# 27 0000 – COMMUNICATIONS GENERAL

## 1Part 1 General

### 1.1 Related Sections

A General

1 This specification section provides general conditions for all division 27 specifications. All contractors working within the division 27 specification shall adhere to this specification.

- Section 27 0258 – Communications Pathways
- Section 27 1000 – Structured Cabling System

### 1.2 Statement of Work

A General

1 This document describes the requirements for the contractors, products, and installation relating to furnishing and installing the described low voltage systems.

2 The Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the specification sections. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the Contractor feels that the system described is incomplete they must address this in writing to the Owner's Representative before providing a bid.

3 All questions concerning non-specified products and services will be addressed to the Owner's Representative before the Contractor provides a bid. The Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.

4 Product specifications, general design considerations, and installation guidelines are provided in this document. Typical installation details, and mounting details are provided in the Construction Drawings. The successful vendor shall meet or exceed all requirements for the systems described in this document.

### 1.3 Regulatory References

A The Contractor will comply with the following:

1 Federal:

- National Electrical Code (NEC) 2008 or latest approved
- Chapter 8: "Communications Systems"
- Article 250: "Grounding"

2 NFPA 70 – National Electric Code

3 FCC – Part 15, Part 68

4 ADA – Americans with Disabilities Act

B State of California

1 CCR, Part 2 – California Building Code

2 CCR, Part 3 – California Electrical Code

3 Occupational Safety and Health Act (OSHA)

4 Title 24, Building Standards, State of California

5 Title 19, California Code of Regulations

6 Title 8, Electrical Safety, State of California

C ANSI Standards

1 ANSI C2-2001 National Electrical Safety Code

2 ANSI C80.3 Specification for Zinc-Coated Electrical Metallic Tubing
3 ANSI/UL 797 Electrical Metallic Tubing
4 ANSI/CEA S-83-596-2001 – Fiber Optic Premises Distribution Cable Technical Requirements

D Industry Standards
1 Telecommunications Industry Associations/Electronics Industry Association (TIA/EIA)
- TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard
- TIA/EIA-568-C.1 General Requirements
- TIA/EIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
- TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
- TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
- TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- TIA/EIA-607 Commercial Building Grounding/Bonding
- TIA/EIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard
- TIA/EIA-758-1 Addendum No. 1 to TIA/EIA-758, Customer Owner Outside Plant Telecommunications Cabling Standard

2 National Electrical Manufactures Association (NEMA)
3 Institute of Electrical and Electronic Engineers (IEEE)
- 802.3 (Ethernet)
- 802.3ab (Gigabit Ethernet over 4-pair Category 5e, 6 & 6A or higher)
- 802.3Z (Gigabit Ethernet over Optical Fiber)

4 Underwriters Laboratories Inc. (UL)
5 International Organization for Standardization/International Electromagnetic Commission (ISO/IEC) ISO 11801 Generic Cabling for Customer Premises
6 Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM 14th Edition or latest)
7 ASCII – American Standard Code for Information Interchange
8 ASTM – American Society for Testing Materials

E Conflict
1 If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
2 This document does not replace any code, either partially or wholly. The Contractor must be aware of and comply with all local codes that may impact this project.

## 1Part 2 Contractor Requirements/Qualifications

### 2.1 Safety and Indemnity

A General
1 The contractor shall be solely and completely responsible for conditions of the job site, including safety of persons and property during performance of work.

### 2.2 Contractor Qualifications

A General
1 Each low voltage contractor/sub-contractor shall submit their qualifications to the district prior to award of contracts.

2 Contractor shall have been in business for no less than five (5) years and have installed a minimum of three (3) projects of similar size and scope.
3 A Manufacture Certified Installer shall complete the System installation. The Contractor shall have completed standards based product and installation training. A copy of the Contractor's Manufacture Certified Installed certificate shall be submitted with their submittal.
4 Sub-Contractor Qualifications
- All Contractors shall submit a list of at least three (3) projects of similar dollar volume completed within the past 24 months for reference purposes.
- The Contractor shall compile detailed information relating to similar work completed, including corporate references sufficient to enable the Owner to evaluate and agree to the Contractor' responsibility, experience and capacity to perform the work.
- Each Contractor to perform telecommunications work on this project shall possess a C7 license and must be certified for installation, termination, splicing, and testing of copper cables, fiber optic cable, riser cable and inside wiring. The appropriate contractor's license for underground construction and conduit installation is also required.
- An on-site Contractor superintendent must be available at all times. Contact can be by person or telephone.

5 Contractors who do not meet the minimum requirements specified will not be accepted.

**2.3** Quality Assurance
A General
1 Contractors are required to comply with the following without exception.
2 The winning Contractor will assign this project to a competent Project Manager who has demonstrated their ability to supervise a telecommunications project of the same size and scope.
- The Contractor will make this person available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.
- Project Manager will be required to be available for scheduled on-site project meetings at no additional cost to the Owner.
- Project Manager will be required to be available to meet on-site with the Owner/Owner's Representative with a minimum of 24 hours' notice for non-emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.

3 All material and equipment to be installed on this project shall be "new". If the Owner/Owner's Representative discovers that "used" material or equipment has been installed on this project, the Contractor will be required to replace said materials and/or equipment with "new" products as no additional cost to the Owner.
- "New" – Materials and products manufactured within one (1) year prior to installation, and meet or exceed the latest published specifications of the manufacture. Also these materials and equipment may not have been in use before installation on this project unless directed otherwise in the project documents.

## 1Part 3 Documentation

**3.1** Products
A Pre-Approved Equals

1 All pre-approved products shall be listed in the relevant specification section.

B Other Products

1 Contractors wishing to approve a system other than those specified in this document will be required to perform the following:
- Provide system specifications and cut sheets for all system components for the proposed new system(s).
- Provide an itemized comparison to each of the system functions as described in this specification. Include in that document how the proposed system compares to the specified system described in this document on a line-by-line basis, using one of the following three criteria:
  - "exceeds"
  - "matches"
  - "unequal"

2 All other products than those specifically addressed in the bid documents the Contractor is seeking approvals for must be received by the Owner's Representative no later than 4 business days before the bid date. All Approved Equals will be published in addendum form prior to the bid date.

3 Failure to receive written approval for products installed that deviate from the products called for in the specifications and/or in the project drawings, will result in the Contractor replacing the unapproved materials and equipment with the originally specified products at no additional cost to the Owner.

4 All proposed system documentation must be sent to the Owner's Representative via one of the following email (itbids@bcsd.com). The Contractor will include the project name, their contact information, and the specification section number that the proposed system is comparable to.

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**3.2** Acceptance

A Project Acceptance

1 The Owner and the Contractor shall accept the project as complete based on the following criteria:
- Before executing any performance testing, the Contractor shall present a test plan to the Owner's Representative for their approval.
- The Contractor has completed all testing and delivered copies of all test resulting the Owner's Representative.
- All test results have been examined and approved by the Contractor and Owner's Representative.
- Copies of all documentation required by [close out documents section] have been delivered to the Owner's Representative.
- All punch list items are completed to the satisfaction of the Inspector of Record.
- Manufacturer Warranty Certification Certificates are provided to the Owner.

2 Following completion and/or compliance with the requirements listed above, the Contractor shall issue a Notice of Completion confirming that the project is complete. A 45-day acceptance period shall begin immediately following the issuance of the Notice of Completion.

3 Minor failures shall be responded to at the Owner's discretion or within one (1) business day.

**3.3** Warranty

A Manufacturer Warranty

1 The installed 27 1000 Structured Cabling (as applicable for given cable media) System, including both inter-building and intra-building sub-systems, shall be warranted by a manufacturer for a minimum of 10 years.
2 The warranty certified systems will be complete systems comprised of products from a single manufacturer for the entire channel (cords, outlets/connectors, cables, cross-connects, patch panels, etc.). The manufacturer shall administer a follow on program through the Contractor to provide support and service to the Owner. In the event that the certified systems cease to support the certified application(s), whether at the time of cutover, during normal use, or when upgrading, the manufacturer and Contractor shall commit to promptly implement corrective action.
3 The Contractor shall be responsible for correcting any problems and malfunctions that are warranty related for the entire warranty period. In the event that a Contractor should not be in business at the time of an issue, the manufacturer shall be responsible for all corrections, if deemed the responsible party.
4 Copies of an extended material warranties shall be passed through to the Owner.

B Contractor Warranty
1 Contractor must warranty all materials, equipment and labor for a minimum of one (1) year from the Owner's acceptance of the work.
- Warranty will provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including labor, travel time/expenses, shipping, taxes, etc.).
- Contractor is required to keep in stock replacement parts for all items covered in this specification and provide a competent service technician to be on site to repair/replace defective items no later than 24 hours after receiving a trouble call.

2 Warranty will cover normal business hours, 8am-5pm, Monday through Friday. All calls received on a Friday or the day before a holiday will be held until the following regular business day.
3 During the installation and up to the date of final acceptance, the Contractor shall protect all finished and unfinished work against damage and loss. In the event of such damage or loss, the Contractor shall replace or repair such work at no cost to the Owner or any other Trade Partnership working on the project.

**3.4** Close-Out Documentation

A Structured Cabling
- Test Result documentation shall be provided in two media, as listed above, one (1) hard copy and one (1) digital copy, within thirty (30) days after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words 'Project Test Documentation', the project name and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) ID, measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
- When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

## END OF SECTION

# 27 0528 – COMMUNICATIONS PATHWAYS

## Part 1 General

**1.1** Statement of Work
- A General
  1. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Underground Ducts and Raceway systems. All systems described herein shall be governed by the Division 26xxxx specifications, should these two documents be in conflict the more stringent shall prevail.
  2. The locations of vaults and pull boxes on the drawings are approximate and reflect the best information available. The Contractor is responsible for locating all existing utilities within the areas to be excavated prior to excavation. Final location of all trenches, communications utility vaults, and pull boxes must be verified and signed off on by the Owner/Owner's Representative.
  3. The contractor shall furnish and install all work necessary to make compete systems, whether or not such details are mentioned in these specifications or shown on the drawings, but which are necessary in order to complete working systems, excepting those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed or supplied by others.

**1.2** References
- A Regulatory References
  1. Contractors will comply with all requirements as specified in Section 27 0000 '1.3. – Regulatory References'.

**1.3** Safety and Indemnity
- A Requirements
  1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

**1.4** Contractor Qualifications
- A Requirements
  1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

**1.5** Quality Assurance
- A Requirements
  1. Contractors shall comply with all requirements as specified in Section 27 0000 '2.3 – Quality Assurance'.

**1.6** Equivalent Products
- A Approved Products
  1. All products described, and part numbers given in this specification are those of Hubbell unless otherwise noted.

B Other Than Approved Products
1 Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 0000 '3.1 Products'.

**1.7** Submittal Documentation
A Requirements
1 The successful contractor shall provide their submittal package in accordance with the Section 27 0000 '3.2 – Submittal Documentation'.

**1.8** Acceptance
A Requirements
1 The contractor shall comply with all requirements as listed in Section 27 0000 '3.3 – Acceptance'.

**1.9** Warranty
A Requirements
1 The contractor shall comply with all requirements as listed in Section 27 0000 '3.4 – Warranty'.

