

**February 7, 2017**  
**BOARD OF COUNTY COMMISSIONERS**  
**ORANGE COUNTY, FLORIDA**  
**Y17-730-MM / ADDENDUM #1**  
**ORANGE COUNTY CONVENTION CENTER NORTH SOUTH BUILDING EXTERIOR**  
**LIGHTING ENHANCEMENTS**  
**Bid Opening Date: February 14, 2017**

This addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents. Underlining indicates additions, deletions are indicated by ~~strikethrough~~.

- A. The Bid Opening Date remains February 14, 2017 at 2:00 P.M.
- B. The following are responses to the Orange County Electrical Plan Review comments received on December 27, 2016:

1. Comment: ALL REFERENCES SHALL BE MADE TO THE FLORIDA BUILDING CODE 5th EDITION (2014) (F.B.C.) & THE 2011 NATIONAL ELECTRICAL CODE (N.E.C.) (F.B.C. ADOPTED June 30, 2015). This note shall appear on the plans.

**Response: Included in General Project Notes; revised Sheet E0.001.**

2. Comment: ALL EQUIPMENT INSTALLED SHALL BE LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) and/or LISTED AND LABELED AS AN ASSEMBLY BY A NRTL. (ARTICLE 90.7, INFORMATIONAL NOTES 1, 2 and 3). This is an important informational note to make all parties aware.

**Response: Included in General Project Notes; revised Sheet E0.001.**

3. Comment: PROVIDE AN EXACT COPY OF DESIGNS FROM THE UL FIRE RESISTANCE DIRECTORY WITH SYSTEM NUMBERS FOR ALL ELECTRICAL PENETRATIONS OF FIRE RATED WALLS, FLOORS AND CEILING ASSEMBLIES. (F.B.C. CHAPTER 7, SECTION 714) - \*\*\*\* ONLY COMPLETE AND EXACT COPIES FROM THE UL FIRE RESISTANCE DIRECTORY ARE ACCEPTED BY THIS DEPARTMENT. \*\*\*\* CUT SHEETS FROM A MANUFACTURER ARE NOT ACCEPTABLE. \*\*\*\* The details sheet E9.003 do not meet the criteria of this AHJ. If you wish to use the details indicated on sheet E9.003 please provide complete and exact copies from UL.

**Response: UL Directory detail sketches (E1 through E9) have been provided and include the following:**

- **Sketch – E1 – System No. C-AJ-1184**
- **Sketch – E2 – System No. C-AJ-2630**
- **Sketch – E3 – System No. C-AJ-5091**
- **Sketch – E4A – System No. C-AJ-5320**
- **Sketch – E4B – System No. C-AJ-5320**
- **Sketch – E5A – System No. C-AJ-2007**
- **Sketch – E5B – System No. C-AJ-2007**
- **Sketch – E6A – System No. C-AJ-1361**
- **Sketch – E6B – System No. C-AJ-1361**
- **Sketch – E7 – System No. C-AJ-2236**
- **Sketch – E8 – System No. C-AJ-5029**
- **Sketch – E9 – System No. C-AJ-5225**

C. The following are questions/responses/clarifications:

1. Question: For the lighting fixtures that will be installed in the columns, can a Scissor Lift in the Outside Balcony Area be used, or other equipment to reach the height were where the lighting is installed be used?

**Response: The scissor lifts are allowed with prior approval from owner. Refer to Part G Page 3 of 4; Work Restrictions paragraph for further information.**

2. Question: The Window Tint will be installed in the inside only or inside & outside? The Window Tint will be for the 5 Arches?

**Response: As indicated in General Note #2 on Sheet LD9.001, film shall be installed on interior side of glazing only. The window tint will be for all Five (5) barrel-vaulted arches.**

3. Question: By Print E5.001 (See attached) indicate that we have to connect the CAT6 cables through the Existing Building Network and create a Unified Network. That OCCC has his own Subcontractor that does the maintenance in the Network? Can you please provide us with their information?

**Response: Contractor is responsible for installing the new racks and providing the connecting jumper between the new rack(s) and the existing rack(s). Shop drawings for this will be coming from Traxon but this is detailed in the BOM and is drawn in 3D (schematically) on the detail. Rack is a typical locking IDF 19" rack. Bidder is required to provide a complete unified lighting system for the new lighting fixtures and components as described in the work. The only interface between the new lighting system and the**

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existing IT infrastructure will be a single CAT6 jumper. Contractor shall refer to revised section 271500 for clarity of requirements; which includes the removal of the "Bidding" section.

D. CHANGES TO IFB BOOKLET, PART G, Supplemental Conditions:

- a. **Orange County Information Systems & Services Building Systems Infrastructure Standards for the Orange County Convention Center, (2) pages are added under Part G SPECIAL PROVISIONS as attached.**

E. CHANGES TO SPECIFICATIONS:

This addendum includes clarifications, corrections, additions, deletions, and revisions that take precedence over the original bid documents. Below is a list of the information contained herein.

- a. **Division 271500 Communications Horizontal Cabling. Remove and replace entire section with attachment; Section 1.08 Bidding was deleted.**

F. CHANGES TO DRAWINGS:

This addendum includes clarifications, corrections, additions, deletions, and revisions that take precedence over the original bid documents. Below is a list of the information contained herein.

- a. **Drawing E0.001; notes added to comply with Building Department review per comments 1 and 2 in part B of this addendum, above.**

G. All other term and conditions of the IFB remain the same.

H. The Proposer shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later than the date and time for receipt of the proposal.

**Receipt acknowledged by:**

\_\_\_\_\_  
**Authorized Signature**

\_\_\_\_\_  
**Date Signed**

\_\_\_\_\_  
**Title**

\_\_\_\_\_  
**Name of Firm**

**SECTION 271500**  
**COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 RELATED WORK AND REQUIREMENTS**

- A. Section 260533 – Raceway and Boxes for Electrical Systems

**1.03 GENERAL**

- A. Use of a manufacturer's name and model or catalog number is for the purpose of establishing standard of quality, general configuration, and operating characteristics desired only. This specification is intended to be a minimum standard for function, operation and performance. Equipment catalog numbers are listed to establish this minimum.
- B. Section Includes:
  - 1. UTP cabling
  - 2. Cable connecting hardware, patch panels, and cross-connects.
  - 3. Telecommunications outlet/connectors.
  - 4. Cabling system identification products.
  - 5. Cable management system.

**1.04 SUMMARY OF WORK**

- A. Furnish and install complete with all accessories a Category 6 Structured Cabling System (SCS). The SCS shall serve as a vehicle for transport of data signals throughout the network from designated demarcation points to outlets located at locations as indicated on the contract drawings and described herein.
- B. The Low Voltage Contractor shall maintain a current copy of the design drawings, specifications, installation schedule, equipment submittals and shop drawings at the job site at all times. These documents shall be made available to the Owner/Engineer at their request.
- C. Throughout the project, the Low Voltage Contractor shall provide levels of manpower necessary to meet all construction schedules.
- D. Wiring utilized for data connections shall originate at owner provided switches and concentrators either wall mounted, in vertical free standing equipment racks, and/or enclosed wall mounted vertical equipment racks located at the Telecommunications Equipment Room (TER), the Main Cross-connect (MC), the Intermediate cross-connect (IC), and/or the Telecommunications Room (TR) location(s). All connectivity, wiring, terminations and patch bays between these designated demarcation points and outlet locations designated on the plans shall be considered part of the contract. Telecommunication Outlets (TO) shall be furnished, wired and installed by the SCS Low Voltage Contractor.
- E. The system shall utilize a network of unshielded twisted pair, riser, tie and station cables. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings.
  - 1. All cables and terminations shall be identified and labeled per owner specifications at all locations.
  - 2. All cables shall terminate in an alpha-numeric sequence at all termination locations.
- F. All copper cable terminations shall comply with, and be tested to ANSI/TIA/EIA 568-B standards for Category 6 installations.

- G. Available and unused pairs between the ER (MDF) and TR (s) (IDF) shall be terminated, tested and shall be identified as spare at each location.
- H. Station cables shall be provided by the Owner.

#### **1.05 REFERENCES**

- A. ANSI/TIA/EIA 568-B.1 - Commercial Building Telecommunications Wiring Standards, General requirements.
- B. ANSI/TIA/EIA 568-B.2 - Commercial Building Telecommunications Wiring Standards, Balanced Twisted Pair Cabling Components.
- C. ANSI/TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
- D. ANSI/TIA/EIA 606-A – Administration Standards for Commercial Telecommunications Infrastructures.
- E. International Standards Organization/International Electrotechnical Commission (ISO/IEC) 11801.
- F. Underwriters Laboratories (UL®) Cable Certification and Follow up Program.
- G. National Electrical Manufacturers Association (NEMA).
- H. American Society for Testing Materials (ASTM).
- I. National Electric Code (NEC®), 1999
- J. Institute of Electrical and Electronic Engineers (IEEE).
- K. UL Testing Bulletin.
- L. American National Standards Institute (ANSI) X3T9.5 Requirements for UTP at 100 Mbps.
- M. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) most recent version.

#### **1.06 RESPONSIBILITY**

- A. The term Low Voltage Contractor as used in this document refers to the company, group, or individual that has contract responsibility for implementing the terms and directives of this specification document and to produce the finished product as described here-in.
- B. The Low Voltage Contractor for this project shall be contracted by the General Contractor.

#### **1.07 DEFINITIONS**

- A. Structured Cabling System (SCS): A SCS is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.
- B. Work Area: The connection between the information outlet and the station equipment in the work area consists of cords, adapters, and other transmission electronics.
- C. Horizontal Cabling: The Horizontal Cabling subsystem Provides connections from the horizontal cross connect to the Telecommunication Outlets (TOs) in the work areas. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and IOs in the work area. Each floor of a building is served by its own Horizontal Subsystem.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlets/connectors be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

3. Bridge taps and splices shall not be installed in the horizontal cabling.
- D. The maximum allowable horizontal cable length for Ethernet is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.
- E. The maximum allowable horizontal cable length for DMX is 920 feet.
- F. Equipment Subsystem: The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room, main cross connect or telecommunications closet and the transmission media required to terminate this equipment on the distribution hardware.
- G. The Administration Subsystem: The Administration Subsystem links all of the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects.

#### **1.08 BIDDING**

- A. ~~At the time of bid, in addition to a complete bid including all pricing information, provide the following:~~
  1. ~~A detailed description of any and all additions, deletions or exceptions taken to the bid documents. Include the reasons why changes are being proposed.~~
  2. ~~Detailed breakout of all requested alternate pricing.~~
  3. ~~A price to install each individual media type and system component under this proposed work.~~
  4. ~~Manufacturer's original equipment cut sheets for each product for use on this project.~~
  5. ~~Add/Delete pricing for all type station outlet configurations as shown on drawings.~~

#### **1.09 SUBMITTALS**

- A. Product Data
  1. Provide manufacturer's catalog information showing dimensions, colors, and configurations.
  2. Submittals shall include all items called for in PART 2 – PRODUCTS of this document and the manufacturers cut sheets for the following:
    - a. All connectors and required tooling.
    - b. All termination system components for each cable type.
    - c. All grounding and building entrance protection surge suppression system components.
  3. For UTP copper cable, provide manufactures technical data sheet that includes the following installation data for each type used:
    - a. Mutual Capacitance
    - b. Impedance
    - c. DC Resistance
    - d. Attenuation (Insertion Loss)
    - e. Return Loss
    - f. Worst Pair-to-Pair Near End Crosstalk (NEXT)
    - g. Power Sum Near End Crosstalk (PSNEXT)
    - h. ELFEXT (ACRF)
    - i. Power Sum ELFEXT (PSACRF)
  4. All submitted product sheets containing more than one product or multiple product options shall have the submitted product clearly identified for review with all options highlight as intended for review.
- B. Shop Drawings to be provided by system manufacture:
  1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  2. Cabling administration drawings and printouts.
  3. Wiring diagrams to show typical wiring schematics, including the following:

- a. Cross-connects.
  - b. Patch panels.
  - c. Patch cords.
- 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Material Provided: The successful Low Voltage Contractor shall be certain that all correct parts are ordered per Products Section of this document and installed in accordance with manufacturers design and installation guidelines. Low Voltage Contractor shall submit complete parts and part numbers to Engineer prior to installation of equipment for approval.
- D. Warranty Documentation
  - 1. Warranty shall be for a minimum of 20 years for the SCS.
  - 2. Complete documentation regarding the manufacturer's warranty shall be submitted as part of the proposal. This shall include, but is not limited to: a sample of the warranty that would be provided to the customer when the installation is complete and documentation of the support procedure for warranty issues.
  - 3. A systems application assurance manual documenting the vendor supported applications and application guidelines shall be provided as part of the submittals

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

#### **1.11 QUALIFICATIONS**

- A. Manufacturer
  - 1. The products specified in this specification shall be supplied by a single manufacturer, with the exception of 1. Data racks and other hardware that is not defined as part of the channel test configuration by ANSI/TIA/EIA 568-B.
- B. General Requirements: Comply with TIA/EIA-569-A.
- C. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Ladder tray, conduit
  - 3. Straps and other devices.
- D. Low Voltage Contractor
  - 1. The Low Voltage Contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.
  - 2. The Low Voltage Contractor shall utilize the authorized manufacturer components and distribution channels in provisioning this Project.
  - 3. The Low Voltage shall have a minimum of five (5) years of recent experience on structured cabling systems of similar type and size.
  - 4. The Low Voltage Contractor and design firm shall be in compliance with all federal, state and local statutes regarding qualifications of firms.
  - 5. The Low Voltage Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
  - 6. The Low Voltage Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and Category 5e and Category 6 metallic premise distribution systems.
  - 7. The Low Voltage Contractor shall have personnel who are adequately trained in the usage of such tools and equipment.

