticker on the wall, next to the pass thru, listing the UL approved method that was used to firestop the pass thru or conduit.

2.11 PATCH CORDS

A. Contractor shall provide one patch cord for each data cable installed. Patch cords shall be at the communications room.
   1. Provide a patch cord for each CAT-6 or CAT-6A cable installed
B. Patch cords shall match the type of cables installed. Provide CAT-6 patches for CAT-6 cables. Provide CAT-6A patches for CAT-6A cables
C. Patch cords shall be 8" or 12" long and shall match the color of the cable/jack they are being plugged into.
   1. Provide Yellow Patch Cords for Wireless Access Points
   2. Provide Green Patch Cords for Security Cameras
   3. Provide Blue Patch Cords for all other data cable connections.
D. Patch cords shall be 28 AWG, small diameter cords
   1. CAT-6 cords shall be Panduit #UTP28SP8IN* where * is the color
   2. CAT-6A cords shall be Panduit #UTP28X8IN* where * is the color
E. Patch cords shall be 28 AWG, small diameter cords
   1. CAT-6 cords shall be Hubbell #HCL6xxyy where xx is the color and yy is the length. 01 length is 12"
   2. CAT-6A cords shall be Panduit # HCL6Axxyy where xx is the color and yy is the length. 01 length is 12"

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine all pathways prior to installation of all cables.
B. Identify locations of all user conduits and backboxes prior to cable installation.
   1. Walk the site during conduit installation and ensure that all boxes are installed where required for termination of all cables.
   2. If any missing locations are not noted during electrical raceway installation the contractor shall be required to fish the wall or install surface raceway to support the cable terminations
C. The Engineer or the Owner has the right to make adjustments to the location of any outlet to a new location within 7 wall-feet of the original location. If the change is made prior to final cable termination, and prior to any raceway being installed, then the changes shall be a no cost change to the contract.
D. Identify all locations where cable will route through furniture raceway or other nonstandard conduit or raceway installation. Make arrangements to install and terminate all cables in accordance with TIA/EIA 568 standards.

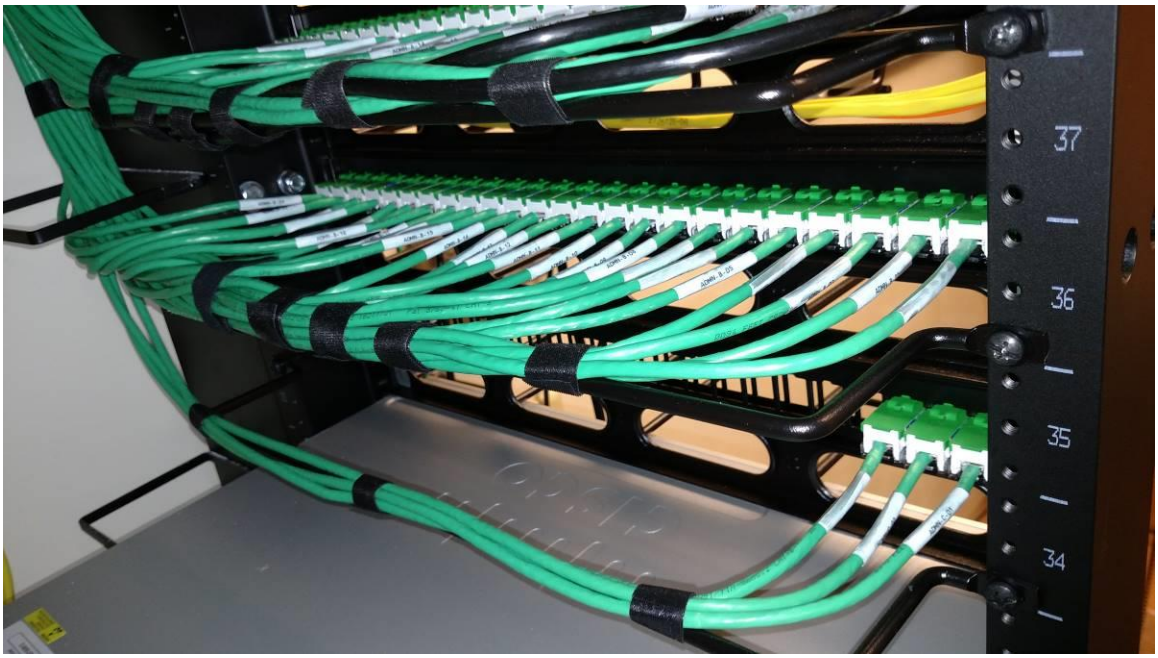
3.02 PREPARATION

A. Locate main path for all cables and install J-hooks where cable tray or raceway is not provided.

B. Coordinate with other trades to install a clear, straight path down major corridors for the routing of user cables back to the communications closet.
C. Plan installation of cables along cable ladder of rack system in communications room. All cable shall be neatly routed in groups of no more than 24 cables.

