SECTION 07 84 13 PENETRATION FIRESTOPPING

Note to specifier: This specification section covers only "Through-Penetration Firestop Systems." Most projects require protection of "Fire-resistive construction joints" as well; a companion section 07 84 43 "Joint Firestopping" should be issued in addition.

Should a Division 7 Specification Section for Firestop Systems not accompany the Project Manual, the Mechanical or Electrical Engineer may utilize this Specification Section and number it within a Division 21, 22, 23, or 26 Specification for "Through-Penetration Firestop Systems".

PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS
 - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.
- 1.02 DEFINITIONS
 - A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Blank openings through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- C. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- D. Openings around structural members which penetrate floors or walls.
- 1.04 RELATED WORK OF OTHER SECTIONS
 - A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
 - 1. Section 03 30 00 Cast-In-Place Concrete
 - 2. Section 04 20 00 Unit Masonry
 - 3. Section 07 84 43 Joint Firestopping
 - 4. Section 07 90 00 Joint Protection
 - 5. Section 09 20 00 Plaster and Gypsum Board
 - 6. Section 09 29 00 Gypsum Board
 - 7. Section 13 48 00 Sound, Vibration and Seismic Control
 - 8. Section 21 00 00 Fire Suppression
 - 9. Section 22 00 00 Plumbing
 - 10. Section 23 00 00 Heating, Ventilating, and Air Conditioning
 - 11. Section 26 00 00 Electrical

12. Section 27 00 00 - Communications

1.05 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
 - 1. UL Fire Resistance Directory:
 - a. Firestop Devices (XHJI)
 - b. Fire Resistance Ratings (BXRH)
 - c. Through-Penetration Firestop Systems (XHEZ)
 - d. Fill, Voids, or Cavity Material (XHHW)
 - e. Forming Materials (XHKU)
- D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- E. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- G. All major building codes: ICBO, SBCCI, BOCA, IBC and Building Code of the City of New York.

Note to specifier: Retain or delete building codes listed above as applicable

- H. NFPA 101 Life Safety Code
- I. NFPA 70 National Electric Code

1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems that comply with specified requirements of tested systems.
- B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for

their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.
- B. Submit copy of the City of New York Department of Buildings MEA Division Report for the firestop materials submitted. MEA Division Report shall list the tested firestop system number within the report for tested systems.

Note to specifier: Retain or delete MEA Division Report submittal requirements as set forth per Building Code of the City of New York if not applicable

- C. Manufacturer's engineering judgment identification number and drawing details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- D. Submit safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

Note to specifier: Add Sections B and C if a firestop specialty contractor is required to firestop the entire project or a portion of it.

- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in project to a single sole source firestop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:

FM 4991 Approved Contractor UL Approved Contractor Hilti Accredited Fire Stop Specialty Contractor

D. Firm with not less than 3 years experience with fire stop installation.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

- 2.01 FIRESTOPPING GENERAL
 - A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
 - B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
 - C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
 - D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

Note to specifier: Retain or delete W-rating listed below if horizontal assemblies require water resistance. W-ratings are not required by the 2006 IBC.

3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of zero (0) as determined by ASTM G21.

Note to Specifier: **Mold Resistance -** On a rating scale from zero to four (0-4), a value of zero (0) indicates No Growth observed; a value of one (1) indicates Traces of Growth observed (less than 10%); a value of four (4) indicates Heavy Growth (60% to complete coverage)

- G. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.
- 2.02 ACCEPTABLE MANUFACTURERS
 - A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturer as identified below:
 - 1. Basis of Design: Hilti, Inc., Plano, Texas 800-879-8000 www.us.hilti.com
 - 2. Substitution requests shall be considered in accordance with contract provisions and the performance requirements outlined in this document.