8. The Low Voltage Contractor shall submit a resume of qualification with the vendor's proposal indicating the following:
  - a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
  - b. A technical resume of experience for the Low Voltage Contractor's Project Manager and on-site installation supervisor who will be assigned to this project.
  - c. A list of technical product training attended by the Low Voltage Contractor's personnel that will install the SCS system.
  - d. Any Sub-Contractor, who will assist the SCS Low Voltage Contractor in performance of this work, shall have the same required training and certification as the Low Voltage Contractor.

#### **1.12 CABLING BASIC REQUIREMENTS**

- A. Cable Pathway: Extension of all data and voice cables shall be within raceway, conduit, cable tray or other designated cable delivery system.
- B. Hardware: Required hardware includes, but is not limited to, termination blocks, fastening devices, data outlets, voice outlets, connectors and all required accessories to comply with this specification.

#### **1.13 PRODUCT WARRANTY AND APPLICATION ASSURANCE**

- A. Structured cabling system (SCS) Extended Product Warranty and Application Assurance Program
  1. Extended Product Warranty
    - a. The Extended Product Warranty covers product defects for all passive components of the SCS. Passive components are defined as those exhibiting no gain or contributing no energy. The manufacturer shall warrant, from the date a Registration Certificate is issued by the manufacturer to the end-user, the following:
      - b. The passive products that comprise the registered SCS will be free from manufacturing defects in material or workmanship under normal and proper use;
      - c. All SCS approved passive cabling products that comprise the registered SCS solution exceed the specification of TIA 568-B.1, B.2, B.3 and exceed ISO/IEC 11801 standards and will conform to the performance specifications of the manufacturer's associated product data sheet in effect at the time the Registration Certificate is issued;
      - d. The installation will exceed the insertion and return loss, attenuation and near end crosstalk (NEXT) requirements of TIA 568-B and the ISO/IEC 11801 standards for cabling links/channel configurations specified in these standards.
        - 1) That each SCS channel comprised exclusively of manufacturer's Category 6 passive products, end-to-end, shall be capable of delivering 1.0 Gbps to the workstation in accordance with application standards..
      - e. This extended Product Warranty shall be applicable to the SCS only on the original site of installation. Under the Extended Product Warranty, manufacturer shall either repair or replace the defective product itself at manufacturer's cost. And in the U.S.A., manufacturer shall pay an Authorized manufacturer's Reseller for the cost of labor to repair or replace any such defective product on behalf of the manufacturer.
    2. Application Assurance
      - a. Application Assurance covers failure of the SCS to operate the applications which the system was designed to support, as well as additional application(s) defined below. Manufacturer shall warrant that the registered SCS solution will be free from failures which prevent operation of the specific applications for which the original SCS was designed.
      - b. The Application Assurance Program shall also cover those applications identified in the current (at the time of installation) SCS Performance Specifications; and
      - c. In accordance with application standards specifications, any applications introduced in the future by recognized standards or user forums that use ANSI/TIA/EIA 568-B or ISO/IEC 11801 components and link/channel specifications for cabling.
    3. Term of Warranty



- a. For a minimum twenty years from the date of issuance of the Registration Certificate or installation, whichever is later.
- 4. Persons / Entity Covered
  - a. This Limited Warranty shall be for the benefit of the person or entity to which the manufacturer's SCS Registration Certificate is issued and any successor Transferable in interest to the site in which such System was originally installed by the manufacturer or an Authorized manufacturer's Reseller.
  - b. If manufacturer repairs the product, it may use new or reconditioned replacement parts. If manufacturer chooses to replace the product, manufacturer may replace it with a new or reconditioned one of the same or similar design. Any such repair or replacement will be warranted for either (a) 90 days or (b) the remainder of the original 20-year warranty period, whichever is longer.

#### **1.14 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION**

##### **A. Cabling**

- 1. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electric Code (NEC®) Articles 725, 760, 770, and 800 and the appropriate local codes.
- 2. All copper cabling shall bear appropriate markings for the environment in which they are installed.

##### **B. Cable Pathway**

- 1. The Low Voltage Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all data and voice cables.
- 2. All cabling shall be run in and supported by cable pathways that are installed solely for the purpose of supporting low voltage communications cabling.
- 3. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
- 4. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.
- 5. Cables shall maintain adequate separation from EMI. and heat sources such as lighting fixtures etc

##### **C. Fire Stopping**

- 1. Sealing of openings around the exterior of the sleeves or openings between floors, through rated fire and smoke walls, existing and created by others shall be the responsibility of others. Sealing of openings between floors used by Low Voltage Contractor for cable pass through, sealing of space internal to the sleeves used for cable pass through and sealing of openings around the exterior of sleeves installed by the Low Voltage Contractor shall be the responsibility of the Low Voltage Contractor.
- 2. Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the local fire and building authorities having jurisdiction over this work.
- 3. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Low Voltage Contractor work.
- 4. Any openings created by or for the Low Voltage Contractor and left unused shall also be sealed as part of this work.

##### **D. Low Voltage Contractor Responsibility**

- 1. The Low Voltage Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- 2. The Low Voltage Contractor shall coordinate all installation requirements of specialty lighting equipment with owner and lighting equipment manufacturer prior to installation. This shall include but is not limited to cable termination types, locations, twisted pair pinouts, color codes and surge suppression requirements.

## **1.15 WORK EXTERNAL TO THE BUILDING**

- A. Any work external to the confines of this building as shown on the drawings shall be governed by the provisions of this specification and the applicable drawings.

## **PART 2 - PRODUCTS**

### **2.01 EQUIVALENT PRODUCTS**

- A. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved and show demonstrated and documented equivalence to the product(s) specified.
- B. Documentation shall include, but is not limited to: product samples, data sheets, and actual test data.
- C. The request for product substitution, and supporting documentation, must be submitted, in writing 5 (five) days prior to submitting the bid.
- D. Written approval for product substitution must be submitted with the bid.

### **2.02 HORIZONTAL CABLING**

- A. Horizontal cabling shall be Category 6 4-pair unshielded twisted pair (UTP) cabling that meets the channel requirements specified above.
- B. Acceptable Horizontal Cabling:
  - 1. ACD TrueNet (Above Grade and or indoor)
  - 2. Commscope Ultra OSP (Below Grade and / or outdoor)

### **2.03 GUARANTEED CHANNEL PERFORMANCE**

- A. Category 6 Guaranteed Channel Performances
  - 1. All copper cable and apparatus shall conform to the Category 6/ Class E Channel Performance Specification.
  - 2. The copper cable and apparatus channel performance shall be measured over the full 100 meters (328 feet) length and include 4 or 6 connection points.
  - 3. The specifications for the 4 pair UTP Category 6 channel are divided into two primary groups based upon high performance and premium performance cable. The Category 6 channel shall consist of all cable and components with four connections that comprise the full 100 meter (328 feet) length circuit from the Hub/Server/LAN Electronics port located in the Telecommunications Closet or the main data administration location to the voice/data/video/imaging device port located at the User Work Station.
  - 4. The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6 channel cable, components, and applications for a period of 20 years.
  - 5. The 20 year warranty shall be a transferable warranty and include all labor to replace any defective components as well as the component replacement.
  - 6. The Category 6 channel with four (4) connections shall have a minimum of 10dB Attenuation to Crosstalk Ratio (ACR); across the full frequency range of 1MHz.
  - 7. The Category 6 solution shall provide a total useable bandwidth of 250 MHz and will deliver lab verified performance of 5dB better than all Category 6 crosstalk and return loss requirements for standards-compliant installations.
  - 8. The Category 6 solution shall provide a total usable bandwidth in excess of 400 MHz and will deliver lab verified performance channel performance of 8dB above all Category 6 crosstalk requirements and 6dB above all Category 6 return loss requirements for standards-compliant installations.
  - 9. The Delay Skew on the 90 meter channel shall not exceed 30 ns.
  - 10. The Category 6 cable and components shall be electrically compatible with future networks and backward compatible with existing Category 3, 5, 5e.

11. The Category 6 components shall be engineered and manufactured to compensate for any Category 3, 5 or 5e component crosstalk and shall provide at least Category 3, 5 or 5e performance in all of the customer's existing installed base of voice/data/video.
12. The Category 6 cable and components shall be physically compatible with existing installed base of equipment.
13. The Category 6 cable and components shall not require special cords, specialty tools or special installation requirements.

## 2.04 OUTLETS

- A. Outlet Locations: Unless otherwise noted on the floor plans or within this document, all voice and data wall outlets for 24 AWG copper cable shall be:
  1. 8-position/ 8-conductor modular outlets
  2. Insulation displacement
  3. Support Universal applications in a multi-vendor environment, accepting modular RJ-45 plugs.
  4. Provided with blank module inserts for all unused module locations. Jack module arrangement is shown on the drawings. Provide color coded inserts at each outlet, termination block and at patch panels as shown on the drawings.
  5. Mounted in one, two or three gang utility outlet boxes.
  6. Equipped with EIA/TIA-T568A and EIA/TIA-T568B universal wiring labels.
- B. Faceplates
  1. General Requirements
    - a. Faceplates shall be available in single, duplex, triplex, quadplex, or sixplex arrangements in a single gang configuration.
    - b. The outlets shall be capable of being installed in any modular faceplate, frame, flush mounted box or surface-mounted box avoiding the need for special faceplates.
    - c. Faceplate outlet openings shall be numbered on both sides for installation and maintenance identification.
    - d. Faceplate shall be installed with the number of ports as required by the designated outlet. Each unused port shall contain a blank insert.
  2. Modular Flush Mounted Faceplates
    - a. Faceplates shall be High-impact, flame retardant, UL-rated 94V-0 thermoplastic.
    - b. Color shall match Architects finish schedule.
  3. Metal Modular Faceplates
    - a. Metal faceplates shall be available in stainless steel.
- C. Category 6 Gigabit outlets
  1. Approved Category 6 Jacks:
    - a. ADC – KM8 Series
  2. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standard, ISO/IEC 11801:2002 Second Edition and be part of the UL® LAN Certification and Follow-up Program.
  3. The Category 6 outlets shall be backward compatible with Category 5e, 5 and 3 cords and cables.
  4. The outlet shall use either the EIA/TIA-T568A or EIA/TIA-T568B wiring. The EIA/TIA-T568B wiring scheme shall be used.
  5. General specifications:
    - a. Meets or exceeds the mechanical, electrical, and clearance specifications in FCC Rules and Regulations, Part 68, Subpart F
    - b. Meet or exceed the Category 6 requirements in ISO/IEC 11801, CENELEC EN 50173, and TIA/EIA568B
    - c. Certifications: UL Listed, CSA Certified and AUSTEL approved.
  6. Color of jacks:

- a. Data – Outlet color shall match faceplate cover.
- b. Voice – Outlet color shall match faceplate cover.