3.03 INSTALLATION

A. CAT-6 and/or CAT-6A cabling shall be installed according to TIA/EIA 568 standards, including all updates and addenda.
   1. When installing CAT-X cables, care shall be taken to avoid crimping or bending the cable past the manufacturer's recommended bend radius.
   2. During installation, the cables shall not be pulled across the ceiling tiles or the structure of the building. This may cause damage to the cable jacket.
   3. Adhere to all pulling tensions and bend radii during installation. Excessive pulling or bending can cause the cable to fail tests after installation. Any cable that does not pass the certification tests after installation shall be fixed or replaced at the Contractor's expense.
   4. All cables shall route neatly in the ceiling. Whether they route in cable tray or J-hooks, the cables shall be neat and orderly.
   5. Cables shall not be laying on or against the building structure. Cables shall not be laying on or against electrical or HVAC pipes.
   6. Cables shall not be installed between the building structure and corrugated steel of the roof deck.
   7. There shall be no more than 24 cables in each J-hook. Provide additional J-hooks as required.
   8. Support all cables at a minimum of every 5 feet.
   9. Provide a short coil of extra cable where the cable enters the vertical conduit. The coil shall consist of no less than 1-1/2 feet.
   10. Provide enough slack in the backbox to fully remove the faceplate and jack and allow work to be done on the cable.
   11. When installing cables in the communications room, all cable shall route neatly through the cable tray and cable ladder.
   12. When transitioning from the ceiling area to the cable ladder of the rack system, all cable shall route through conduits or be attached to vertical section of cable ladder. The Contractor shall provide the conduits shown and any additional conduits or cable ladder required to neatly transition cables from the ceiling to the rack.
   13. Bundle cables in groups of no more than 24 cables as it routes along the cable ladder.
   14. Cables shall route down each side of a rack for termination. Split each panel into 2 sides. The first 12 positions on a panel are on the left, and positions 13 through 24 are on the right. Route the cables for panel positions 1 through 12 down the left cable ladder and route the cables for positions 13 through 24 down the right cable ladder.
   15. Each patch panel shall utilize a rear organizer for holding the cables as they route to the punchdown field.
   16. Cables shall be bundled in groups of 4 as they route through the rear cable organizer.
   17. When terminating cables, ensure that the smallest amount of jacket is removed from the final termination point of the cables.
   18. Pair twists shall be maintained up to the IDC jack for all the cables.
   19. Provide a service loop of the cables on the vertical cable ladder. The loop shall extend no less than 1 foot below the termination point on the patch panel. Route the cables 1 foot below the patch panel, and then back up to the panel. This will provide room for future moves and additions to the rack.
   20. Each cable shall have a self adhesive, self laminating, laser printed label at each end. The label shall show the location identifier of that cable. Labels shall be installed no more than 4 inches from the termination point of the cable.
B. All work on the project shall meet all applicable state, federal, local and industry codes and be installed according to the requirements of he Authority Having Jurisdiction (AHJ).



Detail 01. Proper routing and support of cables on rear organizer. Where possible route 12 cables from right side and 12 cables from left side. This rack in picture did not have right side organizer.

C. CAT-6 and CAT-6A data jacks shall be installed at the user end of each UTP cable installed in the system.
   1. Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as close as possible to the point of mechanical termination.
   2. Jacks shall be installed per manufacturer's instructions and properly mounted in plates, frames, housings, or other appropriate mounting devices.
   3. Jacks shall be installed such that cables terminated to the jacks maintain minimum bend radius of at least 4 times the cable diameter into the workstation outlet. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
   4. See drawings for the color requirements of all modular jacks.

D. Faceplates shall be mounted straight and level with the floor and walls of the building.
   1. Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the faceplate prior to the mounting of the faceplate.
   2. Jacks shall be inserted into the faceplate left to right, then top to bottom. 2 gang plates shall be labeled left to right, then top to bottom for each gang.
   3. Cable slack shall be stored behind the faceplate in such a way that allows the minimum bend radius of the cables to be maintained as per the following:
   4. Care shall be taken when mounting the faceplate to avoid crimping or kinking the cables.
   5. Faceplates shall be securely mounted to a surface mounted housing, a recessed box, or box eliminator bracket.
   6. Each faceplate shall be labeled with laser printed paper inserted behind the clear plastic label strips.
   7. The label shall show the location identifier of the faceplate and the letter designation for each cable. The label shall be as large a font as possible and easily readable.
   8. Each faceplate comes with a label strip at the top and the bottom.

E. Wall mount phone plates shall be mounted to a backbox or a drywall ring securely installed to the wall.
   1. Terminate the cable to the 8-position jack on the wall mount faceplate.
   2. Ensure that the faceplate is at the correct height for all ADA requirements.

3. Provide an adhesive label on the faceplate identifying the cable with its location identifier number.

F. When utilizing 106 style or GFI/Style-Line brackets, the Contractor shall provide self adhesive labels detailing which cable is at each position.
   1. 106 plates and GFI plates will primarily be located in floorboxes or surface raceway.
   2. The contractor shall coordinate the faceplates required with the actual floorboxes installed by the electrical contractor.
   3. Provide the quantity of GFI and 106 style plates required.

G. Surface Mount boxes
   1. Modular Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the surface mount box.
   2. When the surface mount jack is mounted above the ceiling the cable shall be coiled and the cable and surface mount box shall be kept off of the ceiling grid
   3. Attach the coil to the building structure with a plenum rated tie-wrap.
   4. Label each surface mount box for the cable number. Also, install a wrap-around label on each cable.
   5. When attaching a surface mount box to a piece of furniture or to a power pole the contractor shall drill a hole in the furniture/pole that is larger than the hole on the back of the surface box.
   6. Screw the surface box to the furniture or to the pole. Adhesive only solutions are not adequate.