## Part 2 Products

**2.1** Pathways and Fittings

A Surface mount raceway "SMR"
1 Non-metallic raceway is an enclosed pathway used for surface distribution of branch circuit electrical wiring, and cabling for voice, data, multi-media, low voltage, and optical fiber. Raceway is typically installed in existing building structures, or after construction is complete. A complete raceway system includes raceway, covers, mounting hardware, various fittings, and outlet boxes installed at specific locations. Specific codes and standards apply to electrical wires and telecommunications cables that are deployed within non-metallic raceway. Codes that are enforced by the local Authority Having Jurisdiction (AHJ) must be observed during construction.
- Assembly and disassembly of raceway base, cover, and fittings shall require no special tools.
- Installed fittings shall be designed to overlap the raceway junction to cover exposed or uneven edges.
- Security caps shall provide enhanced tamper protection by installing over the assembled raceway in desired locations.
- Raceway shall be designed to accept inline device boxes with either horizontal or vertical faceplate orientations.
- Device boxes shall have a removable knockout portion to permit raceway entry and exit. Device boxes shall serve as an extension box by removing a single knockout.
- Device boxes shall be available in standard NEMA single, double, and 3- gang versions. Device box color shall match raceway color.

- Device boxes shall accommodate various faceplates that accept modular connector inserts or bezels for balanced twisted pair, fiber optic, coaxial, multi-media, and other low voltage cabling connectors.
- Faceplates for device boxes shall accommodate pre-printed labels for proper electrical identification, or telecommunications port identification according to ANSI/TIA/EIA-606-A.
- Faceplates shall be available in colors that match the device box and raceway.
- Category rated communications jacks installed in surface box faceplates shall have provisions for snap-in icons for further identification.

2 Hubbell PP1 System
- **Hubbell PP1 PremisTerak** Latching system raceway is to be used where applicable.

B Cabling Support System

1 Telco Backboards
- Backboards shall be 4’ x 8’ x .75” void free plywood (ACX Plywood with the “A” side turned out).
- The plywood shall be painted with two coats of white fire-retardant paint.
- Cut full size sheet to required size for application type, minimum 6” larger than equipment installed.

2 J-Hooks
- Cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
- Cable supports shall have flared edges to prevent damage while installing cables.
- Cable support system shall provide fasteners that allow them to be mounted to wall, concrete, joist, tee-bar wire, treaded rod, beams and raised floor supports.
- Fasteners shall have the ability to either be factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- Fastener to with one non-continuous cable support, factory or jobsite assembled.
- Color: NA
- Quantity: Contractor will provide quantities of j-hooks and hanger accessories in the amount necessary to support all horizontal cabling every 4-5 feet.
- Part**#:** ERICO CAT425, Cooper B-Line BCH12, BCH21, BCH32, BCH64 and accessories.

C Pull String

- Pull string shall be new 1/8” polypropylene string with a minimum 200 lb. tensile strength.
- Contractor will be required to install a pull string into every conduit that they pull cabling.

**2.2** Passthrough/Sleeves

A General

1 Sleeves shall be 2”, 3” or 4" EMT or smaller. All cables penetrating walls must be sleeved.
2 Sleeves shall maintain a 40% conduit fill ratio.
3 Sleeves must be supported or attached at walls by apparatuses meant to do so. All sleeves shall be rigidly and properly supported.
4 Sleeves must extend past inaccessible areas.
5 Sleeves must be protected by a U.L. rated system at all firewalls designated on the construction drawings.

## Part 3 Execution

### 3.1 General

A Permits and Licensing

1 Contractor is responsible to procure all necessary permits before the commencement of their work to the city or state agencies as required. It is the contractor's responsibility to provide all documentation to the AHJ.

2 Contractor is responsible to procure all necessary licenses for the city or state they are commencing the work in, before the commencement of their work begins.

3 Contractor to procure all encroachment permits as it pertains to the work described in these documents.

4 No person may access or enter in any way, an underground vault or confined space without the training, staff, and safety equipment defined on the confined space permit. Accessing these spaces without a valid permit or without the required support services will be cause for an order to stop work until all violations are resolved and may result in a fine or suspension of the workers involved.

B Safety

1 All federal (OSHA), state, and local safety rules, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to conduct frequent inspections of the job site to ensure compliance.

### 3.2 Installation

A Intra-Building Pathways

1 Communications Vaults

- Site Access
  - The general contractor shall be responsible for providing adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete units.
- Installation
  - Precast concrete units shall be installed to the lines and grades shown in the contract documents or otherwise specified.
  - Precast concrete units shall be lifted by suitable lifting devices at points provided by the precast concrete producer.
  - Precast concrete units shall be installed in accordance with applicable industry standards. Upon request, the precast concrete producer shall provide installation instructions.
  - Field modifications to the product shall relieve the precast producer of liability regardless if such modifications result in the failure of the precast concrete unit.
- Water Tightness
  - Where water tightness is a necessary performance characteristic of the precast concrete unit's end use, watertight joints, pipe-entry connectors and inserts should be used to ensure the integrity of the entire system.

2 Conduit

- All conduit shall be routed parallel or perpendicular to walls.
- All conduit shall be installed in accordance with NEMA "Standard of Installation" and shall meet applicable local and national building and electrical codes or regulations.
- Conduit runs shall not exceed 100 feet or contain more than two 90-degree bends without utilizing appropriately sized pull boxes. No conduits may enter a

pull box at a 90-degree angle. They are not to be installed into the side of a pull box. All conduits must enter the ends of the pull box.

- All conduits entering a building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room. Building entrance conduits shall slope downward away from the building to reduce the potential of water entering the building. All building penetrations are to be sealed from wall to wall and on the outside and inside of the penetrations.
- All conduits penetrating a fire or smoke barrier shall be fully sealed between the conduit and the actual penetration following manufacturer's recommendations. Contractor shall label each fire stop location with the manufacturer's identification number of the product used and shall provide the inspector copies of each products system configuration.
- No communications outlet boxes shall be "daisy-chained." Each communications outlet shall be served by a separate 1-inch (minimum) conduit.
- In rooms with a drop or false ceiling, communications outlets shall be served by a 1-inch conduit stubbed six inches above the false ceiling, angled toward the cable tray or open access area, and be equipped with a compression fitting and plastic bushing. All stubs shall be marked "Comm".
- All conduit shall be equipped with an approved water or barrier seal in building access points.
- No communications conduit shall contain more than 180 degrees of bend without the use of a pull box. Pull boxes must be approved by Engineer of Record to ensure proper sizing and conduit entry placement.
- In areas where hard lid ceilings are in place, all conduits are to run to accessible location or to cable tray.
- Provide labels at both ends of conduits to identify location of far end.

3 Station Cable Support System

- All station cable support systems shall be braced for zone four seismic activity.
- In suspended ceiling and raised floor areas where duct, cable trays, or conduit are not available, station cables shall be bundled with Velcro straps at appropriate distances.
- Velcro straps shall not be over tightened to the point of deforming or crimping the cable sheath.
- Velcro straps shall be UL listed, rated for low smoke, and certified for use in a plenum environment.
- The station cable support system components shall be firmly attached to the existing building structure and installed not more than five feet apart.
- The station cable support system components shall be installed to provide at least three (3) inches of clear vertical space between the cables/optics and the ceiling tiles.
- The station cable support system components shall be spaced to prevent the cables/optics from sagging or buckling.
- No more than eighteen (18) Category 6 cables shall be supported by a J - hook.
- No more than thirty (30) Category 6 cables shall be supported by triangular galvanized metal bracket.
- The station cable support system shall be clearly and neatly labeled per TIA/EIA 606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

4 Raceways

- All dual channel raceway shall be installed with a complete end-to-end channel for future power service installation.
- The raceway shall be stubbed above the false ceiling space and capped so that each section of raceway can be connected to a power service in the future without a requirement to add raceway to visible portions of the system. If no

false ceiling space is available, the power channel is to be stubbed up and capped next to the point at which the communication services enter the room.

5 Pull Boxes
- Pull boxes shall be installed in easily accessible locations.
- Pull boxes installed as part of a horizontal cabling pathway shall be installed immediately above suspended ceilings, where possible.
- Pull boxes shall not be used for splicing cable.
- Pull boxes shall be placed in conduit runs that exceed 100 feet or which require more than two 90-degree bends. The pull boxes shall be located in straight sections of conduit and must not be used for a right-angle bend. Installation shall allow cable to pass through from one conduit to another in a direct line.
- Pull boxes must have a length at least 12 times the diameter of the largest conduit.

**3.3** System Close Out and As-Built Documentation

A Documentation

1 Refer to Section 27 0000 ‘4.5-A – Close Out Documentation’ for requirements.

## END OF SECTION

# SECTION 27 1000

# STRUCTURED CABLING SYSTEM

## Part 1 General

### 1.1 Work Included

A. General

1. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Scope Documentation.
2. This document describes the requirements for the contractors, products and installation relating to furnishing and installing Telecommunications Cabling systems.
3. The Horizontal Cabling System as described in this document consists of cabling, infrastructure, J-hook pathways and termination devices for Data systems.
4. Contractor will provide a bid including all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in this Document. It is the responsibility of the Contractor to provide all material necessary to provide a complete and operable system. If the contractor feels that the system described is incomplete, they must address this in writing to the Owner/Owner's Representative before providing a bid.
5. All questions concerning non-specified product and services will be addressed to the Owner's Representative before Contactor provides a bid. Owner expects that by accepting the Contractor's bid proposal that the Contractor has provided a competent bid for a complete solution.
6. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document.

### 1.2 References

A. Regulatory References

1. Contractors will comply with all requirements as specified in Section 27 0000 '1.3. – Regulatory References'.

### 1.3 Safety and Indemnity

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.1 – Safety and Indemnity'.

### 1.4 Contractor Qualifications

A. Requirements

1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 27 0000 '2.2 – Contractor Qualifications'.

### 1.5 Quality Assurance

A. Requirements

1. Contractors shall comply with all requirements as specified in Section 27 0000 '2.3 – Quality Assurance'.

**1.6** Equivalent Products

A. Approved Products

1. All Products described, and Part Numbers given in this Specification are those of Hubbell unless otherwise noted.

B. Pre-Approved Equals:

1. None

C. Other Than Approved Products

1. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 27 000 '3.1 Products'.

**1.7** Submittal Documentation

A. Requirements

1. The successful contractor shall provide their submittal package in accordance with the Section '01 20 00 – Submittal Schedule' and Section 27 0000 '3.2 – Submittal Documentation'.

**1.8** Acceptance

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.3 – Acceptance'.

**1.9** Warranty

A. Requirements

1. The contractor shall comply with all requirements as listed in Section 27 0000 '3.4 – Warranty'.

**1.10** Technology Clause

A. General Requirements

1. As technology advances, it is understood that improved or enhanced products may supersede existing products in both price and performance and yet be essentially similar. This request for bids seeks to address the rapid advances in technology by allowing functionally similar or identical products that may be introduced in the future, during the term of this bid, to be included under the general umbrella of compatible product lines and are thus specifically included in this bid document.
2. Discontinued or end of life products shall be replaced with an equal product to the original specified product at no additional costs to the owner.