## **2.05 MODULAR PATCH PANELS**

- A. Approved Modular Patch Panels:
  - 1. Match existing
- B. Category 6 Modular Patch Panels
  - 1. The Category 6 modular jack panels shall meet or exceed the proposed Category 6 standards requirements in ISO/IEC 11801 (2002), CENLEC EN 50173 (2002) and ANSI/TIA/EIA 528-B.2-1 and shall be UL Listed.
  - 2. The panel shall be capable of handling either T568A or T568B wiring.
  - 3. The panel shall have 110 style IDC punch downs
  - 4. The jack panels shall be 19-inch rack mountable.
  - 5. The Category 6 patch panel shall have 24/48 port configuration (Type T568B)
  - 6. Provide patch cord organizers between each modular patch panel

## **2.06 COPPER PATCH CORDS**

- A. Category 6 Patch Cords:
  - 1. Patch cords shall be contractor provided as required.

## **2.07 STATION CABLE**

- A. Category 6 Station Cables:
  - 1. Station Cables are provided by owner.

## **PART 3 - EXECUTION**

### **3.01 WORKMANSHIP**

- A. Components of the SCS system shall be installed in a neat, workmanlike manner.
- B. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the system.
- C. Identification markings and systems shall be uniform.
- D. ANSI/TIA/EIA 568-B wiring codes shall standardize all SCS wiring.

### **3.02 WIRING METHODS**

- A. Wiring Method: All cables shall be routed in conduit back to telecommunications backboard. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring Method: Provide a minimum 10'-0" of service loop/ figure eight at the telecommunications rooms for each permanent link.
- D. Wiring Method: Provide a minimum of 8" of cable at each copper UTP outlet location for jack termination.
- E. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- F. All conduit shall be provided with pull cords.

- G. All data cables shall terminate in rack mounted patch panels inside existing equipment rooms.
- H. All data cables shall terminate inside OSP weatherproof connector at light fixtures and light fixture equipment. Coordinate exact connector type and termination requirements with light fixture manufacture prior to installation.

### **3.03 GENERAL DESCRIPTION**

- A. The wiring system components shall comply with all product specifications contained in Section two.
- B. The structured cabling system shall consist of the Work Area, Horizontal, and Backbone – Riser, Backbone – Campus, Telecommunications Room (TR), Equipment Room (ER), Entrance Facility (EF) and Administration elements.

### **3.04 HORIZONTAL**

- A. Horizontal Cabling.
  - 1. The Low Voltage Contractor shall supply horizontal cables to connect each information outlet to the backbone subsystem on the same floor.
  - 2. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP)
  - 3. The 4-pair UTP cables shall be run using a star topology format from the administration subsystem (Telecommunications Room) on each floor to every individual Telecommunication Outlet.
  - 4. All cable routes are to be parallel and/or perpendicular with the outside walls of the building. Alternate paths must be approved by Engineer prior to installation of the cabling.
  - 5. The length of each individual run of horizontal cable for Ethernet connections from the administration subsystem (Telecommunications Closet) on each floor to the Telecommunication Outlet shall not exceed 295 ft (90 m).
  - 6. The length of each individual run of horizontal cable for DMX connections shall not exceed 920 ft (280 m) between terminations.
  - 7. The Low Voltage Contractor shall refer to manufacturers shop drawings and installation details for all DMX terminations and other specialty equipment connection information.
  - 8. The Low Voltage Contractor shall adhere to the manufactures recommendations and specifications with regard to the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.
  - 9. Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices.
  - 10. In suspended ceiling and raised floor areas where walker duct, cable trays or conduit are not available, the Low voltage Contractor shall bundle station wiring with Velcro type cable ties at appropriate distances.
  - 11. Plenum cable will be used in all appropriate areas.
  - 12. The Low voltage Contractor shall conceal horizontal distribution wiring internally within the walls. If obstructions exist, the Low Voltage Contractor shall secure approval by Engineer prior to the use of an alternate method.
  - 13. Every effort will be made to schedule the requirements under this Contract in such a manner so as to complete all above ceiling work prior to ceiling tile installation. In the event the Low Voltage Contractor is required to remove ceiling tiles, such Work shall not break or disturb grid and must be coordinated with the General Contractor.
  - 14. The 4 pair UTP cable shall be Underwriter's Laboratories (UL) listed type MPR, MPP, CMR, or CMP as stated later in this section.
  - 15. The Low Voltage Contractor shall provide shop drawings with detailed cable run diagrams for cable runs within raised floors detailing exact locations of cable for review and approval by Engineer after coordination with other contractors, architect and general contractor and prior to installation.

16. Conduit runs installed by the Low Voltage Contractor should not exceed 100 feet or contain more than two 90 degree sweeping bends without utilizing appropriately sized pull boxes.
17. Station cables and tie cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.

B. Work location information outlets: Supply and install outlets as shown on drawings.

### **3.05 ADMINISTRATION**

- A. The administration subsystem shall consist of wiring blocks and or patch panels for termination of copper cables. All wall field layouts to be as detailed on drawings or as approved by Engineer prior to installation.
- B. Fields: Separate termination fields shall be created for voice and data applications if both are wall mounted.
- C. Termination blocks: Termination blocks that require rotation after connection of horizontal/vertical wiring shall not be allowed.
- D. Cross-connect wire, patch cords: The Owner shall provide cross-connect wire, copper patch cords for cross-connection and inter-connection of termination blocks and patch panels
  1. Jumper type: The type of jumper cables shall depend on ANSI/EIA/TIA Category 6 applications and the termination block used, i.e. a punch panel, a patch panel termination block and be part of the manufacturers total channel solution.

### **3.06 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

### **3.07 INSTALLATION**

- A. All installation shall be done in conformance with ANSI/EIA/TIA 568-B standards, federal and local standards and the SCS manufacturer Design and Installation guidelines.
  1. The Low Voltage Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Low Voltage Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation at no additional cost to the owner. This shall also apply to any and all damages sustained to the cables by the Low Voltage Contractor during the implementation.
  2. The Low Voltage Contractor shall make provisions so that all cabling is stored within a temperature controlled space to ensure that cabling is unspooled, manipulated, and worked with only when the cabling is within the manufacturer's installation temperature specifications and free of condensation.
- B. Bonding and Grounding
  1. The Low Voltage Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities.
  2. The Low Voltage Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework.

3. All grounds shall consist of #6 AWG or larger (As required) copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground.
  4. Grounding must be in accordance with the NEC, NFPA and all local codes and practices.
- C. Power Separation: The Low Voltage Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus. All SCS equipment and terminations must maintain proper separation from sources of EMI as per ANSI/TIA/EIA 562 B2 and BICSI installation practices.
- D. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
  4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.
- E. Miscellaneous Equipment: The Low Voltage Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, wire molding (MC & TR locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.
- F. Special Equipment and Tools: It shall be the responsibility of the Low Voltage Contractor to furnish any special installation equipment or tools necessary to properly complete the System. Tools shall include, but are not limited to:
1. Tools for terminating cables,
  2. Testing and splicing equipment for copper cables,
  3. Communication devices,
  4. Jack stands for cable reels,
  5. Cable wenchers.
- G. Identification/Labeling
1. The Low Voltage Contractor shall be responsible for generating and placing printed labels for all cables and cords, distribution frames, and outlet locations i.e., 2N-001-V, 2N-001-D1, 2N-001-D2 at the time of delivery. Adhere to existing owner standards if exist. All horizontal cables shall be labeled within 4" of terminations on each end.
  2. Labels shall not be written by hand.
  3. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
  4. Comply with ANSI-J-STD-607-A.

H. Identification:

1. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
  - a. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
2. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
3. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
4. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
5. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
6. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
7. Cable and Wire Identification:
  - a. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - b. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - c. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - 1) Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - 2) Label each unit and field within distribution racks and frames.
  - d. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
  - e. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
8. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

- I. Cable Records: The Low voltage Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (switch room), risers, and station connecting blocks in accordance with industry practices.

J. As Built Documentation

1. Upon completion of the project, Low Voltage Contractor is to prepare "As Built" documentation showing actual site conditions and installation as constructed.
2. Provide copies of such documentation to the Owner as mentioned below.
  - a. Upon completion of system installation, Low Voltage Contractor shall provide to Owner for its records the following:
    - 1) MC, TR and EF Diagrams which shall include:



- a) Cable routing
- b) Position of all components and
- c) Detailed layout of the wall field
- d) Labeling plan.
- 2) Riser Distribution Plan
- 3) Campus Distribution Plan
- 4) Fire Stop Penetrations and System ID
- b. Documentation shall be in the following format:
  - 1) Four (4) copies of all diagrams and drawings matching the bid documents in size and format. One (1) copy of electronic plans, drawings and diagrams provided in both PDF format and the latest version of AutoDesk AutoCAD (or Revit if applicable) on CD/DVD Rom Disc, Flash Drive or digital file transfer via email or FTP.
  - 2) One (1) copy of electronic project records including cut sheets, test results (provided in both PDF format and the native tester file format) and cable connectivity schedules provided on CD/DVD Rom Disc, Flash Drive or digital file transfer via email or FTP.
- K. Additional Records: In addition to the engineering diagrams, the following items shall be provided by the Low Voltage Contractor: Cable Records and Assignments detailing all connections to equipment, horizontal cable or riser cable for copper.

### **3.08 PENETRATIONS OF WALLS, FLOORS AND CEILINGS**

- A. Prior consent: The Low Voltage Contractor shall make no penetration of floors, walls or ceiling without the prior consent from **exp**.
- B. Sealing penetrations – The area around the exterior of the sleeve shall be sealed by the contractor who installed the sleeve, the area internal to the sleeve shall be sealed by the Low Voltage Contractor who pulled or placed the cables.
  - 1. Where penetrations through acoustical walls or other walls for cableways have been provided for the Low Voltage Contractor or made by the Low Voltage Contractor such penetrations shall be sealed by the Low Voltage Contractor in compliance with applicable code requirements and as directed by Owner's Architect or General Contractor.
  - 2. Where penetrations through fire-rated walls for cableways have been provided for the Low Voltage Contractor or made by the Low Voltage Contractor such penetrations shall be sealed by the Low Voltage Contractor as required by code and as directed by Owner's Architect or General Contractor.

### **3.09 TESTING / WARRANTY**

- A. Copper Cable testing
  - 1. Testing of all copper wiring shall be performed prior to system acceptance.
  - 2. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
  - 3. Voice and data horizontal wiring pairs shall be tested from the information outlet to the TR.
  - 4. The Low Voltage Contractor shall utilize Level III test equipment for all unshielded twisted pair cabling up to Category 5e.
  - 5. The Low Voltage Contractor shall utilize Level III test equipment for all Category 6 unshielded twisted pair cabling.
  - 6. Test equipment shall be updated with the latest firmware and software releases available from the manufacturer of the test equipment.
  - 7. All test equipment shall include valid proof of calibration within 12 months of the testing date. The calibration shall utilize the manufacturer's recommended calibration practices.
  - 8. The Category 6 cable runs shall be tested for conformance to the specifications of EIA/TIA 568-B Category 6.
  - 9. Category 6 horizontal cables shall be tested according to test set manufacturers instructions utilizing the latest firmware and software.
    - a. Testing shall include all of the electrical parameters.

- b. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge.
  - c. The detailed test results shall include the following:
    - 1) Wire Map
    - 2) Length
    - 3) Insertion loss
    - 4) Near-End Cross Talk (NEXT)
    - 5) Power Sum Near-End Crosstalk (PSNEXT)
    - 6) Equal-Level Far End Crosstalk (ELFEXT)
    - 7) Power Sum Equal-Level Far-End Crosstalk (PSELFEXT)
    - 8) Return Loss
    - 9) Propagation delay
    - 10) Delay skew
10. Complete, end to end, test results must be submitted to Engineer for review. Submit test results in an organized three ring binder.
- B. Manufacturer Warranty: The Low Voltage Contractor shall provide a Twenty (20) year Structured Connectivity Solution Extended Product Warranty and Application Assurance.
  - C. Additional Warranty: The Low Voltage Contractor shall state any additional Contractor supplied warranty.

### **3.10 COMPLETION OF WORK**

- A. At the completion of the System, the Low Voltage Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract.
- B. All clean up, restoration, and removal noted above will be by the Low Voltage Contractor and at no additional cost.
- C. If the Low Voltage Contractor fails in its duties under this paragraph, Owner may upon notice to the Low Voltage Contractor perform the necessary clean up and deduct the costs there of from any amounts due or to become due to the Low Voltage Contractor.