H. Proper support of cables is of paramount importance when installing a cable infrastructure. All cables not in conduit or cable tray shall be supported via J-hooks a minimum of every 5 feet.
   1. Routes of cables shall be parallel or perpendicular to the walls of the building.
   2. Install the J-hooks to minimize changes in the level of the cables as they route through the J-hooks.
   3. Do not install more than 50 cables in any 1 J-hook. Provide additional hooks where more than 50 cables route along a main route.
   4. All communications shall route as high in the ceiling as possible while still being accessible and staying away from other utilities.
   5. When installing the cable through the J-hooks, they shall all have relatively the same droop between hooks. All cables shall be installed neatly and squarely.
   6. Secure the J-hooks to the building structure with beam clamps and threaded rod as required to support the cables.
   7. J-hooks shall never be attached to drop ceiling support wires. Cables shall never be supported by drop ceiling wires.

I. CAT-6 patch panels shall be installed in the racks.
   1. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the modular jack at the patch panel shall be no greater than a 1/2 inch (13 mm).
   2. Panels shall be installed per manufacturer's instructions and properly mounted to a rack, cabinet, bracket, or other appropriate mounting device.
   3. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts.
   4. Each patch panel shall have a rear cable organizer for routing cable from the vertical cable ladder to the patch panel. 1 organizer for each row of 24 cables.
   5. The label for each outlet on the panel shall be the same as the wraparound label on each end of the cable.
   6. Each label shall line up directly below or above the outlet on the panel. Misaligned labels will not be permitted.

J. Patch Cords
   1. Provide patch cords into the communications room where they are to be installed

2. Mark the box with the date they are placed in the room and quantity of each type of patch cable.
3. Send picture of the box to the designer and owner

END OF SECTION

SECTION 28 7200 – TECHNOLOGY SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides the Contractor with requirements regarding Product Data Sheets, Shop Drawings and Product Samples collectively referred to as “Submittals”.

B. This section provides the Contractor requirements regarding As-Built Documentation after installation and prior to Final Completion and Final Payment

C. The requirements of this section deal only with those submittals that are required to be provided by the chosen contractor after bid award. No submittals in this section are required to be provided with the Bid Response.

D. The requirements contained herein should be considered bound and apply to all technology and security specification sections per this contract.

1.02 PRE-INSTALLATION SUBMITTALS

A. The contractor shall provide material submittals to the Construction Manager or directly to the designer, whichever is managing the project.

B. Prior to beginning work, the chosen Contractor shall provide PDF files of all material submittals.

1. Highlight the part number of each item specifically. Submittals that are not highlighted will be rejected and sent back immediately.
2. Provide the PDF with the following file names
   a. Site - Spec Section - Description
   b. In Example: K**ent City 28 1600: Data Cabling submittal**

1.03 AS-BUILT DOCUMENTATION

A. The contractor shall provide As-Built documentation to the Construction Manager or directly to the designer, whichever is managing the project.

B. Provide the As-Builts in hard and soft copy

1. Hard Copy shall include all Red-lined Drawings showing what was actually installed and where it was installed.
2. Soft copy on USB Drives (PDF or Microsoft Word or Excel) shall include all documents provided in the hard copy plus any configuration or data files. Include XLS files for all spreadsheets.

PART 2 - PRE-INSTALLATION SUBMITTALS

2.01 PRODUCT DATA SHEETS

A. Product data sheets shall consist of the manufacturers detailed specification sheets or “cut-sheets” for each product that is to be installed by the contractor or any subcontractors.

B. Product data sheets shall minimally include, but shall not be limited to:

1. Part Number
2. Manufacturer
3. Description of the product
4. Physical dimensions and characteristics of the product
5. Picture or manufacturers drawing of the item, where applicable
6. Electrical characteristics of the product including heat-load for active electronics.
7. Optical characteristics of the product for Fiber-Optic equipment and cable.

C. Provide product data sheets for all equipment and cabling that is to be installed by the contractor

D. Provide a PDF of all the Equipment being submitted. Each actual part number shall be highlighted on the PDF in yellow.

1. Group Product Data Sheets by:

a. Data Cabling
b. Fiber Optic cabling

2.02 SHOP DRAWINGS

A. Shop Drawings shall consist of detailed drawings showing actual connectivity, equipment to be installed and cable types for the systems noted below:
   1. None
B. Shop drawings shall also be provided for systems that the contractor intends to connect differently than what is shown on the contract drawings or where no connectivity is shown.

2.03 PRODUCT SAMPLES

A. Product Samples shall consist of a sample of the actual product that is to be installed.
B. Samples shall be tagged with the part number and specification section to which it pertains.
C. Product Samples shall be provided for the following:
   1. None at this time.

2.04 SUBMITTAL DOCUMENTS

A. The Contractor shall provide all Submittals to the Construction Manager or the designer
B. The Contractor shall provide PDF Files for all Product Data Sheets.
   1. All Product Data sheets shall be PDF files grouped as shown in 2.01/D
   2. The Contractor shall highlight the actual part number on the sheet of the component that they are submitting.
   3. If no part number is highlighted or marked with an arrow, then the entire submittal package will be rejected and sent back for re-submission.
C. The Contractor shall provide 1 set of PDF of Shop Drawings.
   1. Shop drawings shall be marked for the specification section of the bid documents to which they pertain. Mark the Detail (TCXXX/Y) to which the Shop Drawing refers.
   2. All shop drawings that are required to be drawn on the building background shall be provided on full-size drawings the same scale as those in the bid documents.
   3. All lines on the shop drawings shall be highlighted or completed in ink that is not the same color as that provided in the bid documents.
   4. The contractor shall provide a drawing legend detailing all symbols used in creation of the shop drawings.
D. The Contractor shall provide one of each product sample required to be submitted.
   1. Provide a cutsheet with each product sample detailing the specifics of the product and what it is proposed to be used for.