## Part 2 Products

**2.1** Work Area Subsystem

A. General

1. The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:
   - Patch Cords

- Modular Inserts, Jacks and Plugs
- Faceplates

2. Category 6A Wireless Access Points Outlet Patch Cords
   - All category 6A channel patch cords shall be constructed with a snagless boot, made of molded PVC, colored matched to the color of the patch cord cable.
   - All category 6A channel patch cords shall be constructed with category 6A patch cable, 24 AWG, 7/32 tinned copper stranded patch cable, insulated with polyethylene and paired, jacketed with PVC, ETL Verified for ISO 11801, (UL) NEC type CM or CMR, 75º C, Article 800 CSA Type CMG.
   - All category 6A channel patch cords shall be 100% factory tested to pass return loss (RL) and near-end cross talk (NEXT).
   - All category 6A channel patch cords shall be manufactured using a T568-B plug-wiring format.
     - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all Work Area Data Patch Cords.
   - Length:
     - Wi-Fi patch cords will be 3 feet long.
   - Color:
     - Wi-Fi White
   - Quantity
     - Wi-Fi Contractor will provide one (1) patch cable for each Wi-Fi data outlet.
   - Hubbell Premise Part #, or approved equal:
     - Wi-Fi **HCL6AW03**

B. Modular Inserts and Jacks
   1. Category 6 Data/Voice Jack & Camera Termination Plugs
      - Jack will meet the Category 6 Standard.
      - Jacks shall be 8 positions un-keyed
      - Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760" x 580")
      - Jacks shall utilize a 2-layer printed circuit board to control NEXT
      - Jack termination shall follow the industry standard 110 IDC.
      - Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.
      - Jacks shall utilize a paired punch down sequence. Cable pair twists 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.
      - Jacks shall terminate 22-26 AWG stranded or solid conductors.
      - Jacks shall be compatible with single conductor 110 impact termination tools.
      - Jacks shall be compatible with TIA/EIA 606 color code labeling
      - Jacks shall have universal wiring designation.
      - Jacks shall have an attached color-coded wiring instruction label housed between the IDC termination towers.
      - Jacks shall be manufactured in the USA
      - Jacks will be terminated according to theT568B wiring scheme
      - Color:
        - Data/Voice WHITE
        - Camera Factory
      - Quantity: Contractor will provide one jack for every outlet cable shown on the drawings.

- Hubbell Premise Part #, or approved equal.
  - Data/Voice **HXJ6W**
  - Camera **SP6**

2. Category 6A Wireless Access Point Jack
   - Jack will meet the Category 6A Standard.
   - Jacks shall be 8 positions un-keyed
   - Each jack shall be an individually constructed unit and shall snap mount in an industry standard keystone opening (.760" x 580")
   - Jacks shall utilize a 2-layer printed circuit board to control NEXT
   - Jack termination shall follow the industry standard 110 IDC.
   - Jacks shall have a designation indicating Category 6A on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code and an abbreviated catalog number.
   - Jacks shall utilize a paired punch down sequence. Cable pair twists 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.
   - Jacks shall terminate 22-26 AWG stranded or solid conductors.
   - Jacks shall be compatible with single conductor 110 impact termination tools.
   - Jacks shall be compatible with TIA/EIA 606 color code labeling
   - Jacks shall have universal wiring designation.
   - Jacks shall have an attached color-coded wiring instruction label housed between the IDC termination towers.
   - Jacks shall be manufactured in the USA
   - Jacks will be terminated according to theT568B wiring scheme
   - Color:
     - Wi-Fi Purple
   - Quantity: Contractor will provide one jack for every outlet cable shown on the drawings.
   - Hubbell Premise Part #, or approved equal.
     - Wi-Fi **HXJ6W**

C. Wall Mount and Modular Furniture Faceplates
1. Wall Plates
   - Faceplates shall be UL Listed and CSA Certified
   - Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm)
   - Faceplates shall provide for TIA/EIA 606 compliant station labeling
   - Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert
   - Color: WHITE or STAINLESS STEEL.
     - Contractor will field verify and match finish to the existing electrical outlet face plate cover.
   - Quantity: Contractor will provide one single gang faceplate for each outlet shown on the drawings.
   - Hubbell Premise Part #, or approved equal.
     - WHITE
       - **1 Port IFP11W**
       - **2 Port IFP12W**
       - **3 Port IFP13W**
       - **4 Port IFP14W**
       - **6 Port IFP16W**
     - STAINLESS STEEL
       - **1 Port SSFL11**
       - **2 Port SSFL12**

- **3 Port SSFL13**
- **4 Port SSFL14**
- **6 Port SSFL16**

2. Blank Insert
   - Color: Blank Insert to be WHITE –
   - Quantity: Contractor will provide one insert for every unused port in a faceplate.
   - Hubbell Wiring, Part #: **SFBW10**, or approved equal.
3. Wall Phone Plates
   - Faceplate shall be a two-piece design, including a steel base and a stainless-steel cover plate.
   - Faceplates steel base shall incorporate six screw terminals, one 6 position jack and an insulating plastic sleeve.
   - Faceplate shall be equipped with screw studs to be used as the mounts for wall hung telephones.
   - Color: Faceplate to be STAINLESS STEEL
   - Quantity: Contractor will provide one faceplate for each Intercom Handset outlet shown on the drawings.
   - Allen Tel, Part #: **AT630A-6**, or approved equal. Tragic

4. Blank Wall Plates
   - Faceplate shall be constructed from stainless steel.
   - Faceplates shall be UL Listed and CSA Certified
   - Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang.
   - Color: Faceplate to be STAINLESS STEEL
   - Quantity: Contractor will provide one faceplate for each unused data/voice/video/intercom outlet shown on the drawings.
   - Hubbell Wiring Part #: **S13**, or approved equal.

5. Surface Mount Raceway Insert –
   - Inserts for Hubble PB2, PB3, and PS3 Device Mounting Brackets
   - Insert shall allow for two category 6 jacks to be mounted flush.
   - Insert shall match the color of the Raceway installed.
   - Color: Faceplate to be IVORY
   - Quantity: Contractor will provide one 2port insert for each outlet in the Surface Mount Raceway shown on the drawings.
   - Hubbell Part #: **KP2162 or approved equal**.

## **2.2** Horizontal Distribution Cabling

1. The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the Work Area (WA) telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications Room (TR).
   - Cabling Support System
   - Copper Station Cabling
   - Copper Cross-Connect Cabling

### B. Cabling Support System

1. J-Hooks
   - Cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
   - Cable supports shall have flared edges to prevent damage while installing cables.
   - Cable support system shall provide fasteners that allow them to be mounted to wall, concrete, joist, tee-bar wire, treaded rod, beams and raised floor supports.

- Fasteners shall have the ability to either be factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
- Fastener to with one non-continuous cable support, factory or jobsite assembled.
- Color: NA
- Quantity: Contractor will provide quantities of j-hooks and hanger accessories in the amount necessary to support all horizontal cabling every 4-5 feet.
- Part #:
  - ERICO CAT425
  - Cooper B-Line BCH12, BCH21, BCH32, BCH64 and accessories.

C. Copper Station Cable

1. Category 6 Data/Voice, Camera, and Intercom Unshielded Twisted Pair (UTP) Cable
   - Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568-B.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
   - Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
   - The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
   - All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
   - Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
   - Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
   - Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
   - The listed Category 6 cables in this specification are manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell’s Certified Premise Solution also have been pre-approved.
   - Color:
     - Data/Voice BLUE
     - Camera WHITE
     - Intercom YELLOW
   - Quantity: See Drawing for quantity and installation details.
   - Part#:
     - For Riser Application:
       - Data/Voice Hubbell **C6RREB**
       - Camera Hubbell **C6RREW**
       - Intercom Hubbell **C6RREY**
     - For Plenum Application:
       - Data/Voice Hubbell **C6RPEB**
       - Camera Hubbell **C6RPEW**
       - Intercom Hubbell **C6RPEY**
     - For Indoor/Outdoor Application:
       - Data/Voice, Mohawk PN# **M58722** (all cable jackets will be BLACK)

2. Category 6A Wireless Access Point Unshielded Twisted Pair (UTP) Cable

- Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568-B.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
- Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
- The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
- All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- The listed Category 6 cables in this specification are manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell’s Certified Premise Solution also have been pre-approved.
- Color:
  - Wi-Fi BLUE
- Quantity: See Drawing for quantity and installation details.
- Part#:
  - For Riser Application:
    - Wi-Fi Hubbell **C6ASRB**
  - For Plenum Application:
    - Wi-Fi Hubbell **C6ASPB**
  - For Indoor/Outdoor Application:
    - Wi-Fi, Mohawk PN# **M58722** (all cable jackets will be BLACK)

D. Horizontal Copper Cross-Connect Cabling

1. Voice Cross-Connect Cabling
   - Cable shall meet and/or exceed the UL Listed Type CMR and the ANSI/ICEA S-80-576 standard.
   - Core Construction
     - Conductors: Solid-copper conductors, 24 AWG.
     - Insulation: Flame retardant semi-rigid PVC.
     - Core Assembly: Cable core will be made up of 100 pair units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders.
   - Jacket: Gray, flame retardant PVC jacket.
   - Color: Voice cable jacket will be GRAY
   - Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs required for the cross-connect by 1.25 to the nearest 25-pair increment.
   - Part#: Equal to Mohawk Cable:
     - 12 pair = PN# **09-094-02 – Superior Essex**
     - 25 pair = PN# **M58141**
     - 50 pair = PN# **M58522**

- 100 pair = PN# **M585201**

## **2.3** Backbone Cabling

A. General

1. The backbone cabling system is the portion of the telecommunications cabling system that extends from the Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF).
    - Fiber Optic Backbone Cabling
    - Copper Backbone Cabling

B. Fiber Optic Backbone Cabling –

1. Data System Backbone Cabling
    - Cable shall be UL/cUL OFNR/OFN FTA rated and be Flame Resistant in accordance with the UL 1666.
    - Cable shall an indoor/outdoor rated jacket.
    - Cable shall be constructed utilizing a loose tube design.
    - Cable will be fully water blocked combining overall water blocking tape and a moisture blocking gel for each individual tube.
    - Cable will maintain the following:
        - Crush Resistance (EIA-455-41) = 2000 N/cm
        - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
        - Min Bend Radius:
            - Long Term - No Load = 15x Cable diameter
            - Short Term – Load = 20x Cable diameter
        - Operating Temp. = -40°C to +70°C
        - Storage Temp. = -40°C to +80°C
    - Cable shall be constructed of 50/125µ Laser Optimized rated glass capable of:
        - 1 Gigabit Ethernet Link at 1000m/600m (@850nm/1300nm)
        - 10 Gigabit Ethernet Link at 300m/300m (@850nm/1300nm)
    - The Fiber Optic Cable in this specification is manufactured by Mohawk/CDT. All other manufactures eligible for Hubbell's Certified Premise Solution that meet and/or exceed the below specifications have also been pre-approved.
    - Color: Fiber Optic cable jacket will be BLACK
    - Quantity: See Drawing for quantity and installation details.
    - Hubbell Premise Part #:
        - 12 Strand Multi Mode Fiber **HFCD14012R4BK**

C. Copper System Backbone Cabling

1. Voice & Intercom System Backbone Cabling
    - Cable shall meet or exceed those specified in RUS Bulletin 1753F-208 (REA PE-89)
    - Core Construction
        - Conductors: Solid, annealed copper, 24 AWG unless otherwise noted on design documents.
        - Insulation: Dual insulation consisting of an inner layer of foamed polyolefin skin, colored coded in accordance with industry standards
        - Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.
        - Filling Compound: The entire core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.
        - Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
        - Sheath Construction

        - Aluminum Shield: Corrosion protected plastic coated, corrugated 0.008" aluminum tape.
    - Jacket: Black, linear low-density polyethylene.
    - Color: Voice cable jacket will be BLACK
    - Quantity: See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs serving the individual telephone handsets by 1.25 to the nearest 25-pair increment.
    - Part#: Equal to General Cable:
        - 12 pair = PN#**09-094-02 – Superior Essex**
        - 25 pair = PN# **7525758**
        - 50 pair = PN# **7525793**
        - 75 pair = PN# **7525801**
        - 100 pair = PN# **7525819**
        - 200 pair = PN# **7525835**

## **2.4** Telecommunication Room

### A. General Requirements

1. The Telecommunication Room (TR) includes those products that terminate horizontal and backbone cabling subsystems and connect then to the network equipment.
    - Patch Cords
    - Horizontal Cabling Termination Equipment
    - Backbone Cabling Termination Equipment
    - Cabinets, Racks, and Enclosures
    - Cable Support System