### **3.11 INSPECTION**

- A. On-going inspections shall be performed during construction by the Project Manager and/or System Engineer. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly.
- B. The following shall be examined and shall comply satisfactorily in all instances.
  - 1. Is the documentation complete, including Submittals/As-Builds?
  - 2. Are all cables properly labeled, from end-to-end?
  - 3. Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
  - 4. Is the cable type suitable for its pathway?
  - 5. Are the cables bundled in parallel?
  - 6. Have the pathway manufacturer's guidelines been followed?
  - 7. Are all cable penetrations installed properly and fire stopped according to code?
  - 8. Has the Low Voltage Contractors avoided excessive cable bending?
  - 9. Have potential EMI and RFI sources been considered?
  - 10. Is Cable Fill Correct?
  - 11. Are hanging supports within 1.5 meters (5 feet)?
  - 12. Does hanging cable exhibit some sag?
  - 13. Are telecommunications closet terminations compatible with applications equipment?

14. Have Patch Panel instructions been followed?
  - a. jacket removal point
  - b. termination positions
  - c. all pair terminations tight with minimal pair distortions
  - d. twists maintained up to Index Strip
15. Have Modular Panel instructions been followed?
  - a. cable dressing first
  - b. jackets remain up to the Connecting Block
  - c. all pair terminations tight and undistorted
  - d. twists maintained up to the Connecting Block
16. Are connectors properly turned right side up in the Jack Panels without cables wrapped or twisted around the Mounting Collars?
17. Have the correct outlet connectors been used.
18. Have outlets been wired correctly? (T568B)?
19. Is the cable jacket maintained up to the outlet?
20. Are identification markings uniform, permanent and readable?

**END OF SECTION 271500**

**PART G**  
**SUPPLEMENTAL CONDITIONS**  
**Orange County Information Systems & Services Building Systems Infrastructure**  
**Standards for the Orange County Convention Center**

**Section 1: Permitting**

- 1.1 Low Voltage Permitting shall be a requirement for any project. North, South, and West buildings will require separate permits due to physical address.

**Section 2: Standards**

- 2.1. Comply with TIA/EIA-568-B.3 for fiber optic cabling
- 2.2 Comply with NECA 1 for cable installation
- 2.3 Comply with ANSI 4/TIA/EIA-606-A, telecommunications administration
- 2.4 Comply with TIA/EIA-569-A for pull box sizing, length of conduit
- 2.5 Comply with ANSI-J-STD-607-A for grounding
- 2.6 Comply with TIA/EIA-569-A for telecommunication pathways and spaces
- 2.7 Comply with TIA/EIA-569-A, Annex A, "Fire stopping"

**Section 3: As built**

**Section 1: Permitting**

- 1.1 Low Voltage Permitting shall be a requirement for any project. North, South, and West buildings will require separate permits due to physical address.

**Section 2: Standards**

- 2.1. Comply with TIA/EIA-568-B.3 for fiber optic cabling
- 2.8 Comply with NECA 1 for cable installation
- 2.9 Comply with ANSI 4/TIA/EIA-606-A, telecommunications administration
- 2.10 Comply with TIA/EIA-569-A for pull box sizing, length of conduit
- 2.11 Comply with ANSI-J-STD-607-A for grounding
- 2.12 Comply with TIA/EIA-569-A for telecommunication pathways and spaces
- 2.13 Comply with TIA/EIA-569-A, Annex A, "Fire stopping"

**Section 3: As built**

- 4.1 Grounded bus bars must be provided on all wall fields. These grounds must be on a dedicated ground.
- 4.2 Fire rated backboards must be provided in all communication rooms.
- 4.3 All voice and data cable will be certified to meet plenum category 6.
- 4.5 Splicing of category 6 cable will not be permitted.

**PART G**  
**SUPPLEMENTAL CONDITIONS**  
**Orange County Information Systems & Services Building Systems Infrastructure**  
**Standards for the Orange County Convention Center**

- 4.6 Conduit ceiling stub-out minimum  $\frac{3}{4}$ ", home run conduit in the slab or ceiling must be a minimum 1" conduit, and daisy-chaining conduit is not permitted.
- 4.7 Cabling in or below slab must be flooded type.
- 4.8 Horizontal data cabling must not exceed 100 meters.
- 4.9 All wiring will meet the T-568B standard.
- 4.10 Appropriate wire management will be used.
- 4.11 Riser cable and fiber will be provided between closets.
- 4.12 Fill ratios for all conduit and sleeves must meet TIA/EIA Standards.
- 4.13 Fiber not in conduit must be installed in inner duct.
- 4.14 Bend radius must meet TIA/EIA Standards.
- 4.15 Lightning protection will be provided for both ends of copper tie cables.
- 4.16 Riser terminations for phone system will be done on wall mounted 110 blocks.
- 4.17 Riser cabling in the remote building MDF will be terminated on wall mounted 110 blocks next to the lightning protection.
- 4.18 Riser cabling in the all building IDFs will be rack mounted 110 blocks in top of rack for a plug and play solution.
- 4.19 Category 6 voice cabling will be terminated on rack mounted patch panels.
- 4.20 All cables and termination hardware will be labeled in accordance with TIA/EIA Standards.
- 4.21 The cabling contractor must provide ISS with detailed cable records and Cat6 test results.
- 4.22 Cable records must reflect room to jack numbers.
- 4.23 OCISS must be provided with as built drawings for all buildings and outside plant conduit pathways.
- 4.24 Any fire rated wall penetration must be sealed per ANSI/TIA/EIA Standards.
- 4.25 Vendor provided hardware must be securely installed on the communication racks.
- 4.26 Vendor provided hardware must be securely installed inside cabinets or on a rack mounted tray.
- 4.27 Vendor must ensure that all data cables are installed on the copper patch panel in the IDF rooms.
- 4.28 Vendor must coordinate their work with IT staff during implementation.
- 4.29 OCISS will not accept Ethernet extenders. Each data drop must be within 90 meters.
- 4.30 Vendor must comply with IT security policies.
- 4.31 Vendor must use power surge protector for external data drops (outside) at both end points.

ACCENT	
	PLUG-IN SURFACE MOUNTED

JUNCTION BOX	
	SURFACE/RECESSED MOUNTED

LUMINAIRE SYMBOL KEY	
	LUMINAIRE SYMBOL
	LUMINAIRE TYPE (SEE LUMINAIRE TYPE KEY)
	UNIQUE LUMINAIRE IDENTIFIER (SEE IDENTIFICATION KEY)
	PANEL AND CIRCUIT NUMBER

LUMINAIRE TYPE KEY	
	NUMERICAL DESIGNATION
	LUMINAIRE FUNCTION (SEE LUMINAIRE FUNCTION ABBREVIATION)

IDENTIFICATION KEY	
	FIXTURE IDENTIFICATION LETTER
	COLUMN NUMBER OR ARCH NUMBER
	INDICATES LUMINAIRE IS FOR ARCH
	N = NORTH CONCOURSE
	S = SOUTH CONCOURSE

ABBREVIATIONS	
ABV	ABOVE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
ADJ	ADJUSTABLE
ARCH	ARCHITECTURAL
BLDG	BUILDING
BO	BY OTHERS
BOT	BOTTOM
BEL	BELOW
CLG	CEILING
CFCI	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
CONSTR	CONSTRUCTION
CONTR	CONTRACTOR
CONTR	CONTINUOUS
E	EAST
EL	ELEVATION
ELEC	ELECTRICAL
EQ	EQUAL
EXT	EXTERIOR
FL	FLOOR
FT	FOOT OR FEET
CC	GENERAL CONTRACTOR
OND	GRADE
GR	
HGT	HEIGHT
HORIZ	HORIZONTAL
ID	INSIDE DIAMETER
INCH	INCH
INFO	INFORMATION
INT	INTERIOR
L	LENGTH
MFG	MANUFACTURER
N	NORTH
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFI	OWNER FURNISHED OWNER INSTALLED
OFI	OWNER FURNISHED CONTRACTOR INSTALLED
OPP	OPPOSITE
OVHD	OVERHEAD
REV	REVISION
RCP	REFLECTED CEILING PLAN
S	SOUTH
SCHED	SCHEDULE
SECT	SECTION
SHT	SHEET
SIM	SIMILAR
SPEC	SPECIFICATION
STD	STANDARD
STR	STRUCTURE
TYP	TYPICAL
UNO	UNLESS OTHERWISE NOTED
W	WEST, WIDTH, OR WOOD
W/	WITH
W/O	WITHOUT
WP	WATERPROOF
XFMR	TRANSFORMER

GENERAL PROJECT NOTES	
1.	ALL INFORMATION PROVIDED ON THE LEGEND SHEET MAY NOT BE IMPLEMENTED INTO THE PROJECT.
2.	REFER TO FIXTURE CUT SHEETS AND SCHEDULE FOR COMPLETE FIXTURE INFORMATION.
3.	CONTRACTOR TO PROVIDE MATERIAL AND INSTALLATION, INCLUDING ALL REQUIRED CONDUIT, WIRE AND ANY MISCELLANEOUS MOUNTING HARDWARE FOR ALL EQUIPMENT DESIGNED AS PART OF THIS SCOPE AND NOT DEFINED AS OWNER FURNISHED.
4.	CONTRACTOR TO VERIFY EXACT MOUNTING LOCATION OF ALL LIGHT FIXTURES IN FIELD WITH LIGHTING DESIGNER PRIOR TO ROUGH IN.
5.	UNLESS OTHERWISE INDICATED, ALL MOUNTING BOXES FOR LIGHTING FIXTURES MOUNTED TO FACADES TO BE SURFACE MOUNTED TO STRUCTURE. COORDINATE JBOX LOCATION WITH OTHER TRADES.
6.	CONTRACTOR TO VERIFY CONDITIONS ON WHICH THIS WORK DEPENDS IN OTHER ISSUED CONSTRUCTION DRAWINGS AND ON SITE SUCH AS BUT NOT LIMITED TO: • DIMENSIONS • LEVELS • MATERIALS • DETAILS • AVAILABILITY OF REQUIRED UTILITIES.
7.	INFORM CONSTRUCTION MANAGER IN WRITING IN A TIMELY MANNER OF ANY DISCREPANCIES DISCOVERED.
8.	ELECTRICAL INSTALLATION SHALL COMPLY TO THE FLORIDA BUILDING CODE 5TH EDITION (2014) AND THE NATIONAL ELECTRICAL CODE (2011) AS ADOPTED BY THE FLORIDA BUILDING CODE, JUNE 30, 2015.
9.	ALL EQUIPMENT INSTALLED SHALL BE LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) and/or LISTED AND LABELED AS AN ASSEMBLY BY A NRTL. (ARTICLE 90.7, INFORMATIONAL NOTES 1.2 and 3).

MISCELLANEOUS	
REFERENCE NOTE	REFER TO "REFERENCE NOTES" ON DRAWING WHERE NOTE INDICATOR IS SHOWN
SECTION SYMBOL	SECTION DESIGNATION SHEET WHERE SECTION IS FOUND
ELEVATION SYMBOL	ELEVATION DESIGNATION SHEET WHERE ELEVATION IS FOUND
DETAIL SYMBOL	DETAIL DESIGNATION SHEET WHERE DETAIL IS FOUND
REVISION	SPECIFIC REVISION REVISED AREA

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
E0.000	ELECTRICAL TITLE SHEET
E0.001	ELECTRICAL LEGEND AND NOTES
E2.500	ELECTRICAL OVERALL CONCOURSE ROOF PLAN
E2.501	ELECTRICAL NORTH CONCOURSE ROOF PLAN 01
E2.502	ELECTRICAL NORTH CONCOURSE ROOF PLAN 02
E2.503	ELECTRICAL NORTH CONCOURSE ROOF PLAN 03
E2.504	ELECTRICAL NORTH CONCOURSE ROOF PLAN 04
E2.505	ELECTRICAL NORTH CONCOURSE ROOF PLAN 05
E2.506	ELECTRICAL NORTH CONCOURSE ROOF PLAN 06
E2.507	ELECTRICAL NORTH CONCOURSE ROOF PLAN 07
E2.508	ELECTRICAL NORTH CONCOURSE ROOF PLAN 08
E2.509	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 09
E2.510	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 10
E2.511	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 11
E2.512	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 12
E2.513	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 13
E2.514	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 14
E2.515	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 15
E2.516	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 16
E2.517	ELECTRICAL SOUTH CONCOURSE ROOF PLAN 17
E4.001	ELECTRICAL ENLARGED ROOMS
E5.001	LIGHTING CONTROL RISER DIAGRAM
E5.002	LIGHTING CONTROL VAULTED ROOF RISER DIAGRAM
E5.003	LIGHTING CONTROL VAULTED ROOF RISER DIAGRAM
E5.004	LIGHTING CONTROL VAULTED ROOF RISER DIAGRAM
E5.005	LIGHTING CONTROL VAULTED ROOF RISER DIAGRAM
E5.006	LIGHTING CONTROL COLUMN RISER DIAGRAM
E5.007	LIGHTING CONTROL COLUMN RISER DIAGRAM
E5.008	ELECTRICAL EXISTING RISER DIAGRAMS
E7.001	ELECTRICAL SECTION
E8.001	ELECTRICAL SCHEDULES
E9.001	ELECTRICAL ARCHED WINDOW LIGHTING DETAILS
E9.002	ELECTRICAL MOUNTING DETAILS
E9.003	ELECTRICAL DETAILS
LD9.001	LIGHTING DESIGN ARCHED WINDOW TINT DETAILS