2.05 SUBMITTAL REQUIREMENTS

A. Submittals shall be provided for approval prior to installation of the work.
B. Any equipment installed that does not have an approved submittal associated with it can and will be removed from the project and replaced with other equipment as defined by the Designer. All replacement costs shall be the responsibility of the Contractor.
C. It shall be the responsibility of the Contractor to provide the submittals for review in sufficient time to not delay the installation. Work with the Construction manager on the schedule.
D. It shall be the responsibility of the contractor to ensure they have provided and have on hand “Reviewed” or “Furnish as Corrected” submittals for all equipment they install.
E. When reviewing submittals marked “Furnish as Corrected” take into account the comments and incorporate the comments into the products and installation of the systems.

PART 3 - AS-BUILT DOCUMENTATION

3.01 MATERIALS

A. The Contractor shall provide the following to the Designer prior to the issuance of the final payment.
   1. Approved submittals and equipment user manuals.
   2. As-Built Documentation as detailed below.
   3. All spare parts and cover plates for all components of the systems
   4. Manufacturer warranty cards for all components.

3.02 AS-BUILT PROCESS

A. The Contractor shall provide all project as-builts to the designer at substantial completion.
   1. Provide them to the designer for review
   2. Make any required changes the designer requests
   3. Re-submit at the time of Final Completion / final payment. Final Payment is not possible without a complete post installation deliverable package

3.03 PREPARATION

A. All documents for As-Builts and test results shall be neat and clearly labeled with listing of the project and documents included in each binder.
B. Quantity:
   1. Submit Red Lined, As-Built floorplans for the Systems detailed in 3.04/D.
      a. Provide one set of physical documents, full size,
      b. Provide PDF Scans of the As Built Floorplans.
   2. Submit Electronic files for As-Built Documentation
      a. Provide PDF Files. Provide a Coversheet that details:
         A) Client name.
         B) Project name.
         C) Manual title (e.g., “Project Close-out Manual for security system upgrade”).
         D) Date; date format: <month> <day>, <year> (e.g., “January 1, 20xx”).
         E) Installer and General Contractor names and contact information
         F) Warranty contacts for all systems.
      b. Submit Electronic files to Owner, Designer and Construction Manager via email or dropbox or directly through USB Drives.

3.04 PROJECT DELIVERABLES

A. Provide a copy of all submittals and manuals and pamphlets.
B. Provide a copy of all Warranty documents and contact numbers for Warranty requests.
C. The contractor shall provide one set of full sized as-built prints. Provide a PDF of the as-built prints on the USB drives or via Email or Dropbox.
   1. Provide a clean set of the latest drawings with red lines marked for all field changes or bulletins. See above for systems to be included on the As-Built prints
D. The As-Built drawings shall include:
   1. Changes to be reflected on the drawings for Video Security Systems shall include:
      a. Cabling Paths
   2. Changes to be reflected on the drawings for Cabling Systems shall include:
      a. Route of exterior conduits and exterior cabling
      b. Route of backbone cabling, fiber and copper
      c. Route of major cable paths from outlet to comm room.
      d. Rack/cabinet locations.
      e. Faceplate locations
      f. Rack layout of all components in each rack.
      g. Changes to the schematic connectivity of any system shown on the drawings.
      h. Cable numbering for each faceplate.
E. Documentation for the specific systems shall include. Provide the following for each system:
   1. Contractor warranty dates based on Substantial completion date and contact information for warranty work.
   2. Data cabling

a. Testing Documentation for copper and fiber cabling
    A) Include software to read the test results.
    B) Testing Documentation; This shall include actual cable test results. Tabbed Sections in the binder:
        1) Telecommunication Horizontal Cabling Detailed cable test reports
        2) Telecommunications Fiber backbone cabling
        3) Summary report
b. Signed Cabling Warranty from manufacturer

F. Training sign-in sheets detailing what was trained, who was trained and their time in training.

END OF SECTION

SECTION 28 7600 – TECHNOLOGY LABELING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section provides direction on labeling of cables and devices.

PART 2 - PRODUCTS

2.01 CABLE LABELING PRODUCTS INTERIOR

A. CAT- 6, access control and audio / video cabling
   1. Laser-printed, self-adhesive wrap around shall be Brady LAT-18-361 or equivalent.
   2. Label shall be 1.00-inch width x 1.33 inch high.
   3. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
   4. Sheet size shall be 8-1/2 inch x 11 inch.
   5. Printable area shall be a minimum of 1.00-inch width x 0.50 inch high.
   6. All labels shall be printed through a laser printer using labeling software.
   7. The Contractor shall submit a proposal for the labeling scheme for all audio and video wiring. The Engineer shall approve of the scheme prior to all labeling.