### B. Patch Cords

1. Category 6 Data/Voice & Camera TR Patch Cords
    - TR Copper Patch Cords shall comply with those specified in 2.1 Work Area Subsystem, A. Patch Cords, 1. Category 6 Data Outlet Patch Cords
    - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all TR Data and Voice Patch Cords.
    - Color:
        - Data/Voice BLUE
        - Camera RED
    - Quantity: Contractor will provide one patch cord for every data and voice outlet cable shown on the drawings. Contractor will provide the quantity of different length patch cords as follows:
    - Part#:
        - Data/Voice Patch Cords
            - 3-Foot **HCL6B03**
        - Camera Patch Cords
            - 3-Foot **HCL6R03**

2. Category 6A Wireless Access Points TR Patch Cords
    - TR Copper Patch Cords shall comply with those specified in 2.1 Work Area Subsystem, A. Patch Cords, 1. Category 6A Data Outlet Patch Cords
    - All patch cords will be delivered to the site and must be signed for by the Owner/Owner's Representative. It will be the responsibility of other to install all TR Data and Voice Patch Cords.
    - Color:
        - Wi-Fi PURPLE

- Quantity: Contractor will provide one patch cord for every data and voice outlet cable shown on the drawings. Contractor will provide the quantity of different length patch cords as follows:
- Part#:
  - Wi-Fi Patch Cords
    - 3-Foot **HCL6AP03**

3. Fiber Patch Cords
   - Patch Cords shall be a Duplex LC to LC 50/125µm "Laser Optimize" Graded-Index Multimode Fiber Patch Cord.
   - All patch cords shall be factory polished and 100% optically tested for superior performance.
   - Cables shall have a Mated Pair MM Insertion Loss of less than 0.60 dB (0.25 dB Typical).
   - Cable Retention: > 25 pounds
   - All optical, mechanical and environmental performance shall meet and/or exceed the TIAEIA-568-B.3 specifications.
   - Fiber patch cords will be 1-meter long.
   - Color: NA
   - Quantity: Contractor will provide two fiber patch cords for every New fiber optic backbone cable run shown on the drawings.
   - Part#: **DFRCLCLCF1MM**

C. Horizontal Cable Termination Equipment
1. Modular Unloaded Patch Panels (Only 48-Port Patch Panels is Acceptable)
   - Panels shall be made of black anodized aluminum in 24-, 48-, and 96- port configurations.
   - Panels shall have modular jacks employing a tri-plane staggered contact array with a flat "hairpin" contact design made of Beryllium copper with a minimum 50-micro-inch gold plating on contact surfaces over 50-100 micro-inch of nickel compliant with FCC part 68.
   - Panels shall be equipped with 110-style termination made of fire retardant UL 94V0 rated thermoplastic and tin lead solder plated IDC.
   - Panels shall have optional rear cable support bar for strain relief. Cable support bar shall attach to the rear of the patch panel itself without the use of additional fasteners or screws.
   - Panels shall have self-adhesive, clear label holders and white designation labels provided with the panel for each row of 24 ports.
   - Panels shall provide wiring identification & color code and maintain an in-line, paired punch down sequence that does not require the splitting of conductors from individual cable pairs.
   - Panels shall terminate 22-26 AWG solid conductors, maximum insulated conductor outside diameter 0.050".
   - Panels shall be ANSI/TIA/EIA-568-B.1, B.2 and ISO/IEC 11801 category 6 compliant.
   - Panels shall be UL LISTED 1863 and CSA certified.
   - Panels shall be made by an ISO 9002 Certified Manufacturer.
   - Panels installed in a 4-connector channel with a category 6 modular jack, and category 6 patch cords, all from the same manufacturer, and a qualified category 6 cables shall meet or exceed the requirements of Draft 5 of the TIA UTP Systems Task Group PN3727, Category 6 Draft Addendum to the ANSI/TIA/EIA-568-B.2 standard.
   - Color: Patch Panel shall be BLACK
   - Quantity: See Drawing for quantity and installation details. The number of patch panels to be supplied shall be derived by multiplying the number of data/voice

cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 24 port increment.

- Part#:
  - 24 port Category Patch Panel, **HWS14608C**
  - 48 port Category Patch Panel, **HWS14609C**
    - *Provide one Cable Management Bar, PN# **PCBLMGT**, for each 24 ports.

D. Horizontal Voice & Intercom Cross-Connect 66 Wiring Blocks

1. Wall Mount
   - Blocks shall be available in a 25 pair unit.
   - Blocks shall be wall mounted.
   - Wiring blocks shall be available as kits that include the wiring blocks, the proper number of connecting clips, wire management and label strips.
   - Blocks shall be constructed of a UL94 V0 rated polycarbonate blend.
   - Blocks shall be mounted to a rugged 16 ga steel distribution frame. Frame shall support the 66 blocks and allow for a through for cables to be routed through the rear of the blocks directly to the termination point.
   - Blocks shall be UL VERIFIED for TIA/EIA-568-B compliance.
   - Color: NA
   - Quantity: See Drawing for quantity and installation details.
   - Part#: 6 pair block, PN# **HPW66B16**
   - Part#: 25 pair block, PN# **HPW66B425**
   - Accessories to be provided with each installed 66 Block:
     - Mounting Bracket PN# **HPW89D**

E. Backbone Cable Termination Equipment

1. Fiber Optic Cassette
   - ETL Tested per TIA/EIA-568-C.3
   - MM Mated Pair Insertion Loss: <0.5dB (0.35dB typical)
   - Return Loss: <-35dB
   - Operating temperature: 0-70°C
   - Materials:
     - Connector ferrule: Zirconia ceramic
     - Connector body/nut: Nickel plated brass/zinc or polymer
   - Strain relief boot: Flame retardant (UL-Rated 94-V0) polymer
   - Color: Aqua
   - Quantity: See Drawing for quantity and installation details.
   - Part#: **OCLC50G4CVI**

F. Copper Termination Panels

1. Voice 110 Wiring Blocks
2. Wall Mount
   - Blocks shall be available in a 300-pair unit.
   - Blocks shall be wall mounted.
   - Wiring blocks shall be available as kits that include the wiring blocks, the proper number of 5 pair connecting clips, wire management and label strips.
   - Blocks shall be constructed of a UL94 V0 rated polycarbonate blend.
   - Blocks shall be mounted to a rugged 16 ga steel distribution frame. Frame shall support the 110 blocks and allow for a through for cables to be routed through the rear of the blocks directly to the termination point.
   - Blocks shall be UL VERIFIED for TIA/EIA-568-B compliance.
   - Color: NA
   - Quantity: See Drawing for quantity and installation details. The number of 110 blocks to be supplied shall be derived by multiplying the number of

voice/intercom cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 300 pair block increment.
- Part#: 300 pair block, PN# **110WMK**

3. OSP Protection Panels
   - 110 connector input and output
   - wall or frame mountable
   - designed with an internal splice chamber and cover over incoming and outgoing connections and protection modules
   - stackable to allow for future service expansion
   - equipped with an internal fuse link
   - external ground connectors accept 6-14 AWG ground wire
   - accommodates industry standard 5 pin protection modules
   - designed to exceed the requirements set forth in Underwriters Laboratory's UL497
   - Color: NA
   - Quantity: One protection panel will be installed per IDF home run to the MDF. Protection panels are not required at the IDF side of the cable run.
4. Part#: Circa Enterprise inc. –
   25 pair block, PN# **1880ECA1-25**
   50 pair block, PN# **1880ECA1-50**
   100 pair block, PN# **1880ECA1-100**

G. Fiber Termination Panels
1. MDF Rack Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16 ga. steel with a black powder paint finish and provide for fully enclosed fiber patching and termination.
   - Panels shall have a removable smoked Plexiglas front cover with optional lock kit. The panel shall have a removable top, front and rear covers. The panel adapter tray shall be removable from the front of the panel by sliding the tray forward. Panels shall come with rack mounting brackets that allow it to be mounted with the front cover flush with the front of the rack, or with the front of the panel extended 5.0" in front of the rack.
   - Panels shall be 2 rack spaces, accepting 9 adapter panels.
   - Adapter panels shall be available with SC multimode adapters. Adapter shall have a zirconia alignment sleeve.
   - Panel shall have a splice tray mounting stud incorporated into the base for mounting of mechanical or fusion splice trays. Adapter tray shall have cable management anchor points and come with cable anchors allowing for the maintenance of the incoming cable with the proper minimum bend radius.
   - Panels shall have four cable entrance ports on the top and 2 on the bottom, which are covered by knock outs. Panels shall have two jumper ports in the bottom at the front of the panel with plastic dust covers for routing of jumpers.
   - Color: Fiber Panel will be BLACK
   - Quantity: See Drawing for quantity and installation details.
   - Hubbell Premise Part #, or approved equal:
     - 4U Rack Mount Panel **FCR4U15SPL**
     - Insert Panels
       - Blanks **FSPB**

2. IDF Rack Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16-gauge steel with a black powder paint finish.
   - The panel shall have a hinged swing-out fiber drawer. Panels shall come with rack mounting brackets that allow it to be mounted on a 19" or 23" rack. Panel shall occupy no more than one rack space.

- Panel shall be constructed to accept up to 3 adaptor panels.
- Panels shall have cable entrance points in the rear, which are covered by knock-outs
- Color: Fiber Panel will be BLACK
- Quantity: See Drawing for quantity and installation details.
- Hubbell Premise Part #, or approved equal:
  - Rack Mount Panel
    - 1U Rack Mount Panel **FCR1U3SPL**
  - Insert Panels
    - Blanks **FSPB**

3. IDF Wall Mount Fiber Panel
   - Panels shall be constructed of cold rolled 16-gauge steel with a black powder paint finish.
   - Panel shall be constructed to accept up to 1 adaptor panels.
   - Color: Fiber Panel will be BLACK
   - Quantity: See Drawing for quantity and installation details.
   - Corning Cabling System Part #, or approved equal:
     - Wall Mount Panel
       - Single Panel Housing **SPH-01P**

H. Cabinets, Racks, and Enclosures
1. Contractor will provide the following 'MDF/IDF' Cabinets, Racks, Enclosures and components based on the number of cables to that will be terminated:

1. Floor Mount Cabinets
   - Width: 750.0mm 29.52" (19" EIA)
   - Height: 1991.0mm 78.38" (42 RMU)
   - Depth: 39"
   - **Color:** Floor Mount Cabinet will be or **BLACK**
   - **Quantity:** See Drawing for quantity and installation details.
   - **Part#:**
     Floor Mount Cabinet
     AR3150 NetShelter SX 42U
     - Contractor to provide 3 for MDF

2. Floor Mount 2-post Racks
   - Overall dimensions of 86.0"H x 29.1" W x 18.6" D
   - Provides 45U x 19" W of mounting space
   - Channel or Trough Depth 3"
   - Rack shall provide High-density cable management fins provide an integrated vertical pathway for premise cabling and facilitate adherence to bend radius requirements
   - Features EIA-310-D, Universal spacing, threaded #12-24 mounting holes
   - Frame components are aluminum, while cable rings are an engineered polymer
   - Finished with black, powder coat paint
   - Supports 1,000 lb. [110 lb. maximum. per cable fin]
   - Color: BLACK
   - Quantity: See Drawing for quantity and installation details.
   - Part #'s:
     - 2-Post Rack **HPW84RR19**
     - Vertical Management **VM820**
3. Wall-Mounted Cabinets
   - Wall-mounted cabinets shall be manufactured from steel sheet.