GENERAL PROJECT DESCRIPTION	
A.	THE WORK CONSISTS OF THE FOLLOWING: 1. THIS PROJECT INVOLVES INSTALLATION OF NEW COLOR CHANGING, INTELLIGENT LIGHTING FIXTURES AT THE TOP OF THE BUILDING'S SCUPPER COLUMNS AND ON THE BACK OF THE VAULTED ARCHED SKYLIGHTS ON BOTH THE NORTH AND SOUTH CONCOURSE FACADES. THIS PROJECT ALSO INVOLVES THE INSTALLATION OF TINTED WINDOW FILM ON THE VAULTED ARCHED SKYLIGHTS ON BOTH THE NORTH AND SOUTH CONCOURSES. 2. TO ACCOMMODATE THE NEW LIGHT FIXTURES, CONTRACTOR SHALL PROVIDE CONDUIT FOR POWER AND DATA TO EACH OF THE LIGHTING LOCATIONS. 3. AT (59) SCUPPER COLUMN LOCATIONS, A NEW BRACKET ASSEMBLY TO HOLD (2) LIGHT FIXTURES SHALL BE PROVIDED BY OWNER AND INSTALLED BY CONTRACTOR. 4. LIGHT FIXTURES, BRACKET ASSEMBLIES AND ASSOCIATED CONTROL COMPONENTS WILL BE PROVIDED BY THE OWNER AND INSTALLED BY THE CONTRACTOR. ALL COMPONENTS INCLUDING LIGHT FIXTURES SHALL BE COMPLETELY WIRED, TERMINATED AND TESTED BY THE CONTRACTOR FOR THIS PROJECT PER DETAILED SHOP DRAWINGS AND INSTALLATION INSTRUCTIONS PROVIDED BY THE LIGHT FIXTURE SYSTEM MANUFACTURER. THE CONTRACTOR SHALL ENGAGE AN EXPERIENCED SUBCONTRACTOR FOR INSTALLATION, WIRING AND FINAL TESTING FOR ALL OF THE LIGHT FIXTURES. BELOW IS A LIST OF OWNER PROVIDED EQUIPMENT. SEE PART-2 OF THIS SPECIFICATION FOR OWNER'S EQUIPMENT DETAILED INFORMATION. FIXTURE BOM: A. QTY (124) TYPE A1, INCLUDES (6) SPARES. B. QTY (210) TYPE A2, INCLUDES (10) SPARES. C. QTY (88) BRACKEN DATA INJECTORS, INCLUDES (5) SPARES D. QTY (50) SCUPPER COLUMN MOUNTING BRACKETS E. QTY (12) XB 30-AWG14 CABLE AC US 100M F. QTY (334) ALLEGRO 5-WIRE FIELD INSTALLABLE CONNECTOR MALE, INCLUDES (16) SPARES. G. QTY (334) XB SHIELD AC 5-WIRE FIELD INSTALLABLE CONNECTOR FEMALE, INCLUDES 16 SPARES. H. QTY (88) 3/8" INCH INSTALL CONNECTOR F GREEN/WHITE, INCLUDES 5 SPARES. I. QTY (7) XB 30-AWG14 CABLE AC US 100M J. QTY (176) RJ45 FIELD INSTALLATION MALE CONNECTOR, INCLUDES 10 SPARES. K. QTY (4) ASSEMBLED OUTDOOR ENCLOSURE (SIGNAL BOOSTER/LIGHTNING TRAP ROM ISOLATOR) L. QTY (2) ROM ISOLATOR, INCLUDES 2 SPARES. M. QTY (4) DIN RAIL MOUNT UPS N. LIGHTING CONTROL RACKS O. QTY (4) ASSEMBLED, WALL MOUNTED ENCLOSURE W/ LOCKING DOOR (CONTROL EQUIPMENT / SURGE SUPPRESSION) P. QTY (4) RACK MOUNT SURGE SUPPRESSION Q. QTY (2) LIGHTING CONTROL ENGINE 2 R. QTY (1) BUTLER S2, INCLUDES 1 SPARE S. QTY (4) BUTLER GARAGE 2 T. QTY (2) 1 SPACE (1 3/4") RACKMOUNT 17" LED MONITOR WITH KEYBOARD AND TOUCH PAD AND 8 PORT KVM SWITCH U. QTY (4) RACKMOUNT UPS, 2200VA /1650W, 2 SPACE (3 1/2"), BLACK FINISH V. QTY (4) 300 SERIES 24 PORT SWITCH W. QTY (4) LONG 12 OUTLET, SINGLE 20 AMP CIRCUIT POWER STRIP W/CORD AND BLADE PLUG X. QTY (20) AC POWER CORD (US) 5. STRUCTURAL/ BUILDING MODIFICATIONS SHALL BE MADE AT THE TOP OF THE (59) SCUPPER COLUMNS (BOLT HOLES) AND TO THE BACK OF THE 16 ARCHES AND 4 SKYLIGHTS TO ACCOMMODATE THE NEW LIGHT FIXTURES. 6. ELECTRICAL POWER SHALL BE CONNECTED FROM EXISTING ELECTRICAL ROOMS AT THE PENTHOUSE LEVEL TO PROVIDE POWER TO THE NEW LIGHT FIXTURES. 7. NETWORK CONNECTIONS SHALL BE CONNECTED FROM EXISTING OF RACKS AT THE PENTHOUSE LEVEL VIA NEW DATA EQUIPMENT RACKS PROVIDED BY OWNER TO TRANSMIT DATA TO THE NEW PROJECTORS. 8. ALL WORK SHALL BE PERFORMED IN A MANNER AND SCHEDULED TO REDUCE DISRUPTION TO THE CONVENTION CENTER OPERATIONS. 9. THE WORK SHALL COMMENCE IN TWO PHASES WITH THE NORTH STARTING / FINISHING AND THEN SOUTH STARTING / FINISHING. 10. THE LIGHT SYSTEM MANUFACTURER, TRAXON, SHALL PROVIDE FACTORY PERSONNEL FOR THE SYSTEM COMMISSIONING AND PROGRAMMING. FACTORY PERSONNEL SHALL ATTEND (1) ON-SITE MEETINGS / VISITS (1) ONE AT COMMENCEMENT OF THE WORK ON THE NORTH SIDE TO ASSIST CONTRACTOR WITH A DETAILED WALKTHROUGH OF THE SYSTEM COMPONENTS AND WORK FLOW, (1) ONE AT THE SUBSTANTIAL COMPLETION OF WORK ON THE NORTH SIDE TO PROVIDE THE AFOREMENTIONED SYSTEM COMMISSIONING AND FACTORY TURN ON, AND (1) ONE FINAL TRIP AT THE SUBSTANTIAL COMPLETION OF WORK ON THE SOUTH SIDE TO PROVIDE THE AFOREMENTIONED SYSTEM COMMISSIONING AND FACTORY TURN ON. 11. THE FOLLOWING IS A LIST OF REQUIREMENTS FOR THE ELECTRICAL SUB-CONTRACTOR RESPONSIBLE FOR THE INSTALLATION OF THE LIGHTING SYSTEM. GENERAL CONTRACTOR SHALL ENGAGE A SUB-CONTRACTOR WITH THE FOLLOWING MINIMUM QUALIFICATIONS: A. SUB-CONTRACTOR SHALL HAVE A MINIMUM OF 10 YEARS EXPERIENCE INSTALLING INTELLIGENT LIGHTING SYSTEMS WITH DMA PROTOCOLS. B. SUB-CONTRACTOR SHALL HAVE EXPERIENCE WITHIN THE LAST 5 YEARS INSTALLING TRAXON LIGHTING SYSTEMS. 12. THE FOLLOWING IS A LIST OF REQUIREMENTS FOR THE WINDOW TINT SUB-CONTRACTOR RESPONSIBLE FOR THE INSTALLATION OF THE TINT ON THE ARCHED SKYLIGHTS. GENERAL CONTRACTOR SHALL ENGAGE A SUB-CONTRACTOR WITH THE FOLLOWING MINIMUM QUALIFICATIONS: A. SUB-CONTRACTOR SHALL HAVE A MINIMUM OF 10 YEARS EXPERIENCE INSTALLING SOLAR CONTROL FILMS IN COMMERCIAL APPLICATIONS WITH AT LEAST 5 YEARS EXPERIENCE INSTALLING SOLAR CONTROL FILMS IN COMMERCIAL APPLICATIONS OVER 40' ABOVE THE GROUND. B. SUB-CONTRACTOR SHALL HAVE A MINIMUM OF 50,000 SF OF EXPERIENCE INSTALLING SOLAR CONTROL FILMS IN COMMERCIAL APPLICATIONS WITH A MINIMUM OF 50,000 SF OF EXPERIENCE INSTALLING SOLAR CONTROL FILMS IN COMMERCIAL APPLICATIONS OVER 40' ABOVE THE GROUND.



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2016299.00	ACE
12/2/2016	KMS

10/17/2016	30% CONSTRUCTION DOCUMENTS
11/07/2016	60% CONSTRUCTION DOCUMENTS
12/02/2016	90% CONSTRUCTION DOCUMENTS
12/21/2016	100% BID DOCUMENTS
01/20/2017	AHJ REVIEW COMMENTS

ORANGE COUNTY  
 CONVENTION CENTER  
 NORTH-SOUTH BUILDING  
 EXTERIOR LIGHTING  
 ENHANCEMENTS

ELECTRICAL  
 LEGEND AND  
 NOTES

E0.001

# System No. C-AJ-1184

## XHEZ.C-AJ-1184

### Through-penetration Firestop Systems

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#### Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
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- Only products which bear UL's Mark are considered Certified.

#### XHEZ - Through-penetration Firestop Systems

#### XHEZ7 - Through-penetration Firestop Systems Certified for Canada

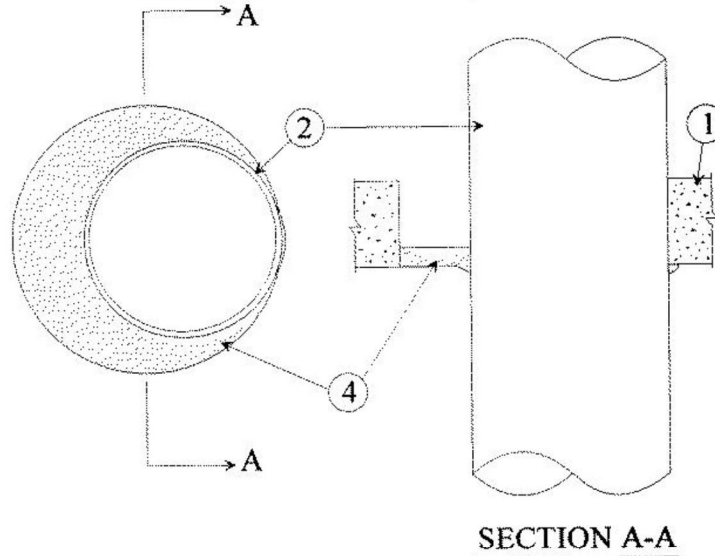
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

# System No. C-AJ-1184

January 07, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 3 Hr	F Rating — 3 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 3 Hr
	FTH Rating — 0 Hr



1. **Floor or Wall Assembly** — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Floor may also be constructed of any min 7-1/2 in. (190 mm) thick UL Classified hollow core **Precast Concrete Units\***. Max diam of opening is 14 in. (356 mm) when concrete floor or wall is used and max 7 in. (178 mm) when precast concrete units are used.