B. Fiber Cable labeling.
   1. Laser-printed, self-adhesive wrap around labels for and fiber cables in the comm rooms and ay the back of the patch panels shall be Brady LAT-19-361 or equivalent.
      a. Label shall be 1.00-inch-wide x 3.167 inch high.
      b. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
      c. Sheet size shall be 8-1/2-inch x 11 inch.
      d. Printable area shall be 1.00-inch-wide x 0.97 inch high.
      e. All labels shall be printed through a laser printer using labeling software.
      f. Install on fiber cable at the patch panel as it enters and at the coil of fiber on the wall or in the cable ladder
   2. Interior exposed fiber cable and fiber cable inside inner duct shall be labeled every 100 feet, label shall be Panduit No. PST-FO.
      a. Label shall be covered with a clear laminate to protect the legend of the label.
      b. Attachments for tie wraps shall be available on the label to attach it to the cable or inner duct.

C. Faceplate Labels
   1. Laser-printed, paper labels shall be used to label user faceplates.
   2. Individual paper labels shall be installed behind the clear plastic strips of all user faceplates and surface mount housings.
      a. The labels shall show the location identifier number and letter of each individual cable.
   3. Where a faceplate or surface mount box does not have a clear plastic strip the contractor shall install an adhesive label on the plate or surface mount box showing the cable number of each cable in the plate.

D. CAT-6/6A patch panels in comm rooms
   1. Laser-printed, labels shall be used to label Cat-6 Patch panels
   2. Label the side of the patch panel for the panel number in the comm room. “Panel A” etc. label on two spot on each panel
   3. The panels shall be labeled 1-24. Use factory numbering or paper numbering if no factory numbering is provided.

E. Rack and Cabinet labels
   1. Provide and install Engraved, lamacoid labels at the top of each rack or cabinet installed. Shall be black label with white engraved letters

2. Shall be 1” high minimum.
3. Coordinate rack number and comm room number prior to ordering

F. Custom Faceplates
1. Engraved labels shall be installed at locations including but not limited to:
a. Audio and Video special input plates. Detail each input and output
2. Size the phenolic labels for their individual uses. Provide a sample to the Engineer for approval prior to ordering or installation.

2.02 LABELING PRODUCTS EXTERIOR

A. Exterior exposed fiber cable and fiber cable inside handholes, manholes and pullboxes shall be labeled.
1. Label shall detail the type of fiber and strand count.
2. Label shall detail the termination locations of the fiber cable. Include both building names and room numbers/descriptions.
3. Label shall be covered with a clear laminate to protect the legend of the label.
4. Attachments for tie wraps shall be available on the label to attach it to the cable or inner duct.
5. Cable shall be Panduit # PST-FO.

B. Aerial fiber cables shall be labeled at every other pole.
1. Label shall include a stamped metal tag that includes:
a. Type of fiber and strand count.
b. Termination locations of the fiber cable. Include both building names and room numbers/descriptions
c. Metal tag shall be embossed with all information.
2. Shall be attached to the cable and strand with outdoor rated metal wraps.
3. See sample type of embossed metal label below:
a. 

b. Submit sample to designer for approval prior to purchasing
4. At each metal tag location, also install an orange cable label that is easily seen from the ground.
a. 

b. Fiber optic tools #FOTF1-0094F or equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Terminate all cables in proper color code sequence.
B. Clean any surfaces where an adhesive label is to be installed.
C. Prior to beginning the work, the contractor shall submit to the engineer a plan for labeling all the cables. This shall take into account to what components each cable is connected.

3.02 GENERAL LABELING

A. Everything shall be labeled as per the specs and drawings.
B. All labels shall be installed to more easily identify the cables and ports on all panels. If there are any questions regarding labeling, contact the Engineer prior to installation.

C. Engraved lamacoid labels shall be provided and installed whenever there is no location for paper inserts on faceplates, power poles, poke thru's, floor boxes, modular furniture and surface raceway.
   1. Engraved lamacoid labels shall provide the same labeling as the paper inserts, but they shall be self-adhesive.
   2. These labels shall be adhered to the location closest to the modular jack.
   3. Individual letters shall be provided for each cable. An overall location identifier can be provided for all the cables at that faceplate or floor box.
   4. Engraved labels for rack shall be at least 1-1/2 inch high with letters 1 inch high.
   5. These labels shall be affixed to the top and front of each rack or cabinet. Verify that the label will fit the rack or cabinet prior to purchasing.

3.03 DATA CABLING LABELING EXECUTION

A. Cable labels for CAT-6 user cables from the faceplate to the patch panel shall be installed within 4 inches of the end of the cable sheath.
   1. The location identifier is made up of 3 fields, and a sample might look like this:

      A-X-YY

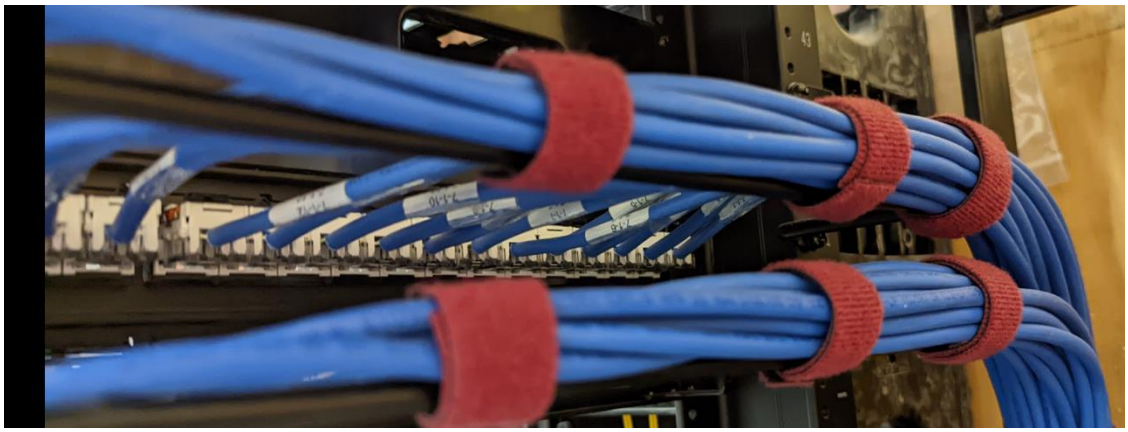
      The A stands for the communications room where the cables are terminated.
      The X represents that the Patch panel in that comm. room.
      The YY represents the cables number in that panel 01-48.