- Each cabinet will have a rear panel that attaches to the wall, a hinged cabinet body that swings open from the rear panel providing easy access to the rear of equipment and a locking front door.
- The rear panel will provide cable access with pre-punched knockouts, up to 3", for conduit along the top and bottom edges of the panel. There will also be cutouts in the back of the rear panel so that cables can enter the panel through the wall. The rear panel will provide attachment points for accessory equipment mounting brackets and cable tie points within the panel (cabinet).
- The cabinet body will include a single pair of vertical 19" EIA equipment mounting rails. The mounting rails will be EIA-310-D compliant with the Universal hole pattern. Mounting holes will have #12-24 threads.
- Mounting rails will be adjustable in depth so that they can be positioned at any point within the cabinet body. The design of all cabinets will allow an additional pair of mounting rails (for a total of two pairs of mounting rails per cabinet) to be added to the cabinet.
- The wall-mount cabinet shall provide a hinge design that attaches the cabinet body and the rear panel and allow the rear panel to be removed during installation. The hinge design will allow the cabinet body to open at least 90°. The hasp used to secure the rear panel and the cabinet body together will assist in drawing the components together during the locking action.
- The cabinet body will include vents that are designed to accept fan kits.
- The front door will be hinged and locking. The front door and rear panel will be keyed alike. The front door will have rounded edges and corners. The cabinet body will allow the front door to be attached so that it will swing open from the right or left. The cabinet manufacture shall provide an option for a solid or a tinted plexi-glass window front door. The plexi-glass in doors shall be bronze acrylic (not clear) with a UL flammability classification of 94HB or better.
- Finish shall be epoxy-polyester hybrid powder coat (paint).
- The cabinet shall have the option of being delivered fully assembled. All cabinets will include installation hardware (hex lag screws) for wood studs and 50 each #12-24 equipment mounting screws.
- Load bearing capacity for cabinets that wall-mount will be a minimum of 200 pounds per cabinet.
- Cabinets that are wall-mount only will be certified and UL Listed to standard UL 60950 under category NWIN.
- Color: Wall Mount Cabinet will be White
- Quantity: See Drawing for size, quantity and installation details.
- Part#:
  - **Hubbell RE4X**
  - **Great Lakes GL24WE-B-0**
  - **Great Lakes GL48WMCMM-B-SH-AF-CM**
  - **11900-724 Chatsworth Cube-it**

  - Accessories to be provided with each installed cabinet:
    - Sound Dampening Kit **REKS**
    - Fan Kit **REKF**
    - Fan Filter Kit **REKFF**

I. Telco Backboards
1. Backboards shall be 4' x 8' x .75" void free plywood (ACX Plywood with the "A" side turned out).
2. Sheets shall be but to size for the application intended.
3. The plywood shall be painted with two coats of white fire-retardant paint.
   - Flame Stop III paint additive ASTM E-84, NFPA 255, UL 723

- Add one pint of Flame Stop III and one pint of water to one gallon of latex-based paint.

## Part 3 Execution

### 3.1 Installation

A. Work Area Outlets Installation

1. No more than 12” of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
2. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
3. The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
4. All UTP cables shall have no more than 12.7mm (½ inch) of pair untwist at the termination point.
5. Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
6. Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position left of the data jack.
7. Video jacks, unless otherwise noted in drawings, shall occupy the bottom position(s) on the faceplate. Video jacks in horizontally oriented faceplates shall occupy the position left of the data/voice jack.
8. All faceplates installed shall be level.
9. All outlets will be labeled according to the approved labeling scheme.
10. Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
11. Cables shall be identified by a self-adhesive label in accordance with the Identification and Labeling section of this specification and ANSI/TIA/EIA-606. The cable label shall be applied to the cable no further than 6” behind termination module, behind the faceplate on a section of cable that can be accessed by removing the cover plate.

B. Horizontal Distribution Cable Installation

1. Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices.
2. Tie Wraps will not be allowed for supporting, bundling and/or dressing of any station cables on this project.
3. Contractor will provide a three foot “service loop” for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
4. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in all “common” conduit runs. “Common” Conduit Runs are those that house more than one cable or set of cables that do not specifically feed a Work Station Outlet. Examples of “Common” Conduit Runs are: floor/ceiling penetrations, stub-throughs, distribution conduits, all conduits between J-boxes, etc.
5. Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
6. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
7. The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.

8. Pulling tension on 4-pair UTP cables shall not exceed 25-lb for a four-pair UTP cable.
9. The Cable Support System shall be installed in such away that will allow for future cables to be added and to provide sufficient protection of all cable.
10. For all installs where station cables are not installed in a continuous conduit run the following guidelines will apply. The Contractor will be responsible to reinstall all cables and pathways that do not meet with the following at no additional cost to the Owner:
11. J-hooks shall be installed to support all station cables every 4ft to 5ft.
12. All pathways shall be run at right angles. No diagonal pathways will be allowed unless otherwise noted on the drawings.
13. Horizontal cables shall be bundled in groups of no more than 25 cables per Cooper B-Line's BCH21 J-hook, no more than 40 cables per Cooper B-Line's BCH32 J-hook, and no more than 64 cables per Cooper B-Line's BCH64 J-hook.
14. At no point shall cable(s) rest on acoustic ceiling grids, acoustic panels, or lighting fixtures.
15. All cables will be installed so that there is a minimum of 3" of clearance above all ceiling grid and tiles.
16. All cables will be installed so that there is a minimum of 12" of clearance above all florescent lighting.
17. All cables will be installed so that there is a minimum of 6" of clearance from all fire alarm and electrical system conduits.
18. Cables shall not be attached to the ceiling grid or lighting fixture wires. The contractor will provide their own carriers wires to support their horizontal cabling.
19. All cables shall be installed above fire-sprinkler systems and plumbing system fixtures and devises. Cables shall not be attached to or supported by these fixtures and/or their ancillary equipment or hardware.
20. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
21. Contractor is responsible for sealing around all cables that penetrate fire rated barriers.
22. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

C. Horizontal Cross-Connect Installation
1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A standard, manufacturer's recommendations and best industry practices.
2. The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
3. All UTP cables shall have no more than 12.7mm (½ inch) of pair untwist at the termination point.
4. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
5. All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Contractor will use Velcro strip to bundle cables together. The use of Tie –Wraps is not permitted.
6. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

D. Backbone Cable Installation
1. Backbone cables shall be installed separately from horizontal distribution cables.

2. Where possible the backbone and horizontal cables shall be installed in separate conduits.
3. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
4. Pulling tension on Backbone cables shall not exceed the manufacture's limitations.
5. The minimum bend radius for all Backbone cables is 16 times the cable diameter or the manufactures specification, whichever is greater.
6. All OSP cables may not penetrate more than 50ft into the buildings before be terminated or splices to cable with a fire resistant jacket, unless the jacket is indoor/outdoor rated.
7. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
8. A pull cord (nylon; 1/8" minimum) shall be installed with all empty OSP and Entrance Facility conduit.
9. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
10. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
11. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
12. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

E. Backbone Cross-Connect Installation
1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A document, manufacturer's recommendations and best industry practices.
2. Bend radius of the cable in the termination area shall not exceed 16 times the outside diameter of the cable.
3. All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks.
4. Contractor will provide a minimum of a 3 foot "service loop" for each backbone cable before terminating to allow future rearrangement. Cables will be coiled and secured above the ceiling where possible or to the Telco Backboard where entrance point is from the floor.
5. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.
6. Contractor shall provide a machine label 1ft. to 2ft. from the entrance point of the TR and 6in. to 12in. from the termination point on each backbone cable. Cable shall be easily identified and fully legible without removing the bundle support ties.

F. Cabinets, Racks, Enclosures and Ladder Rack Installation
1. Wall Mount Racks/Cabinets shall be securely attached to the Telco Backboard using minimum 3/8" hardware or as required by local codes.
2. Floor Mount Racks/Cabinets shall be securely attached to the concrete floor using minimum 3/8" drop-in anchor hardware or as required by local codes.
3. All Floor Mount Racks/Cabinets will be either; secured on one side to the wall or attached to the closest wall with ladder rack.
4. All Racks/Cabinets shall be braced to meet Zone 4 seismic requirements.
5. Contractor will maintain a minimum of 36 inches of clearance from the front of the all rack/cabinets and all other obstructions.
6. Floor Mount Racks/Cabinets shall be installed to allow for a minimum of 36" from rear and all other obstructions.
7. All racks shall be grounded to the telecommunications ground bus bar.

8. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
9. The plywood bottom edge shall be mounted vertically no less than 12” above the finished floor.
10. Contractor will provide all cutouts for the Electrical Contractors expansion rings and electric receptacles as shown on the drawings.
11. Ladder Rack must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
12. Ladder rack shall be installed so that there is a minimum of 8” of unobstructed clearance above rack.
13. Ladder Rack shall be installed so that there is a minimum of 12” of clearance from all: florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.

## **3.2** Identification and Labeling

### A. General Requirements

1. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor.
2. The approved system will comply with the TIA/EIA -606-A Class 2 designations and include at a minimum, identifiers for all major components of the system: telecommunication rooms, grounding bus bars, racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
3. All label printing will be machine generated or hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
4. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

## **3.3** Testing and Acceptance

### A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-A Addendum 5, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Manufacturer’s Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
3. Contractor will notify the Owner/Owner’s Representative 72 hours before commencement of testing.
4. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 10% witnessed “spot testing” of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the “spot test” Contractor will retest the entire cable plant at no additional cost.

B. Copper Cable Testing
   1. Twisted Pair Cable
      - All twisted-pair copper cable links (including backbone cables) shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below.
      - Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
      - Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
   2. Category 6 Performance
      - Follow the Standards requirements established in:
        - ANSI/TIA/EIA-568-A -TSB-67
        - Wire Map
        - Length
        - Attenuation
        - NEXT (Near end crosstalk)
        - □ ANSI/TIA/EIA-568-A -TSB-95
        - Return Loss
        - ELFEXT Loss
        - Propagation Delay
        - Delay skew
        - □ ANSI/TIA/EIA-568-A, Amendment 5.
        - PSNEXT (Power sum near-end crosstalk loss)
        - PSELFEXT (Power sum equal level far-end crosstalk loss)
      - A Level III or better test unit is required to verify category 6 performances and must be updated to include the requirements of TSB-95 and Amendment 5. Testers will be equal to Fluke Network's DXT CableAnalyzer™ Series.
      - All testers shall have been recalibrated with 6 months of use on this project. Contractor will be asked to provide proof of recalibration.
      - Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The approved Level Three tester shall provide a printed document for each test that is also available in a downloadable file using an application from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable.

C. Fiber Optic Cable Testing
   1. 50/125µ Backbone Fiber
      - Each fiber strand shall be tested for attenuation with an Optical Power Meter and light source and with an Optical Time Domain Reflectometer (OTDR) for actual length and splice/connector loss. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
      - All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF. The results of OTDR testing to define the length of each riser

cable shall be documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM, A to B, B to A, and OSPL (OSPL is defined as La + Lb). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss. Tests shall be conducted using ANSI/EIA/TIA/EIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1.The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.

- Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
- All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
- Fiber optic riser and station cable test results shall be provided in electronic format to the Owner.

**3.4** System Closeout and As-built Documentation

A. General Requirements

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
2. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
3. The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
4. Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on disk within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
5. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.

6. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
7. The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
8. Contractor will provide one laminated 11”x17” drawing at each IDF that includes the building layout for that IDF, along with the outlet locations and all of the approved labeling.

## END OF SECTION


# INSTALLATION METHODS AND REQUIREMENTS FOR AUDIO/VIDEO EQUIPMENT

Revised 10/2024

# INSTALLING OF A SMART BOARD IQ, LCD, AND WALL CONNECTION DEVICE.

**Smart Board IQ / LCD Display**

Mounting bracket:

Unless otherwise approved by the district, a Premier Mounts low profile or articulating wall mount with a correct weight tolerance per the display being installed must be used.

Unless otherwise approved by the district, the Premier Mounts universal rectangular washer is required to be installed at each M screw position in relation to the securement of the Smart Board IQ or LCD to the bracket.