See **Concrete Blocks (CAZT)** and **Precast Concrete Units (CFTV)** categories in the Fire Resistance Directory for names of manufacturers.

2. **Through-Penetrants** — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe, conduit or tubing and periphery of opening shall be min 0 in. (point contact) to max 3-1/4 in. (83 mm). Pipe, conduit or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

- A. **Steel Pipe** — Nom 10 in. (254 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. **Iron Pipe** — Nom 10 in. (254 mm) diam (or smaller) cast or ductile iron pipe.
- C. **Conduit** — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or steel conduit.
- D. **Copper Tubing** — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing.
- E. **Copper Pipe** — Nom 4 in. (102 mm) diam (or smaller) regular (or heavier) copper pipe.

3. **Forms — (Not Shown, Optional)** — Used as a form to prevent leakage of fill material during installation. Forms to be rigid sheet material, cut to fit the contour of the penetrating item and positioned as required to accommodate the required thickness of fill material. Forms to be removed after fill material has cured. Additional forming material may be used concrete block wall is penetrated. A min 1/2 in. (13 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation is firmly packed into the annulus as a permanent form and recessed from both surfaces of the wall as required to accommodate the required thickness of fill material.

4. **Fill, Void or Cavity Material\* — Sealant** — Min 1 in. (25 mm) thickness of fill material applied within the annulus. At the point contact location between through penetrant and concrete, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the concrete through penetrant interface. When precast concrete units are used, the fill material shall be installed within annular space, flush with lower surface of floor. When concrete block wall is penetrated, a min 1 in. (25 mm) thickness of fill material shall be applied within the annulus flush with both surfaces of wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** — FS605, FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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ADD/REV A/R#-	ASI/RFI	DR BCS	CK BJL
DATE	01/20/2017	JOB NO #2016299.00	
SCALE	N/A	<b>E1</b>	
REFER TO SHEET NO	E9.003		



# System No. C-AJ-2630

## XHEZ.C-AJ-2630

### Through-penetration Firestop Systems

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#### Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
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- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

#### XHEZ - Through-penetration Firestop Systems

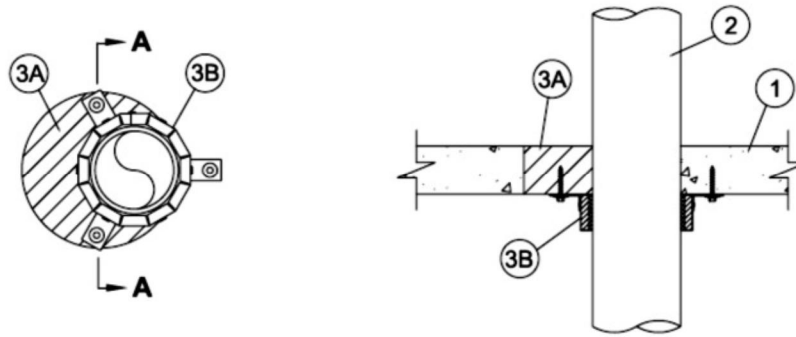
See General Information for Through-penetration Firestop Systems

# System No. C-AJ-2630

July 13, 2009

F Rating — 2 Hr

T Rating — 1-1/2 Hr



Section A-A

1. **Floor or Wall Assembly** — Min 2-1/2 in. (64 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening is 8 in. (203 mm).

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. **Through Penetrants** — One nonmetallic pipe to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe and opening shall be min 0 in. (point contact) to max 3-1/2 in. (89 mm). Pipe to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of nonmetallic pipes may be used:

- A. **Polyvinyl Chloride (PVC) Pipe** — Nom. 4 in. (102 mm) diam (or smaller) Schedule 40 solid-core or cellular core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.
- B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** — Nom 4 in. (102 mm) diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.
- C. **Acrylonitrile Butadiene Styrene (ABS) Pipe** — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
- D. **Flame Retardant Polypropylene (FRPP) Pipe** — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

3. **Firestop System** — The firestop system shall consist of the following:

A. **Fill, Void or Cavity Material\* - Mortar** — Min 2-1/2 in. (64 mm) thickness of fill material applied within the annulus between penetrant and periphery of opening, flush with bottom surface of floor or both surfaces of wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** — CP 637 Firestop Mortar

B. **Firestop Device\* — Firestop Collar** — Firestop collar to be sized for nom diam of penetrant and to be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the pipe and secured to the concrete and mortar (Item 3A) at underside of floor or both sides of wall using the anchor hooks provided with the collar. (Minimum 2 anchor hooks for 1-1/2 and 2 in. (38 and 51 mm) diam pipes, 3 anchor hooks for 3 and 4 in. (76 and 102 mm) diam pipes). The anchor hooks are to be secured to CP 637 mortar with min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long concrete screw anchors or Hilti 1/4 in. (6 mm) diam by 1-1/4 in. (32 mm) long KWIK-CON II+ concrete screw anchors. The anchor hooks are to be secured to concrete floor or wall with min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel expansion bolts or min 0.145 in. (3.7 mm) diam by 1-1/4 in. (32 mm) long powder actuated fasteners utilizing a 1-7/16 in. (36 mm) diam by 1/16 in. (1.6 mm) thick steel washer. As alternates to the anchors specified above for concrete, Hilti 1/4 in. (6 mm) diam by 1-1/4 in. (32 mm) long KWIK-CON II+ concrete screw anchor, or Hilti 1/4 in. (6 mm) diam by 1-3/4 in. (44 mm) long KWIK-BOLT 3 steel expansion anchor or Hilti X-DNI 27 P8 S15 powder actuated floor pin with integral nom 9/16 in. (14 mm) diam washer may be used.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** — CP 643 50/1.5"N, CP 643 63/2"N, CP 643 90/3"N, CP 643 110/4"N Firestop Collar

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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SCALE	N/A	E2	
REFER TO SHEET NO	E9.003		



# System No. C-AJ-5091

## XHEZ.C-AJ-5091

### Through-penetration Firestop Systems

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#### Design/System/Construction/Assembly Usage Disclaimer

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- Only products which bear UL's Mark are considered Certified.

#### XHEZ - Through-penetration Firestop Systems

#### XHEZ7 - Through-penetration Firestop Systems Certified for Canada

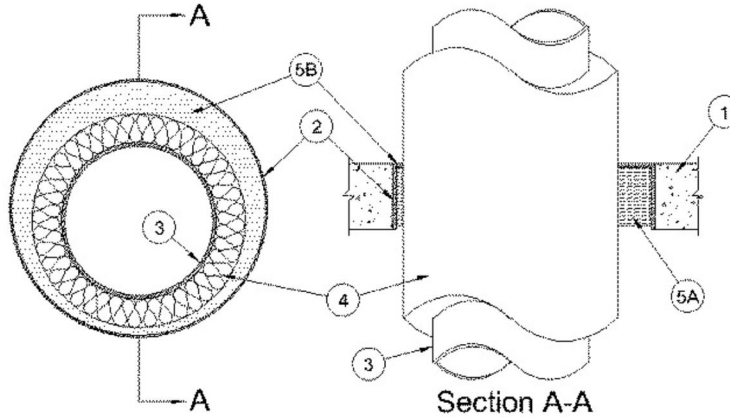
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

# System No. C-AJ-5091

January 13, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Ratings — 0 and 1 Hr (See Items 2 and 4)	FT Ratings — 0 and 1 Hr (See Items 2 and 4)
L Rating At Ambient — 4 CFM/sq ft	FH Rating — 2 Hr
L Rating At 400 F — Less Than 1 CFM/sq ft	FTH Ratings — 0 and 1 Hr (See Items 2 and 4)
	L Rating At Ambient — 4 CFM/sq ft
	L Rating At 400 F — Less Than 1 CFM/sq ft



**1. Floor or Wall Assembly** — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening is 29 in. (737 mm).

See **Concrete Blocks** (CAZT) category in the Fire Resistance directory for names of manufacturers.

**2. Metallic Sleeve** — (Optional) — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe sleeve cast or grouted into floor or wall assembly, flush with floor or wall surfaces or extending a max of 3 in. (76 mm) above floor or beyond both surfaces of wall. If the steel sleeve extends beyond the top surface of the floor or both surfaces of the wall, the T Rating of the firestop system is 0 hr.

**2A. Sheet Metal Sleeve** — (Optional) - Max 6 in. (152 mm) diam, min 26 ga galv steel provided with a 26 ga galv steel square flange spot welded to the sleeve at approximately mid- height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51 mm) larger than the sleeve diam. The sleeve is to be cast in place flush with bottom surface of floor and may extend a max of 1 in. (25 mm) above the top surface of the floor.

**2B. Sheet Metal Sleeve** — (Optional) - Max 12 in. (305 mm) diam, min 24 ga galv steel provided with a 24 ga galv steel square flange spot welded to the sleeve at approximately mid- height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51 mm) larger than the sleeve diam. The sleeve is to be cast in place flush with bottom surface of floor and may extend a max of 1 in. (25 mm) above the top surface of the floor.

**3. Through Penetrants** — One metallic pipe or tubing to be installed either concentrically or eccentrically within the firestop system. Pipe or tubing to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or tubing may be used:

- A. **Steel Pipe** — Nom 12 in. (305 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. **Iron Pipe** — Nom 12 in. (305 mm) diam (or smaller) cast or ductile iron pipe.
- C. **Copper Pipe** — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
- D. **Copper Tubing** — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.

**4. Pipe Covering** — Min 1/2 in. (13 mm) to max 2 in. (51 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m<sup>3</sup>) glass fiber units jacketed on the outside with an all-service jacket. Longitudinal joints sealed with metal fasteners or factory-applied, self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. The annular space between the insulated pipe and the edge of the periphery of the opening shall be min 1/2 in. (13 mm) to max 12 in. (305 mm). **When thickness of pipe covering is less than 2 in. (51 mm), the T Rating for the firestop system is 0 hr.**

See **Pipe Equipment Covering — Materials** — (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

**4A. Pipe Covering** — (Not Shown) — As an alternate to Item 4, max 2 in. (51 mm) thick cylindrical calcium silicate (min 14 pcf or 224 kg/m<sup>3</sup>) units sized to the outside diam of the pipe or tube may be used. Pipe insulation secured with stainless steel bands or min 18 AWG stainless steel wire spaced max 12 in. (305 mm) OC. The annular space shall be min 1/2 in. (13 mm) to max 12 in. (305 mm).

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SCALE	N/A	<b>E3</b>	
REFER TO SHEET NO	E9.003		

# System No. C-AJ-5320

## XHEZ.C-AJ-5320

### Through-penetration Firestop Systems

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#### Design/System/Construction/Assembly Usage Disclaimer

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#### XHEZ - Through-penetration Firestop Systems

#### XHEZ7 - Through-penetration Firestop Systems Certified for Canada

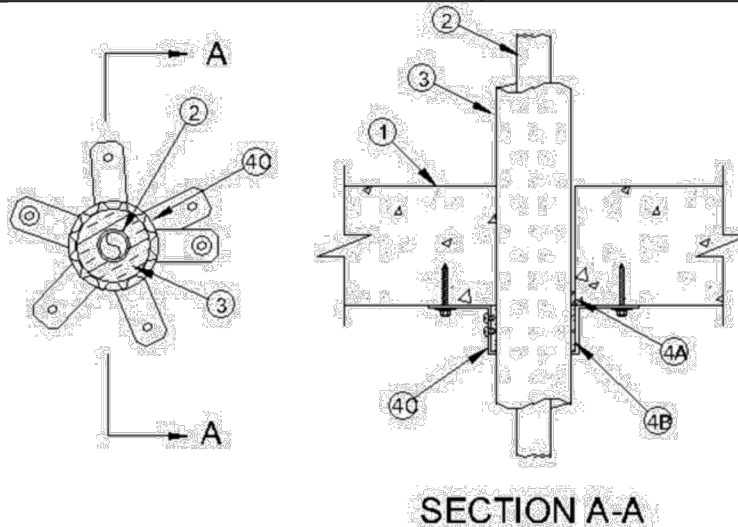
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

# System No. C-AJ-5320

January 13, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Rating — 2 Hr	FT Rating — 2 Hr
	FH Rating — 2 Hr
	FTH Rating — 2 Hr



1. **Floor or Wall Assembly** — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600 - 2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening is 7 in (178 mm).

See **Concrete Blocks (CAZT)** category in the Fire Resistance Directory for names of manufacturers.