      This system of identification provides the Owner with an easy way to keep track of cables, and where they are located or terminated.

   2. The cable label shall be similar to the label below:

A-X-YY
A-X-YY
A-X-YY

   3. Provide a sample label to the Engineer for approval prior to installation of all labels.
   4. Labels shall be installed at each end of each cable. Shall be within 4" of the termination.
   5. Shall be at a uniform distance from termination on the patch panels. See pic below:



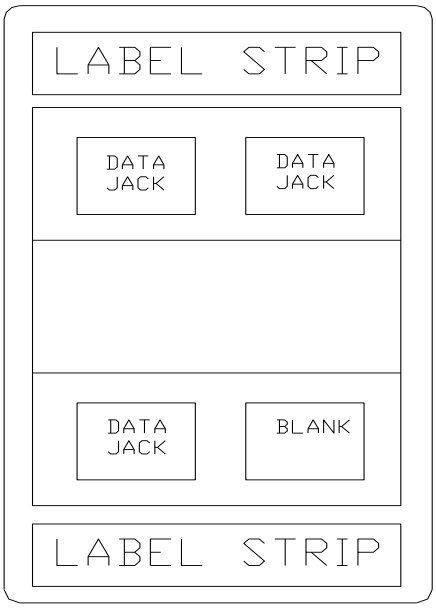
B. Paper inserts shall be supplied for all faceplates and patch panels labels.
   1. Paper inserts for the faceplate shall detail the exact location identifier for each cable.
   2. They shall fully cover the background of the insert space on the faceplate, but all numbers and letters of the identifier shall be visible after installation of the plastic cover plate.
   3. The paper insert for a standard faceplate will look like this:

A-2-24 A-2-5

Top Label Strip

A-2-26

Bottom Label Strip



4. Provide a sample label to the Engineer for approval prior to installation of all labels.

C. CAT-6 Patch panels shall be labeled for the panel they are numbered in the comm room and for the cameras (1-24 or 1-48)
   1. See below diagram:
      a. Install labels at each end detailing the panel number.

Panel A	01	02	03	04	05	06	07	08	09	10	11	Panel A

D. CAT-6 Patch panels for Wireless Access Points shall be labeled for the WAP number
   1. See below diagram:
      a. Install labels below each outlet on the patch panel detailing the WAP number
      b. Meet with the owner and obtain the WAP number and label the panel with that WAP number. Install .laser printed label
      c. Example below shows WAP number of BU (for Butler building)-0XX etc.

Panel A	01	02	03	04	05	06	07	08	09	10	11	Panel A
	BU-021	BU-022	BU-023	BU-024	BU-025	BU-026	BU-027	BU-028	BU-029	BU-030	BU-031	

TYPICAL PANEL LABELING

3.04 FIBER OPTIC CABLING LABELING EXECUTION

A. Fiber optic cables shall have a wrap around label at each end that details the 2 buildings and/or closets where the cables terminate.
   1. A fiber cable with 12MM strands terminates in White Hall Room 012 and Green Hall Room 243. The wrap around label shall look like this:

12MM
WT 012-GR 243

   2. The wrap around labels shall be installed within 12 inches of the end of the sheath of the copper and fiber cables.
   3. Provide a sample label to the Engineer for approval prior to installation of all labels.

B. Fiber Panel labeling shall be done for the front of each fiber optic patch panel.
   1. The figure below demonstrates the layout of the fiber panel label. Each label shall be customized for each individual panel. The figure below is for the 72 port panel.
   2. Contact the Engineer with questions on the correct labeling prior to installation.

12 SM TO HIGH SCHOOL						12 MM TO COMM RM “B”						12 SM TO COMM RM “C”					
01	03	05	07	09	11	01	03	05	07	09	11	01	03	05	07	09	11
02	04	06	08	10	12	02	04	06	08	10	12	02	04	06	08	10	12

Figure A – Label for 36 Port Fiber Patch Panel

END OF SECTION

SECTION 28 7700 – TECHNOLOGY TESTING

PART 1 - GENERAL

1.01 WORK INCLUDED
- A. This section provides direction on
  1. Testing of copper and fiber cable,
  2. Testing and commissioning of the technology systems

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Approved vendors for cable testers are:
  1. Fluke or equal