The low profile wall mounted bracket is required to be secured to three studs. In absence of a third wall stud Toggle Anchors with a minimum of a 200 pound load tolerance will be required. The wall mount bracket is required to be installed with six of the appropriate lags.

The articulating wall mount bracket is required to be secured to two studs. In the absence of a second wall stud Toggle Anchors with a minimum of a 200 pound load tolerance will be required. The wall mount bracket is required to be installed with four of the appropriate lags.

Wood Studs:

When securing to a wood stud the installation requirements are 3” 5/16” wood lags with the appropriate flat standard washer.

Metal Studs:

When securing to a metal stud the installation requirements are #12 3”metal self-tapping lag with the appropriate flat standard washer.

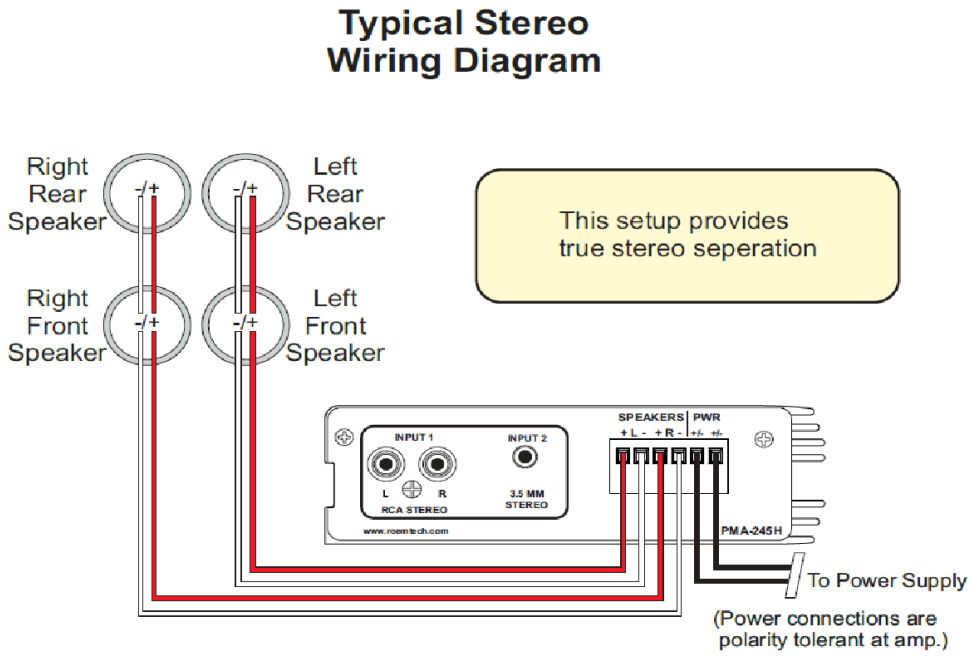
Concrete Wall

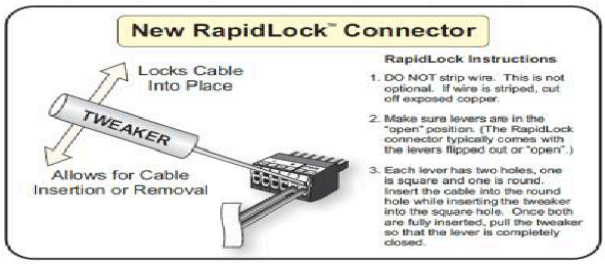
When securing to a concrete wall the installation requirements are 3’ X 3/8” Red Head Wedge Anchor with the appropriate flat standard washer.

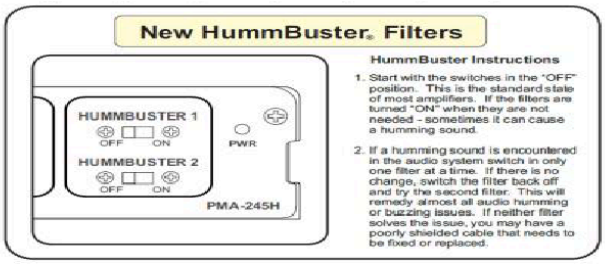
**Wall Connection Device**

1. Unless otherwise approved by the district, all wall connection devices in relation to the connection for the Smart Board or LCD will be at the standard duplex height in relation to the classroom.
2. Connection devices are required to be installed near or next to existing data ports.
3. Unless otherwise approved by the district, all connection devices will be required to be installed on the same teaching wall as the Smart Board or LCD.
4. Unless otherwise approved by the district, all wall connection devices need to have a protective device cover installed. All covers must be approved by the district.

# Installing Classroom Amplifier (typical)



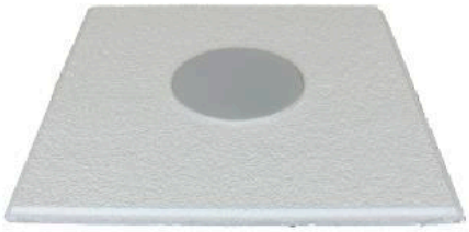




When installing a classroom amplifier, install the AMP below the IQ Smart Board / LCD shroud, above the ceiling tile or behind the LCD. The preferred method of installation for the district is behind the shroud. The AMP is required to be secured with two of the appropriate screws for the wall surface using the two notches located on the sides of the AMP. The power brick will be required to be secured to the wall surface with industrial grade 1 ½" Velcro with a minimum of a ten pound tolerance load. When Velcro is used, the portion that is attached to the wall surface will be required to be secured with the appropriate screws.

# Ceiling Speaker Installation Guide

Pictures of finished installation

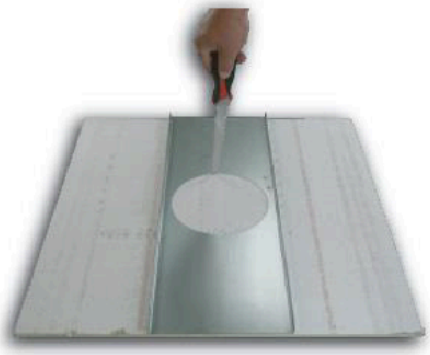


Front/grill side

Rear/speaker can side

**STEP 1** - Place the ceiling tile face down on a clean surface.

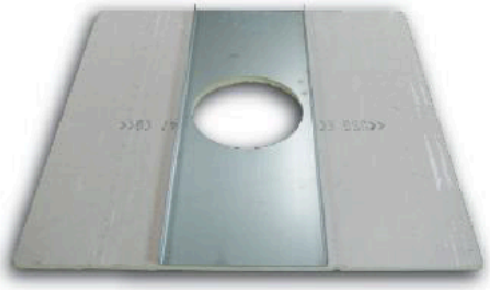
**STEP 2** - Measure across the tile to find the exact center. Place the tile brige on the back of the tile and align the tile bridge so that it is centered on the tile.



**STEP 3** - Use the tile bridge as a template to trace the outline for the hole to be cut in the tile.

**STEP 4** - Remove the tile bridge and use a roto tool, keyhole saw, or saber saw to cut the hole in the tile.

**STEP 5** - Place the tile bridge on the tile and align it with the hole.



**STEP 6** - While holding the tile bridge to the back of the tile, turn the tile and bridge over and place it so the sides are supported while allowing an opening for the speaker to be placed into the hole. A cardboard box or trash bin can be used to support the tile.

**STEP 7** - Lower the speaker into the hole. The photo shows the speaker being lowered from the side for clarity.

Front view of a properly installed speaker with its grill in place.

Rear view of a properly mounted speaker with tile bridge. Note three of the speaker clamps are visible.

**STEP 8**- Release the 4 speaker clamps so they are firmly holding the speaker to the tile, with a twist and drop motion.


**STEP 9** - Drop the speaker wire down from the empty tile hole in the ceiling and connect it to the speaker. Remove the insulation from the end of the wires. While pushing the plastic tab to open the terminal insert the bare wire into the terminal hole and release the tab. Connect the red wire to the red terminal and the black wire to the black terminal.

Add your safety wire to this attachment point, as required by local code. Safety wire will support the entire speaker and tile bridge assembly.



**STEP 10** - Gently place the speaker/tile assembly into the ceiling.

# Installation Requirements

Ceiling Speaker Installations:

1. Each speaker must be secured with the provided manufacturer tile bridge assembly and a contractor provided seismic safety cable with a minimum of a 3 pound load tolerance at the attachment point on each ceiling speaker.

   Wood Rafter

   When anchoring the safety cable to the closest wood rafter to the ceiling speaker, a ¼" X 3" Acoustical Eye Lag is required.

   Metal Rafter

   When anchoring the safety cable to the closest metal rafter to the ceiling speaker, a ¼" X 2" Self Tapping Acoustical Eye Lag is required.

2. The preferred placement of ceiling speakers is a four position pattern that encompasses the student area of the classroom without creating an excessive overlap or dead zone.
3. The preferred placement of ceiling speakers within the ceiling tile is directly center and must mirror the same placement as the adjoining speaker. If the pathway of the speaker is blocked, the speaker can be installed in a half tile pattern.

Wall Speaker Installations:

1. The installation of the raceway must reflect a "T" pattern, each wall speaker is required to be 3ft from the center of the raceway main pathway leading up from the Smart Board or LCD Display.
2. Each wall speaker is required to be installed at 58 ½" from the bottom of the Smart Board or Display, unless otherwise approved by the district.
3. The provided manufacturer wall speaker bracket is required to be installed horizontally and secured in two separate positions within the bracket.

   Drywall / Tact Board Wall:

   When securing to a drywall or tact board wall, a wall anchor with a minimum of a 20 pound load tolerance is required. Depending on the size of the appropriate screw to the anchor a standard flat washer will be required.

Wood Wall:

When securing to a plywood or plywood backed wall, a #8 X 1-¼" or #8 X 1-5/8" wood screw with the appropriate standard flat washer will be required.

Surface Mounted Raceway:

1. The path of the raceway must be clear of any obstruction, including any existing raceway and cannot be installed over any décor.
2. Surface mounted raceway that is installed on a non-concrete or brick wall will be secured with #8 X 1 5/8" or #8 X 1 ¼" wood screws and will not be secured with any adhesive backing.
3. When raceway is installed on a concrete or brick wall, it will be secured with concrete anchors and screws. Adhesive raceway backing may be used during the installation.

Drop Ceiling Installations:

1. Unless otherwise noted the preferred installation pathway of cabling will be from the Smart Board IQ or LCD up through the drop ceiling tile and back down through a drop ceiling tile that is near a teacher's computer station location.
2. "J Hooks" will be used at each entrance through the ceiling tile and at the appropriate locations to ensure that the cabling is not touching or resting on other ceiling tiles or electrical lines.
3. Cabling for the Smart Board, LCD and Speakers cannot be intertwined with any existing cables, conduits or be laying on fluorescent light panels.
4. Unless otherwise approved by the district, entrance fittings are required to be installed at each breach of the ceiling tile in relation to raceway pathways.
5. Service Loops of the cabling are required above each breach of the ceiling tile or installed equipment.

Hard Cap Ceiling Installations:

1. The preferred installation pathway of cabling will be from under the Smart Board or LCD to the teacher's location.
2. The installation of the raceway must reflect an "L" pattern to the appropriate drop location.
3. In relation to the Smart Board or Display any excess cabling must be secured to the wall behind the unit that does not affect the mounting location or securement of the unit.