2. **Through-Penetrant** — One nonmetallic pipe or conduit installed concentrically or eccentrically within the firestop system. Pipe to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of nonmetallic pipes may be used:

A. **Polyvinyl Chloride (PVC) Pipe** — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

B. **Chlorinated Polyvinyl Chloride (CPVC) Pipe** — Nom 4 in. (102 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.

3. **Pipe Insulation** — Required on pipes with nom diam of 1 in. (25 mm) or smaller. Nom 3/4 in. (19 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing with skin. Annular space between pipe insulation and periphery of opening to be min 0 in. (point contact) and max 3/16 in. (4.8 mm).

See **Plastics (QMFZ2)** category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL94 Flammability Classification of 94-SVA may be used.

3A. **Pipe Covering\*** — Required on pipes with nom diam greater than 1 in. (25 mm). Nom 1 in. (25 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 48 kg/m<sup>3</sup>) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. A nom annular space of min 0 in. (point contact) to max 1/2 in. (13 mm) is required within the firestop system.

See **Pipe and Equipment Covering - Materials (BRGU)** category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4. **Firestop System** — The firestop system shall consist of the following:

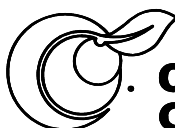
A. **Fill, Void or Cavity Material - Sealant\*** — Min 1/2 in. (13 mm) thickness of fill material applied within annulus, flush bottom surface of floor or both surfaces of wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** — FS-ONE Intumescent Sealant or FS-ONE MAX Intumescent Sealant

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**B. Fill, Void or Cavity Material\* – Wrap Strip** — Nom 3/16 in. (4.8 mm) thick by 1-3/4 in. (44 mm) wide intumescent wrap strip. The wrap strip is continuously wrapped around the outer circumference of the pipe covering one time for nom pipe diam of 1 in. (25 mm) or less and three times for nom pipe diams exceeding 1 in. (25 mm) with ends held in place with tape. When multiple wrap strips are used to achieve the required total length, the ends are to be butted end to end and held in place with tape. The bottom edge of the wrap strip shall be butted tightly against the bottom surface of the concrete floor. In walls, the wrap shall be installed on both surfaces of the wall such that the wrap strip is butted tightly against the surface on each side of the wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** — CP648-E Wrap Strip

**C. Steel Collar** — Steel collar fabricated from coils of precut min 0.016 in. (0.41 mm) thick (No. 28 gauge) galv steel available from fill material manufacturer. Collar shall be nom 1-3/4 in. (44 mm) deep with 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs on 1-3/4 in. (44 mm) centers for securement to bottom of floor or both surfaces of wall. The opposite side incorporates retainer tabs, 1/2 in. (13 mm) wide by 3/16 in. (4.8 mm) long, pre-bent toward the pipe surface. Collar shall be tightly wrapped over the wrap strip, overlapping min 1 in. (25 mm) at seam and held together by two #10 by 3/16 in. (4.8 mm) or 1/4 in. (6 mm) long sheet metal screws installed at the center of the 1 in. (25 mm) overlap. Optional securement of the collar may be accomplished with a nom 1/2 in. (13 mm) wide stainless steel hose clamp secured to the collar at its mid-height (not shown). Every other tab of collar (min of two anchor tabs for pipe diams of 1 in. (25 mm) or less) secured to bottom of floor or both surfaces of wall with min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel expansion bolts or min 0.145 in. (3.7 mm) diam by 1-1/4 in. (32 mm) long powder actuated fasteners utilizing a 1-7/16 in. (36 mm) diam by 1/16 in. (1.6 mm) thick steel washer or Hilti 1/4 in. (6 mm) diam by 1-1/4 in. (32 mm) long KWIK-CON II+ concrete screw anchor, or Hilti 1/4 in. (6 mm) diam by 1-3/4 in. (44 mm) long KWIK-BOLT 3 steel expansion anchor or Hilti X-DNI 27 P8 S15 powder actuated floor pin with integral nom 9/16 in. (14 mm) diam washer.

**\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2015-01-13

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# System No. C-AJ-2007

## XHEZ.C-AJ-2007

### Through-penetration Firestop Systems

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- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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#### XHEZ - Through-penetration Firestop Systems

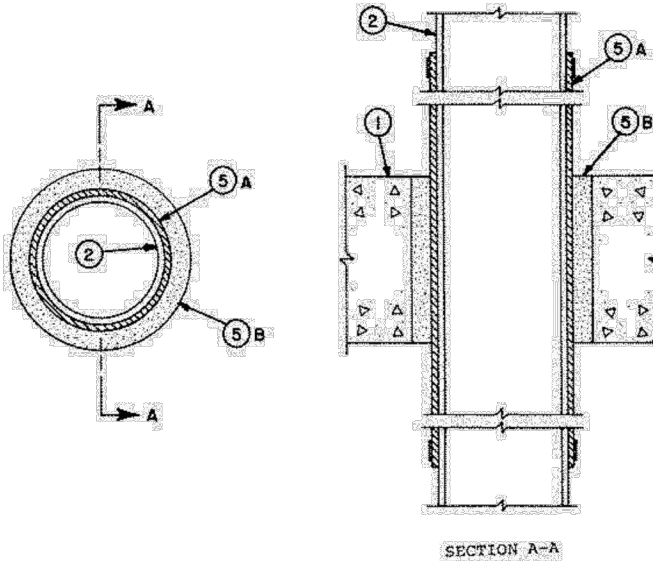
[See General Information for Through-penetration Firestop Systems](#)

## System No. C-AJ-2007

January 06, 2010

**F Rating — 2 Hr**

**T Rating — 2 Hr**



1. **Floor or Wall Assembly** — Min 3-3/4 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Max diam of opening is 3-1/2 in.
  2. **Rigid Nonmetallic Conduit+ or Electrical Nonmetallic Tubing+** — Max 2 in. diam rigid nonmetallic conduit (Schedule 40 or Schedule 80) or max 1 in. diam electrical nonmetallic tubing centered in the opening and rigidly supported on both sides of assembly.
- See **Rigid Nonmetallic Conduit** (DZKT) or **Electrical Nonmetallic Tubing** (FKHU) categories in the Electrical Construction Materials Directory for names of manufacturers.

The size of the opening is dependent upon the diam and type of penetrating item as shown below:

Type of Penetrating Item		Penetrating Item Identification	
Rigid Nonmetallic Conduit		A	
Electrical Nonmetallic Tubing		B	
Diam of Penetrating Item In.	Penetrating Item Identification	Diam of Opening In.	
1/2	A and B	2	
3/4	A and B	2-1/4	
1	A and B	2-1/2	
1-1/4	A	3	
1-1/2	A	3	
2	A	3-1/2	

3. **Forms** — (Not Shown, Optional) — Used as a form to prevent leakage of fill material during installation. Forms to be rigid sheet material, cut to fit the contour of the penetrating item and fastened to the underside of floor or both sides of wall. Forms to be removed after fill material has cured.
4. **Packing Material** — (Not Shown) — Mineral wool batt insulation firmly packed between the forms and the penetrating item to prevent the leakage of fill material while in a liquid state.
5. **Firestop System** — The firestop system shall consist of the following:
  - A. **Fill, Void or Cavity Material\* — Blanket** — Blanket tightly wrapped twice around the penetrating item. Each wrap of blanket shall extend a min of 6 in. from each surface of the assembly. The blanket shall be secured to the penetrating item by means of steel hose clamps. If the nom diam of the penetrating item (Item 2) is 1 in. or smaller, the blanket is optional.

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**B. Fill, Void or Cavity Material\* – Wrap Strip** – Nom 3/16 in. (4.8 mm) thick by 1-3/4 in. (44 mm) wide intumescent wrap strip. The wrap strip is continuously wrapped around the outer circumference of the pipe covering one time for nom pipe diam of 1 in. (25 mm) or less and three times for nom pipe diams exceeding 1 in. (25 mm) with ends held in place with tape. When multiple wrap strips are used to achieve the required total length, the ends are to be butted end to end and held in place with tape. The bottom edge of the wrap strip shall be butted tightly against the bottom surface of the concrete floor. In walls, the wrap shall be installed on both surfaces of the wall such that the wrap strip is butted tightly against the surface on each side of the wall.

**HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC** – CP648-E Wrap Strip

**C. Steel Collar** – Steel collar fabricated from coils of precut min 0.016 in. (0.41 mm) thick (No. 28 gauge) galv steel available from fill material manufacturer. Collar shall be nom 1-3/4 in. (44 mm) deep with 1 in. (25 mm) wide by 2 in. (51 mm) long anchor tabs on 1-3/4 in. (44 mm) centers for securement to bottom of floor or both surfaces of wall. The opposite side incorporates retainer tabs, 1/2 in. (13 mm) wide by 3/16 in. (4.8 mm) long, pre-bent toward the pipe surface. Collar shall be tightly wrapped over the wrap strip, overlapping min 1 in. (25 mm) at seam and held together by two #10 by 3/16 in. (4.8 mm) or 1/4 in. (6 mm) long sheet metal screws installed at the center of the 1 in. (25 mm) overlap. Optional securement of the collar may be accomplished with a nom 1/2 in. (13 mm) wide stainless steel hose clamp secured to the collar at its mid-height (not shown). Every other tab of collar (min of two anchor tabs for pipe diams of 1 in. (25 mm) or less) secured to bottom of floor or both surfaces of wall with min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel expansion bolts or min 0.145 in. (3.7 mm) diam by 1-1/4 in. (32 mm) long powder actuated fasteners utilizing a 1-7/16 in. (36 mm) diam by 1/16 in. (1.6 mm) thick steel washer or Hilti 1/4 in. (6 mm) diam by 1-1/4 in. (32 mm) long KWIK-CON II+ concrete screw anchor, or Hilti 1/4 in. (6 mm) diam by 1-3/4 in. (44 mm) long KWIK-BOLT 3 steel expansion anchor or Hilti X-DNI 27 P8 S15 powder actuated floor pin with integral nom 9/16 in. (14 mm) diam washer.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Last Updated on 2015-01-13

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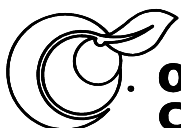
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# System No. C-AJ-1361

## XHEZ.C-AJ-1361

### Through-penetration Firestop Systems

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#### Design/System/Construction/Assembly Usage Disclaimer

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- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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### XHEZ - Through-penetration Firestop Systems

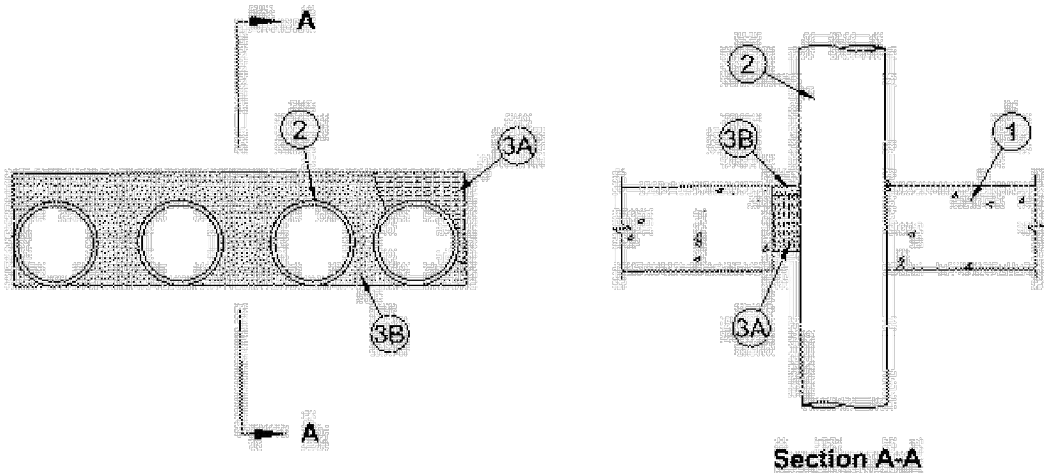
[See General Information for Through-penetration Firestop Systems](#)

# System No. C-AJ-1361

October 05, 2000

**F Rating — 2 Hr**

**T Rating — 0 and 1/4 Hr (See Item 2)**



1. **Floor or Wall Assembly** — Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete floor. Floor may also be constructed of any min 6 in. thick hollow-core **Precast Concrete Units\***. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max area of opening is 144 sq in. with a max diam of 24 in. Max area of opening in floors constructed of hollow-core concrete is 49 sq in. with a max diam of 7 in.