2.02 TESTING PRODUCTS
- A. Category 6 cable shall be tested.
  1. Cable tester shall support Cat 6 channel and permanent link certification.
  2. Tester shall provide accuracy beyond TIA level III requirements traceable to laboratory reference standards.
  3. Through add on fiber optic probes, the tester shall be able to test multimode and single mode fiber cable.
  4. Test results shall be able to be stored on internal or removable compact flash memory cards.
  5. Tester shall have optional talk set for discussions over the cable being tested.
  6. Tester shall support a frequency range of 1-350 MHz with accuracy to the current proposed TIA Level III.
  7. Tester shall support the following tests:
     a. Near end crosstalk (NEXT).
     b. Attenuation.
     c. Equal level far end crosstalk (ELFEXT).
     d. Return loss.
     e. Ambiant noise.
     f. Wire map shall identify miswires, shorts, opens, reversals, and split pairs.
     g. Shall measure cable length and distance to faults (if any).
     h. Propagation delay.
     i. Loop resistance.
  8. Tester shall support the following test standards:
     a. TIA Cat 6 and ISO Class E.
     b. TIA Cat 5.
     c. TIA TSB-95.
     d. TIA Cat 3, 4 and 5 per TIA TSB-67.
     e. UTP, STP, SCTP coaxial and twinax cabling.
     f. IEEE: all Ethernet 802.3UTP and fiber PMD interfaces including 1000BASE-T; other 802.x PMD interfaces including token ring and demand priority.
     g. ATM: All UTP and fiber PMD interfaces.
  9. Tester shall have all required probes and accessories required to perform CAT-6 tests and “Network Tests.”
  10. Tester shall have been recently calibrated (within 4 months), and shall be utilizing the latest software.
- B. Fiber Optic Tester:
  1. Fiber cable shall be tested with a light power meter.

a. Multimode at 850nm and 1300nm, and single mode at 1310nm and 1550nm shall be tested by the light meter.
b. Power meter testing shall have a range of +20 dBm.
c. Testing at both wavelengths shall appear on the readout at one time for both multimode and single mode.
d. All connector types shall be available for testing.
e. Resolution of testing shall be to 1 foot.

2. All fibers shall be tested prior to any splice (other than pigtails) being closed and secured.

2.03 PUNCHLIST PROCESS

A. The contractor shall be required to go through a punchlist process prior to substantial completion and final completion/payment of each project

B. Contractor shall be responsible for reviewing their own work and checking to ensure it has met the project requirements.

C. The contractor shall:
1. Review your work in each room
2. Review the specifications and drawing and review their work to ensure it meets requirements
3. Create a punchlist document showing what work is not yet done and what as-builts are yet to be completed. Send document to designer.
a. Provide a date when contractor punchlist work will be completed.
4. Schedule a punchlist and substantial completion meeting with designer.
5. Present updated punchlist document to the owner
6. Walk the site with the contractor and demonstrate all systems and review the work completed. Demonstrate how all work is completed

D. Designer will create an “Owner Punchlist” document
1. This will be provided to the contractor
2. Contractor shall review the list, fix/upgrade/replace all equipment and cabling and finish work on the punchlist
3. Return punchlist to the designer showing when the work was fixed/completed and a signature on the sheet showing that the contractor has reviewed each item.

E. Meet onsite with the designer to review the finished work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Testing shall be completed after fiber is installed inside the fiber patch panel and the fiber panel has been put together.

B. All cables and panels where cables terminate shall be labeled with the cable label or name of each individual cable. Identify how each cable and panel will be labeled.

3.02 CATEGORY UTP/STP CABLE TESTING

A. Cable tests for CAT 6 cables shall be provided for each user CAT-6 cable.
1. Prior to beginning the testing, the Contractor shall provide the Engineer with a notice that testing will begin. Written notice shall be given at least 3 business days prior to testing beginning.
2. Tester shall be calibrated each day with manufacturer provided calibration cable.
3. Tests shall be saved under each cables unique location identifier.
4. Contractor shall provide the correct cables and probes specifically for the cable and modular jacks that are being tested.
5. During the test the tester shall be set to check all “Network Tests.”
6. Test results shall be provided in hard copy and soft copy. Along with the soft copy, provide a copy of the software required to read the test results.

7. Contractor shall supply 2 copies of the paper results and 2 copies of the file results.
8. Provide all paper results in 3-ring binders. Binders shall have a cover that shows the job name, job number, building and closet where the cables were tested, and the range in the location identifiers of the cables tests provided.
9. Tester shall be set to match the cable being tested.
10. Contractor is responsible for ensuring that all cables pass the tests. Any cable found not to pass shall be removed and replaced at the Contractor's expense.