Placement / Cabling Installations:

1. The placement of the Smart Board IQ / LCD unless otherwise approved by the District will always be center of the front teaching wall. If an object IE: a White Board or pull down screen is blocking the pathway, the contractor will be required to remove the object and place it in the rear of the room.
2. To allow proper ease of cable management, the shroud will be required to be notched in a manner that is not visible from the front of the Smart Board IQ. Installation of a section of Hubbell PL1ABC7 wil need to be installed below the center of the Smart Board IQ unit that will clear from behind the unit and into the shroud will be required. All cabling from the Smart Board IQ into the shroud will be required to pass through the raceway section.
3. In relation to a Smart Board IQ with a lower shroud, any excess cabling must be secured to the wall below the unit that does not affect the mounting location or securement of the unit and must be concealed from view with the placement of the shroud. The following items can be used as cable management: Nylon mounting zip ties, Velcro strips or B-Line / Eaton BCH21 “J Hook”.
4. Unless otherwise approved by the district, the termination of LAN to the Smart Board IQ will be required to be terminated to a RJ45 CAT6 punch down jack in the shroud area. A provided CAT6 Patch Cable will be required to complete the connection from the modular jack to the Smart Board IQ LAN Port.
5. Unless otherwise approved by the district, two space differentials are required for the securement of the HDBaseT Receiver located under the shroud. The following items can be used as a space differential: 5/16 stainless steel nuts, Nylon mounting holes from a zip tie or a Premier Mount universal spacer.
6. All cable management will be required to be “clean” to aid in identification of cabling.
7. Unless otherwise approved when installing a power strip or power brick behind the shroud, securement of the device is required to be attached to the wall surface with industrial grade 1 ½” Velcro with a minimum of a ten pound tolerance load. When Velcro is used, the portion that is attached to the wall surface will be required to be secured with the appropriate screws.

Hubbell Raceway Systems:

1. Unless otherwise approved by the district, only Hubbell Poly Track Non-metallic Raceway is approved for installation of the Smart Board or LCD cabling. Refer to Installation Scope of each job for approved raceway systems.

General Housekeeping:

1. After each installation is complete the work area will be required to be free of any associated hardware, material packaging and dust or debris.
2. The floors that were in the immediate area of installation are required to be vacuumed to ensure that all hazards have been removed.

Installation Heights:

Unless otherwise approved by the district, see installation heights listed below.

| Grade Level | Height in Inches |
|---|---|
| T-K<br>Kindergarten<br>Special Ed Grade Levels 1st through 2nd<br>1st through 2nd | 32” To the bottom of the Smart Board IQ or LCD to the finish floor. |
| Special Ed Grade Levels 3rd through 8th<br>3rd through 8th | 36” To the bottom of the Smart Board IQ or LCD to the finish floor. |
| Parent Resource Centers<br>Library<br>Conference Room | 40” To the bottom of the Smart Board IQ or LCD to the finish floor. |

Installation of Cabling and Modules Below the Shroud:

Below the Smart Board IQ the wall area is to be sectioned into a quadrant for cable management and quick cable and module identification. IE: Audio, Receiver, Power, LAN.

Unless otherwise approved by the district a 6" clearance space will be required from the outside edge of the Smart Board IQ to the inside module placement. No equipment, cabling or hardware can be installed in the clearance area.

Unless otherwise approved, two CAT6 LAN cables will be required to be installed below the shroud, both lines are to be terminated to a CAT6 punch down jack.

A. Installation of one 7' CAT6 Patch Cable from one of the terminated jacks to the input LAN port on the Smart Board IQ is required.

Unless otherwise approved the Roemtech 45+ amplifier is to be installed directly to the wall surface with the appropriate screws. A service 16/2 speaker cable loop is required to be installed near the receiver.

A. When installing the 3.5mm cable from the receiver to the Smart Board IQ, install one 15' 3.5mm stereo cable from the 3.5mm input port on the amplifier to the output port on the Smart Board IQ.
B. Unless otherwise approved the output volume level is required to be set at a ¾ output volume level.
C. The "Hum Buster " ground loop isolator is required to be activated on the output port that is connected to the 3.5mm stereo cable.

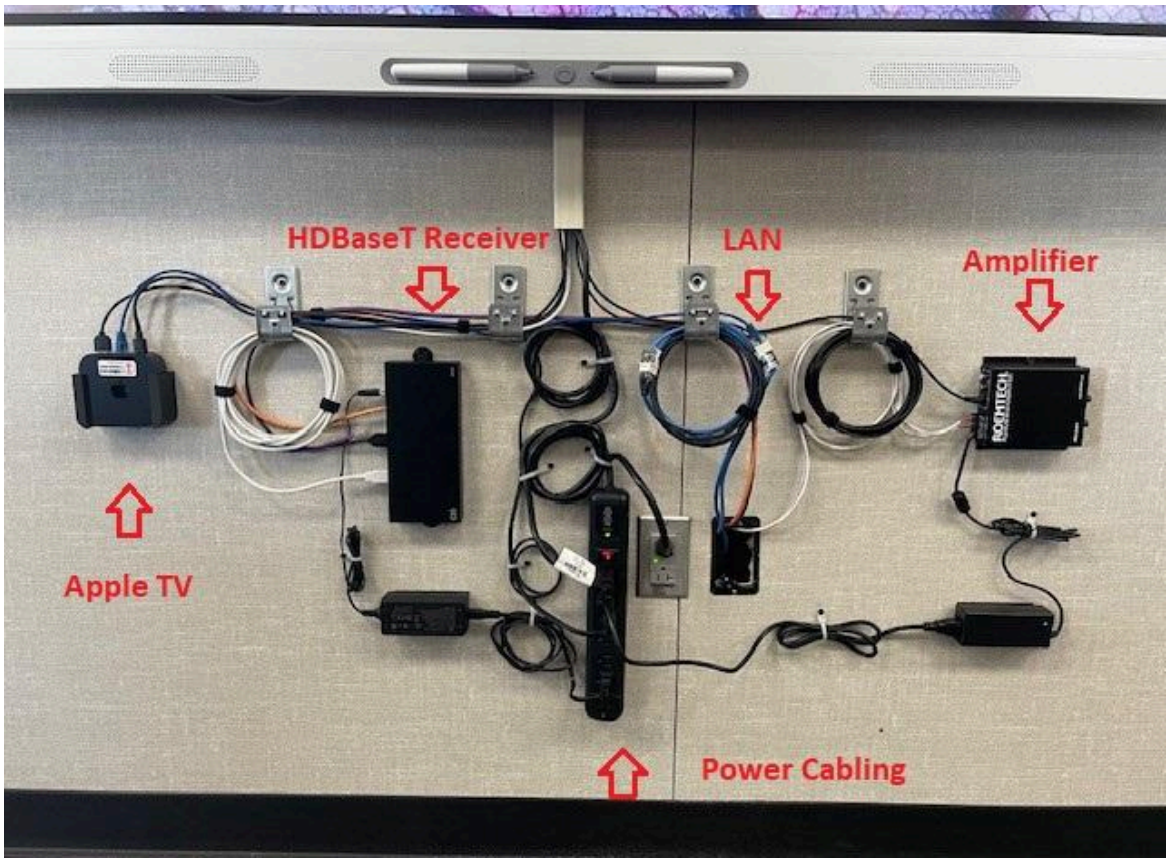
At no time can the exhaust ports located on the sides of the HDBaseT receiver be blocked by any module. IE: Power brick, Amplifier, Apple TV.

A. When installing the HDMI cabling from the receiver to the Smart Board IQ, install one 6' HDMI cable from the output HDMI port on the module to the HDMI input port #2 on the IQ.
B. When installing the USB cabling from the receiver to the Smart Board IQ, unless otherwise specified the district standard USB cables are a 2.0 A/B 5m, 3m or 3.0 A/B. Install one of the specified USB cables from the 1.4 output USB port on the module to the HDMI input port #2 on the IQ.
C. When installing the CAT6 to the HDBaseT receiver a service loop of the primary (orange) and secondary (purple) CAT6 will be required. Both lines are required to be terminated to a RJ45 modular crimp jack.

6. When applicable the Apple TV module will be required to be attached to the wall with the appropriate wall mount and screws.

A. When installing the HDMI cabling from the Apple TV to the Smart Board IQ, install one 6’ HDMI cable from the output HDMi port on the module to the HDMI input port #1 on the IQ.
B. When installing the CAT6 patch cable from the Apple TV to the terminated CAT6 punch down jack, install one 3’ CAT6 patch cable from the input port on the Apple TV to the secondary CAT6 punch down jack LAN.

# INSTALLATION EXAMPLES (typical)



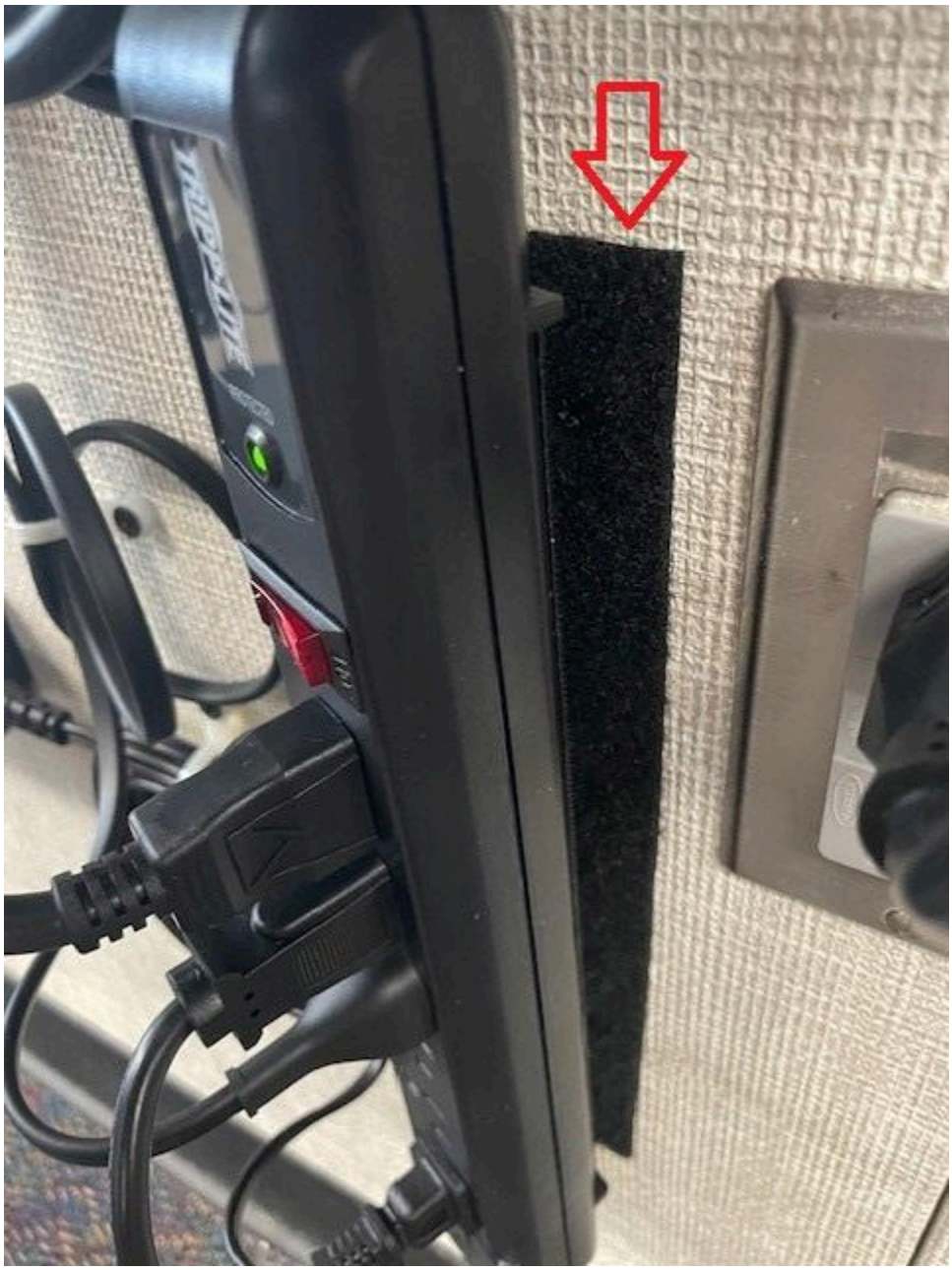

Typical layout of modules and cabling below the shroud.