See **Concrete Blocks (CAZT)** or **Precast Concrete Units (CFTV)** categories in the Fire Resistance Directory for names of manufacturers.

2. **Through Penetrants** — One or more pipes, conduits or tubing to be installed within the opening. The space between the pipes, conduits or tubes shall be min 1 in. to max 2 in. The annular space between the pipes, conduits or tubing and the periphery of the opening shall be min 0 in. (point contact) to max 2 in. Pipes, conduits or tubing to be

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rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

- A. **Steel Pipe** — Nom 4 in. diam (or smaller) Schedule 5 (or heavier) steel pipe.
- B. **Iron Pipe** — Nom 4 in. diam (or smaller) cast or ductile iron pipe.
- C. **Conduit** — Nom 4 in. diam (or smaller) rigid steel conduit, steel electrical metallic tubing (EMT) or flexible aluminum or steel conduit.
- D. **Copper Pipe** — Nom 4 in. diam (or smaller) regular (or heavier) copper pipe.
- E. **Copper Tube** — Nom 4 in. diam (or smaller) Type L (or heavier) copper tube.

**When Through Penetrant A, B or C is used, the T Rating is 1/4 hr. When Through Penetrant D or E is used, the T Rating is 0 Hr.**

3. **Firestop System** — The firestop system shall consist of the following:

A. **Packing Material** — Min 4 pcf mineral wool batt insulation compressed and tightly packed to min 3 in. thickness. Packing material recessed from top surface of floor or both surfaces of wall or precast concrete unit as required to accommodate fill material (Item 3B).

B. **Fill, Void or Cavity Material\*-Sealant** — Min 1/2 in. thickness of fill material applied within annulus, flush with top surface of floor assembly or both surfaces of wall assembly. In floors constructed of hollow-core precast concrete, fill material installed symmetrically on both sides of floor assembly. At point contact locations, min 1/4 in. diam bead of fill material applied at metallic pipe/concrete interface on top surface of floor or on both surfaces of wall or precast concrete units.

**SPECIFIED TECHNOLOGIES INC** — SpecSeal LCI Sealant

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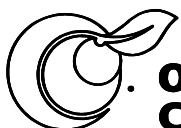
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# System No. C-AJ-2236

## XHEZ.C-AJ-2236

### Through-penetration Firestop Systems

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- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
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#### XHEZ - Through-penetration Firestop Systems

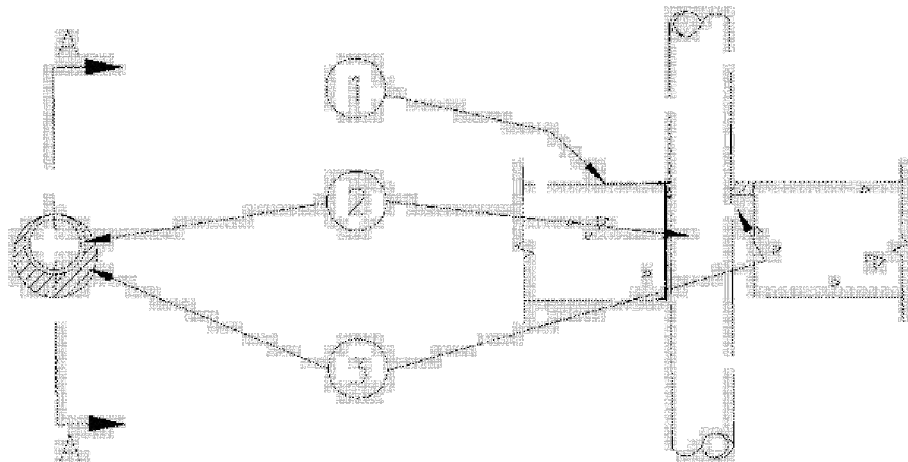
[See General Information for Through-penetration Firestop Systems](#)

# System No. C-AJ-2236

November 27, 2001

**F Rating — 2 Hr**

**T Rating — 2 Hr**



**SECTION A-A**

**1. Floor or Wall Assembly** — Min 4-1/2 in. thick lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening is 3 in.

See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

**2. Through Penetrant** — Nom 2 in. diam (or smaller) SDR 11 chlorinated polyvinyl chloride (CPVC) pipe or Schedule 40 solid core polyvinyl chloride (PVC) pipe for use in closed (process or supply) piping systems. One pipe to be installed either concentrically or eccentrically within the firestop system. The annular space between pipe and periphery of opening shall be min 3/8 in. to max 1/2 in. Pipe to be rigidly supported on both sides of floor or wall assembly.

**3 Fill, Void or Cavity Material\*** — Sealant — Min 1 in. thickness of fill material applied within annulus, flush with top surface of floor or both surfaces of wall.

**JOHNS MANVILLE** — Firetemp(TM) CI

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REFER TO SHEET NO	E9.003		





# System No. C-AJ-5029

## XHEZ.C-AJ-5029

### Through-penetration Firestop Systems

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#### XHEZ - Through-penetration Firestop Systems

#### XHEZ7 - Through-penetration Firestop Systems Certified for Canada

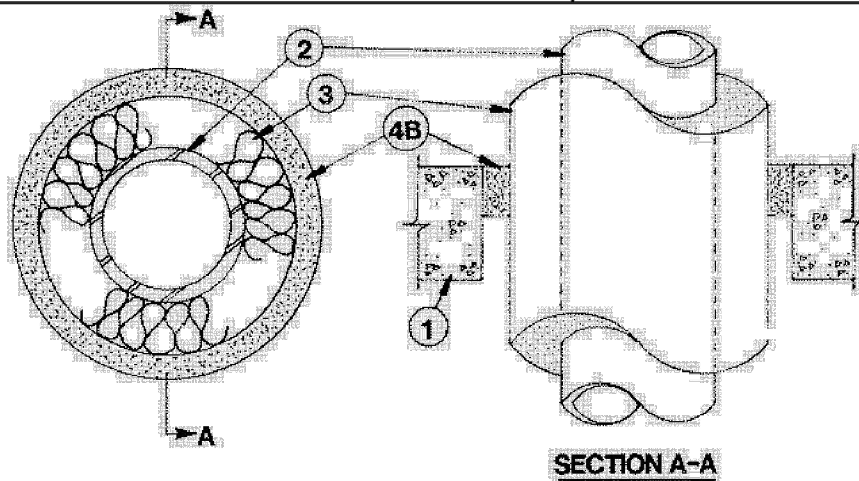
[See General Information for Through-penetration Firestop Systems](#)

[See General Information for Through-penetration Firestop Systems Certified for Canada](#)

# System No. C-AJ-5029

August 18, 2011

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating - 3 Hr	F Rating - 3 Hr
T Rating - 1 Hr	FT Rating - 1 Hr
	FH Rating - 3 Hr
	FTH Rating - 1 Hr



1. **Floor or Wall Assembly** — Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening is 12 in.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. **Steel Pipe** — Nom 6 in. diam (or smaller) Schedule 10 (or heavier) steel pipe. One pipe to be centered within the firestop system. Pipe to be rigidly supported on both sides of floor or wall assembly.

3. **Pipe Covering\*** — Nom 2 in. thick hollow cylindrical heavy density (min 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. A nom annular space of 11/16 in. is required within the firestop system.

See **Pipe and Equipment Covering-Materials** (BRGU) category in the Building Materials Directory for names of manufacturers Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4. **Firestop System** — The firestop system shall consist of the following:

A. **Packing Material** — (Not shown, Optional) — Min 2 in. thickness of min 6 pcf mineral wool batt insulation firmly packed into opening. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material. The packing material may be removed after the fill material cures.

B. **Fill, Void or Cavity Material\*** — **Caulk** — Min 2 in. thickness of fill applied within the annulus, flush with top surface of floor or with both surfaces of wall.

**SPECIFIED TECHNOLOGIES INC** — SpecSeal 100, 101, 102 or 105 Sealant

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

exp U.S. Services Inc.  
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## Orange County Convention Center

### Orlando, FL

ADD/REV A/R#-	ASI/RFI	DR BCS	CK BJL
DATE	01/20/2017	JOB NO #2016299.00	
SCALE	N/A	<h1 style="font-size: 2em;">E8</h1>	
REFER TO SHEET NO	E9.003		



# System No. C-AJ-5225

## XHEZ.C-AJ-5225

### Through-penetration Firestop Systems

Page Bottom

#### Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

#### XHEZ - Through-penetration Firestop Systems

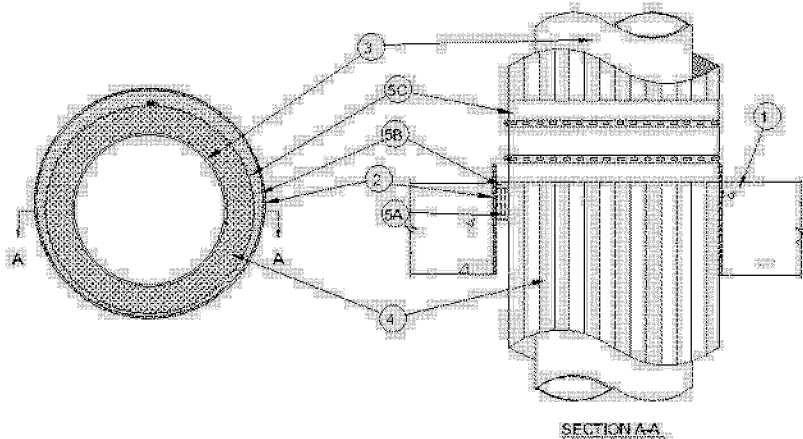
See General Information for Through-penetration Firestop Systems

# System No. C-AJ-5225

March 23, 2016

F Rating — 2 Hr

T Rating — 3/4 Hr



1. **Floor or Wall Assembly** — Min 4-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Floor assembly may also be constructed of any min 6 in. thick UL Classified hollow-core **Precast Concrete Units\***. Wall may also be constructed of any UL Classified **Concrete Blocks\***. Max diam of opening 28 in. Max diam of opening in floors constructed of hollow-core concrete is 7 in.

See **Concrete Blocks (CAZT)** and **Precast Concrete Units (CFTV)** categories in Fire Resistance Directory for names of manufacturers.

2. **Steel Sleeve** — (Optional)- Nom 28 in. diam (or smaller) cylindrical sleeve formed from min 1/8 in. thick uncoated steel. Length of steel sleeve to be 1-1/2 in. greater than thickness of floor or 3 in. greater than thickness of wall. Steel sleeve to project 1-1/2 in. beyond top surface of floor or both sides of wall.

3. **Through Penetrants** — One metallic pipe or tubing to be installed concentrically or eccentrically within opening. Penetrant to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or tubes may be used:

- A. **Steel Pipe** — Nom 20 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
- B. **Iron Pipe** — Nom 20 in. diam (or smaller) cast or ductile iron pipe.
- C. **Copper Tubing** — Nom 6 in. diam (or smaller) Type L (or heavier) copper tube.
- D. **Copper Pipe** — Nom 6 in. diam (or smaller) Regular (or heavier) copper pipe.

4. **Pipe Covering Cellular Glass Insulation** — Nom 2 or 3 in. thick cellular glass units sized to the outside diam of the pipe and supplied in nom 24 in. long half sections or nom 18 in. long segments. Pipe insulation installed on pipe in accordance with the manufacturer's instructions. The annular space between pipe insulation and edge of opening shall be min 0 in. (point contact) to max 2 in.

5. **Firestop System** — The firestop system shall consist of the following:

A. **Packing Material** — Min 2 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material. In floors constructed of hollow-core concrete, packing material to be recessed from top and bottom surfaces of floor as required to accommodate the required thickness of fill material.

B. **Fill, Void or Cavity Materials\* - Caulk** — Min 1/2 in. thickness of caulk applied within the annulus, flush with top surface of floor or with both surfaces of wall. In floors constructed of hollow-core concrete, min 1/2 in. thickness of caulk applied within the annulus, flush with top and bottom surfaces of floor.

**RECTORSEAL** — Biostop 500+

C. **Metal Jacket** — (Optional) Min 12 in. long jacket formed of min 0.010 in. thick aluminum sheet cut to wrap tightly around the pipe insulation with a min 2 in. lap and secured using stainless steel hose clamps. Hose clamps to be located within 2 in. of each end of the jacket and spaced max 8 in. OC. Jacket to be installed with edge abutting surface of caulk on top surface of floor or both surfaces of wall. Metal jacket to be used in addition to any other jacketing material which may be required or desired on the pipe insulation.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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