3.03 FIBER CABLE TESTING

A. Fiber cable shall be tested with a light meter for end-to-end tests.
   1. Prior to beginning the testing, the Contractor shall provide the Engineer with a notice that testing will begin. Written notice shall be given at least 1 week prior to testing beginning.
   2. Light meter tester shall be calibrated at the beginning of each day.
   3. Light meter test results shall be provided in a spreadsheet format.
   4. Contractor shall supply 2 copies of the paper results and 2 copies of the file results.
   5. Provide all paper results in 3-ring binders. Binders shall have a cover that shows the job name, job number, building and closet where the cables were tested, and the range in the location identifiers of the cables tests provided. Test reports shall include the following information for each cabling element tested:
      a. Actual measured and maximum allowable attenuation (loss) at the specified wavelengths per Part 2, Section 3 and the margin. An individual test that fails the link criteria shall be marked as FAIL.
      b. Reference method.
      c. Number of mated connectors and number of splices (if any).
      d. Actual length and maximum allowable length per Part 2, Section 3. Any individual test that fails the link length criteria shall be marked as FAIL.
      e. Group refractive index (GRI) for the type of fiber tested, if length was optically measured.
      f. Tester manufacturer, model, serial number, and software version.
      g. Circuit ID number and project/job name.
      h. Link criteria (autotest) used.
      i. Overall pass/fail indication.
      j. Date and time of test.
   6. Contractor shall test all user fiber cables to the following limits:
      a. Link attenuation shall be tested in accordance with ANSI/TIA/EIA-526-14A. Reference measurements shall be made in accordance with Method B or equivalent
      b. Multimode loss shall be no more than .6dB per mated connector and shall be no more than 3dB/km at 850nm and 1dB/km at 1300 nm.
      c. Singlemode loss shall be no more than .6dB per mated connector and shall be no more than .5dB/km at 1310 nm and .4dB at 1550 nm.
      d. If the measured loss is above the limits, the Contractor shall take action to fix the cables and get the tests to be below the loss limits.
   7. Contractor is responsible for ensuring that all cables pass the tests. Any cable found not to pass shall be removed and replaced at the Contractor's expense.
   8. Testing shall be of the optical link. An optical fiber link is defined as the passive cabling network between 2 optical cross connects (patch panels or outlets). This includes cable, connectors, and splices but does not include active components. The link test contains the representative connector loss at the patch panel associated with the mating of patch cords but does not include the performance of the connector at the equipment interface.

END OF SECTION

SECTION 28 7800 – TECHNOLOGY WARRANTY

PART 1 - GENERAL

1.01 SECTION INCLUDES
- A. This section includes directions for the Contractor regarding system and equipment warranties.

1.02 SYSTEM DESCRIPTION
- A. The project is not complete until all paperwork has been provided.

1.03 COORDINATION
- A. Coordinate as-built drawings and records with the Engineer and Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Provide manufacturer's warranty for all equipment installed
- B. Provide contractor warranty for workmanship and equipment
- C. Provide software upgrade protection (SUP) warranty as detailed in the specifications.

2.02 MATERIALS
- A. The Contractor shall provide the following to the owner/designer at Substantial Completion and any updates prior to the issuance of the final payment
  1. Manuals and pamphlets on all electronic equipment.
  2. All spare parts and cover plates for all components of the network.
  3. Red lined set of as-built drawings for the entire project.
- B. Updated hard copy and soft copy of the As-Built Documentation. See associated spec section.

PART 3 - EXECUTION

3.01 EXAMINATION
- A. Contractor shall fully examine all components of the system to make sure that all manuals and paperwork are included in the final submittal.
- B. Examine all equipment and cabling to ensure that it is labeled as per the drawings and specifications.

3.02 GENERAL WARRANTY
- A. Warranty Period shall be 1 year after a signed copy of Substantial Completion. This shall be the Warranty Period.
- B. See further specifications for additional warranty requirements that may be longer for certain systems.
  1. Contractor shall be responsible for generating and submitting the Substantial Completion document to the designer for review and signature.
- C. Warranty shall include each and every part, cable or software system provided as part of this project. This includes cabling, Networking, Wireless, Audio/Video systems and Access Control and Video Security systems.
  1. During the Warranty Period:

a. If any part is broken due to a manufacturing defect or installation defect, the Contractor shall fix and/or replace the broken item at their own expense.
b. If any equipment loses connectivity or fails for any reason the contractor shall be onsite to diagnose and fix or replace equipment and upgrades software.
c. The Contractor shall also supply all configuration and programming necessary to keep all electronic equipment to the latest revision of software during the warranty period.
d. If the “system” goes down, and needs configuration to be brought back up, the Contractor shall be liable for any programming or reconfiguration.
e. During the warranty period, the Contractor shall make the Owner aware of any software upgrades that are available.
f. Contractor shall install all software upgrades for that warranty period or as detailed below for specific systems.
g. If the system does not run well during the warranty period the contractor shall be onsite to diagnose and fix the system.

D. The contractor shall be onsite within 24 hours after a call from the owner or designer regarding system or equipment issues.

3.03 EXTENDED CABLING WARRANTY

A. The Contractor shall provide to the Owner a “Link Warranty” on all the components of the voice/data cabling system. This includes all components from the faceplate, through the jacks, cable, and back to the patch panels, not including patch cords.
   1. This shall include Fiber Optic cabling and termination equipment.
B. Cable shall be installed that is covered as part of the complete warranty on the data cabling system. Cable that cannot be covered under the warranty shall not be installed.
C. The warranty shall be provided through the manufacturer of the faceplate, jacks, and patch panels. All components shall be by the same manufacturer.
D. The warranty shall guarantee that if any part or piece of the “Link” is found to be defective for a period of no less than 15 years, then that part or piece shall be replaced or fixed at no cost to the Owner.
E. The Contractor shall be responsible for installing the system in such a manner that the manufacturer will provide this warranty to the Owner.
F. The Contractor is responsible for compiling and submitting all the paperwork required to receive the warranty. This includes gathering all the information, completing any required forms, and submitting these forms and any other records to the manufacturer as required.
G. It shall be the Contractor’s responsibility to receive the approved warranty notification from the manufacturer and provide that and all the associated paperwork to the Owner.
H. The installation shall not be considered finally complete until the Owner has received notification, from the manufacturer, that the entire cabling system is covered by their warranty

END OF SECTION