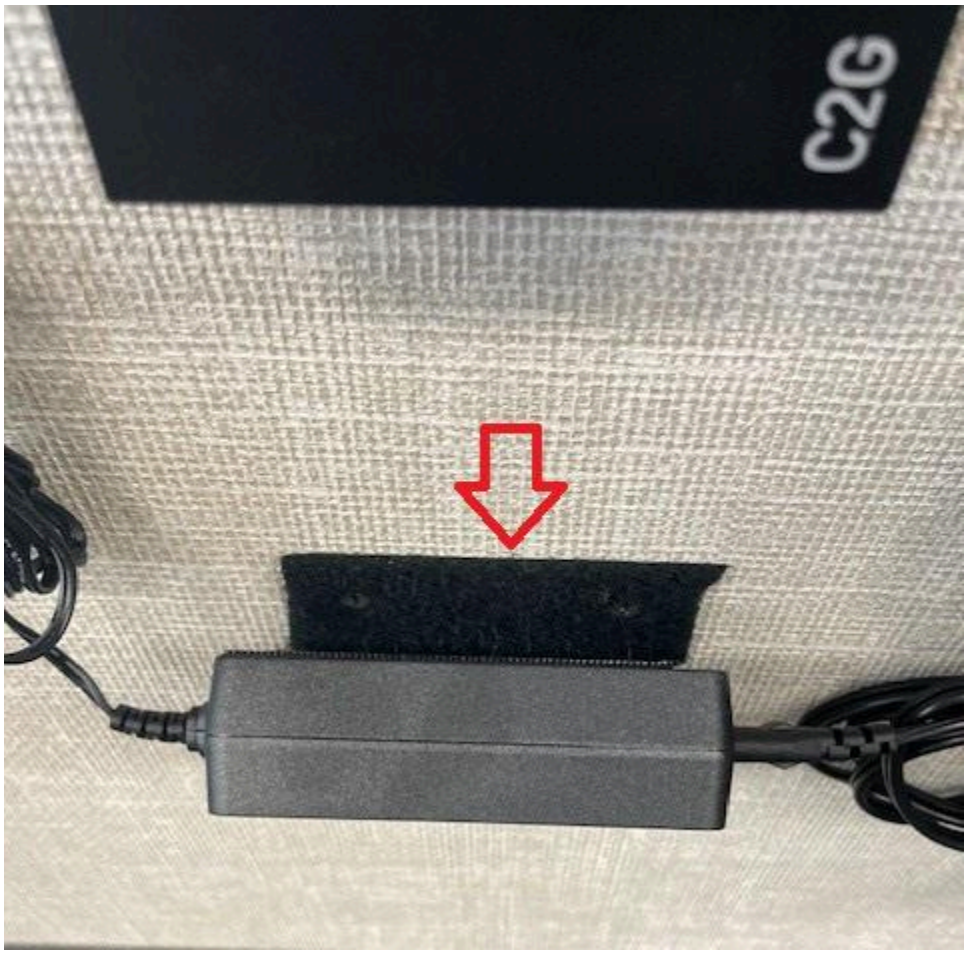

Placement of spacer to allow the receiver to exhaust heat.


The Amplifier is set to ¾ on the output audio level.

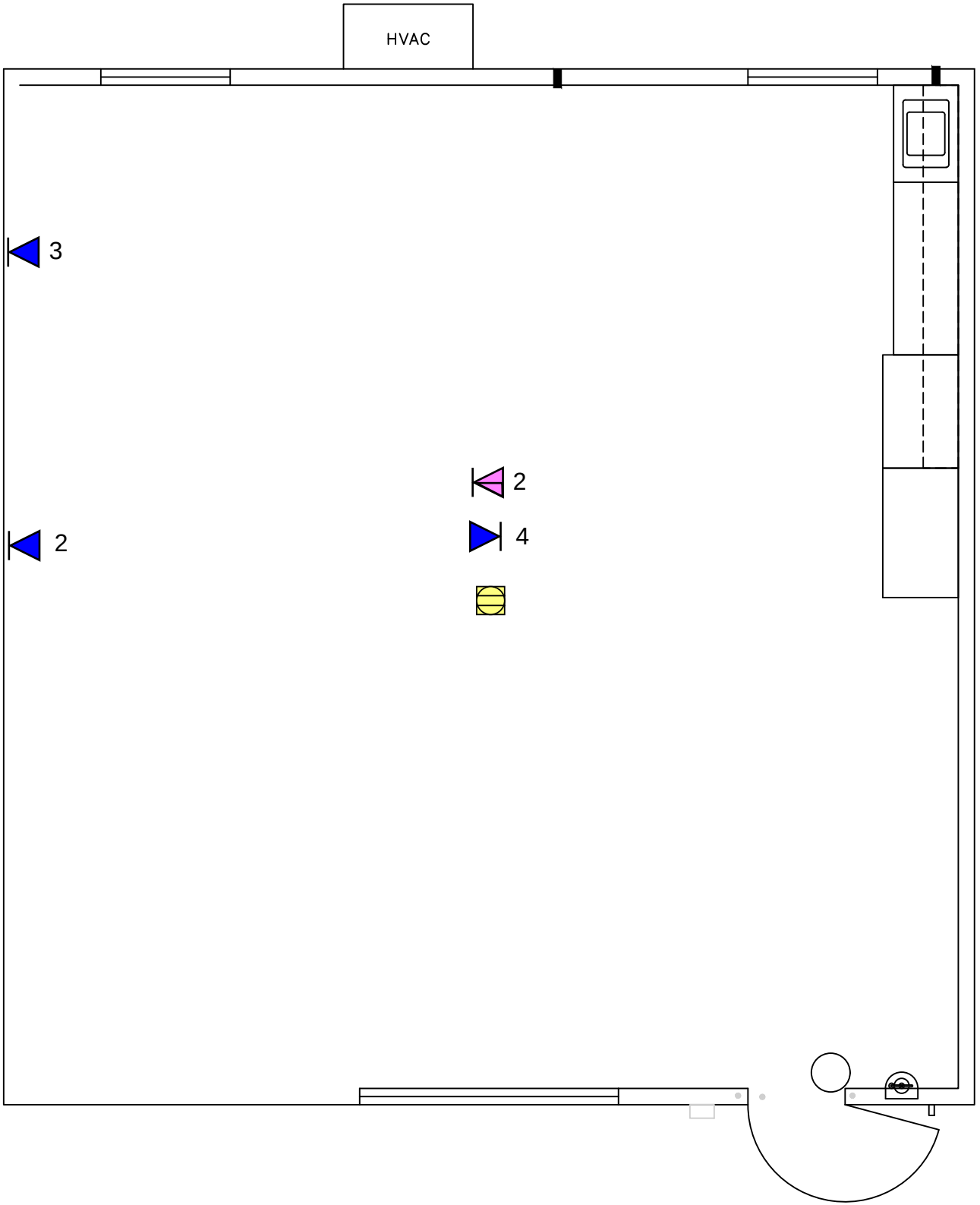
The “Hum Buster” ground loop isolator is turned on.

The appropriate screw is securing the unit to the wall surface.





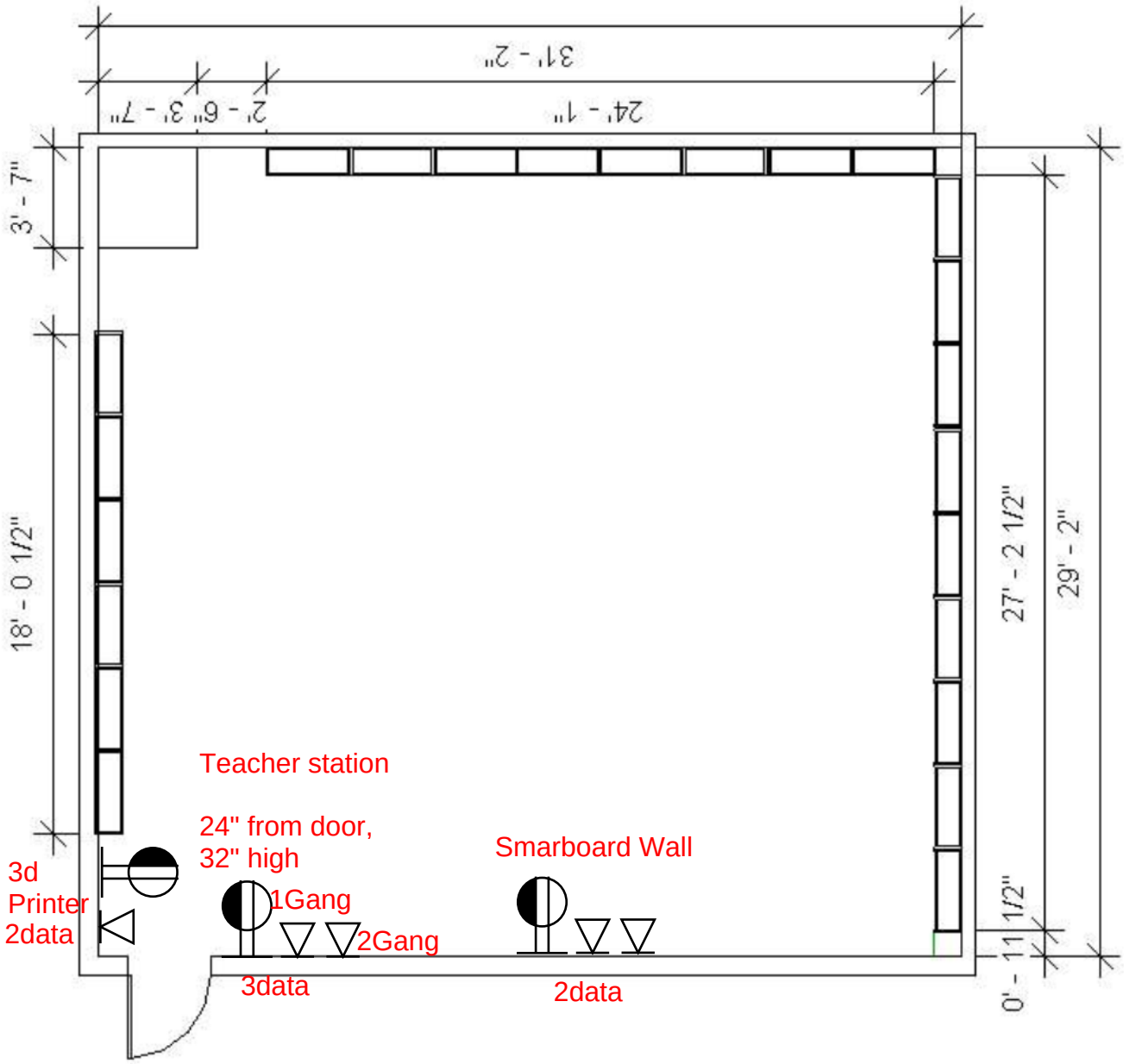

The Velcro section that is attached to the wall is secured with the appropriate screw.




Blue Cat6

Blue Cat6a
2port plate mounted in tile

PA Speaker(District provided)
Yellowcat6 to TC


31' - 2"
24' - 1"
2' - 6" 3' - 7"
3' - 7"
18' - 0 1/2"
27' - 2 1/2"
29' - 2"
0' - 11 1/2"
Teacher station
24" from door,
32" high
3d
Printer
2data
1Gang
2Gang
3data
Smarboard Wall
2data