2.03 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-formed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors the following products are acceptable:
 - 1. Hilti Cast-In Place Firestop Device (CP 680-P)
 - a. Add Aerator Adaptor when used in conjunction with aerator system.
 - 2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - 3. Hilti Cast-in Place Firestop System for Metal Decks (CFS CID MD P) including all components as described by manufacturer for proper installation.
 - 4. Hilti Cast-in Place Firestop System for Metal Decks (CFS CID MD M) including all components as described by manufacturer for proper installation, for use with noncombustible penetrants.
 - 5. Hilti Tub Box Kit (CP 681) for use with tub installations.
 - 6. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
 - 7. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - 8. Hilti Firestop Block (CFS-BL)

- 9. Hilti Closet Stub (CFS-CID CS)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - 2. Hilti Fire Foam (CP 620)
 - 3. Hilti Flexible Firestop Sealant (CP 606)
 - 4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - 5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - 1. Hilti Silicone Sealant Gun Grade (CFS-S SIL GG)
 - 2. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - 3. Hilti Flexible Firestop Sealant (CP 606)
 - 4. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- F. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - 2. Hilti Fire Foam (CP 620)
 - 3. Hilti Flexible Firestop Sealant (CP 606)
 - 4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - 5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
- G. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - 1. Hilti Firestop Putty Stick (CP 618)
 - 2. Hilti Firestop Plug (CFS-PL)
- H. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
 - 1. Hilti Firestop Putty Pad (CFS-P PA)
 - 2. Hilti Firestop Putty Pad (CP 617)
 - 3. Hilti Firestop Box Insert
- I. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 - 1. Hilti Firestop Collar (CP 643N)
 - 2. Hilti Firestop Collar (CP 644)
 - 3. Hilti Wrap Strips (CP 648-E/648-S)

- J. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti Firestop Block (CFS-BL)
 - 2. Hilti Composite Sheet (CFS-COS)
 - 3. Hilti Firestop Mortar (CP 637)
 - 4. Hilti Fire Foam (CP 620)
 - 5. Hilti Firestop Board (CP 675T)
- K. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - 1. Hilti Firestop Block (CFS-BL)
 - 2. Hilti Firestop Board (CP 675T)
- L. Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:
 - 1. Hilti Firestop Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - 2. Hilti Firestop Cable Collar (CFS-CC)
 - 3. Hilti Firestop Sleeve (CFS-SL SK)
 - 4. Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - 5. Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - 6. Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
- M. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits or cables is expected, the following products are acceptable:
 - 1. Hilti Firestop Block (CFS-BL)
 - 2. Hilti Firestop Plug (CFS-PL)
- N. For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies the following product is acceptable:
 - 1. Hilti Firestop Cable Disc (CFS-D)

PART 3 - EXECUTION

- 3.01 PREPARATION
 - A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

- 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 109, International Building Code 2000, ed.

3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
 - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 - 3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- B. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- E. Manufacturer's Field Services: Contractor to ensure a manufacturer's direct representative is on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. Training will be done per manufacturer's written recommendations published in their literature and drawing details.

During installation, contractor shall have manufacturer's representative provide periodic visual observations and written documentation of the results. Contact Hilti for support at 800.879.8000.

3.05 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- A.1 The Documentation Form for through penetrations is to include:
 - 1. A Sequential Location Number
 - 2. The Project Name
 - 3. Date of Installation
 - 4. Detailed Description of the Penetration's Location
 - 5. Tested System or Engineered Judgment Number
 - 6. Type of Assembly Penetrated
 - 7. A Detailed Description of the Size and Type of Penetrating Item
 - 8. Size of Opening
 - 9. Number of Sides of Assemblies Addressed
 - 10. Hourly Rating to be Achieved
 - 11. Installer's Name
- B. Copies of these documents are to be provided to the general contractor at the completion of the project.
- C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - 1. The words: "Warning: Through Penetration Firestop System Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address and phone number.
 - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Through-penetration firestop system manufacturer's name.
 - 6. Installer's name.
- D. A firestop documentation manager software shall be used to document, track, and maintain the passive firestop systems throughout the construction and maintenance phase of the facility. The software solution shall be used to track and document every firestop system installed on the project and each subsequent addition, change, or removal of the firestop system. The firestop documentation shall be managed with a cloud-based software which allows the installer to use a standard smartphone or tablet device (either iOS, Android or Windows capable) to capture the relevant information for the installation. The following data shall be tracked for each penetration within the facility: product installed, system installed, date of installation, location of the penetration including a notation on the 2D plan image, F-rating, name of installer, photo (pre-installation and post-installation), and inspection status. The Owner and/ or Construction Manager may designate additional items to be tracked. The firestop documentation manager software must perform the following basic functions:

- 1. Create multiple projects/ facilities, add/create/ remove users for each project, upload documents including UL systems, 2D floor plans, product data, engineering judgments, etc.
- 2. Define data to track using pre-defined input fields or creating custom input fields as desired.
- 3. Capture multiple photos for each penetration, including a pre-installation and post-installation photo.
- 4. Scan QR Code on Hilti identification label to link the program data to a specific penetration location.
- 5. Annotate (mark) location of penetration on 2D floor plan.
- 6. Create reports by filtering data and utilizing report templates.
- 7. Online/ offline (for use in areas where data service is unavailable) synchronization of data between mobile device, online application and cloud-based system.
- 8. Ability to transfer ownership of projects from one customer to another from construction phase to facility maintenance.

Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove or change penetrating items or firestopping. Labels shall have a unique QR code for each penetration which can be scanned by the firestop documentation software to quickly identify the penetration attributes.

Acceptable Software: Hilti CFS-DM, from Hilti Inc., Tulsa, OK. Tel (800) 879-8000 or Hilti (Canada) Corporation, Mississauga, Ontario (800) 363-4458 website: www.us.hilti.com or www.hilti.ca.com

- 1. Substitutions: Not permitted.
- 2. Single Source: Obtain firestop documentation manager software and firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

3.05 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.
- 3.06 LABOR USE TO INSTALL FIRESTOP SYSTEMS
 - A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.
- 3.07 SCHEDULE OF THROUGH PENETRATION FIRESTOP SYSTEMS

	CONCRET	E FLOORS		CONCRETE	OR BLOCK WALLS
TYPE OF PENETRANT	F- RATING (HR)	BASIS OF DESIGN UL SYSTEM	TYPE OF PENETRANT	F- RATING (HR)	BASIS OF DESIGN UL SYSTEM
	1	F-A-0006, C-AJ-0055, C-AJ-0090	CIRCULAR BLANK	1	C-AJ-0055, C-AJ-0090
OPENINGS	2	F-A-0006, C-AJ-0055, C-AJ-0090	OPENINGS	2	C-AJ-0055, C-AJ-0090
	3	F-A-0006, C-AJ-0055, C-AJ-0086,		3	C-AJ-0055, C-AJ-0086
	1	C-AJ-1226, F-A-1028, F-A-1017		1	C-AJ-1226, W-J-1067, W-J-1020
SINGLE METAL PIPES OR	2	C-AJ-1226, F-A-1028, F-A-1017	SINGLE METAL PIPES OR	2	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248
CONDUIT	3	C-AJ-1226, F-A-1017	CONDUIT	3	C-AJ-1226, W-J-1041, W-J-1068
	4	C-BJ -1037, C-BJ-1034		4	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2053, F-A-2025, C-AJ-2109, C-AJ- 2098, C-AJ-2271, C-AJ-2167,	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342
	2	C-AJ-2098, C-AJ-2271, C-AJ-2167, C- BJ-2021, C-AJ-2371, C-AJ-2342		2	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342
	3	F-A-2054, C-AJ-2109, C-AJ-2098, C- AJ-2371, C-AJ-2342		3	C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342
	4	C-BJ 2016, C-AJ-2017		4	W-J-2057, W-J-2091
	1	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ- 3283	SINGLE/CABLE BUNDLES	1	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
SINGLE/CABLE BUNDLES	2	F-A-3007,C-AJ-3095,C-AJ-3334, F-A- 3060		2	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167, W-J-3189
	3	F-A-3007, C-AJ 3095, C-AJ-3285		3 4	C-AJ-3095, C-AJ-3180, W-J-3167 W-J-3050
	1	C-AJ-4034, C-AJ-4035	CABLE TRAY	1	W-J-4027, C-AJ-4034, C-AJ-4035
CABLE TRAY	2	C-AJ-4034, C-AJ-4035		2	W-J-4027, C-AJ-4034, C-AJ-4035
0.222	3	C-AJ-4034. C-AJ-4035		3	C-AJ-4034, C-AJ-4035
	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-	SINGLE INSULATED	4	W-J-8007 C-A.I-5090 C-A.I-5091 C-A.I 5061 W- I-5042
SINGLE INSULATED	2	5091, C-AJ-5090, C-AJ-5048 F-A 5015, F-A 5017, C-AJ-5090, C-AJ-		2	C-A I-5090 C-A I-5091 C-A I-5061 W- I-5042
PIPES	2	5091, C-AJ-5090	PIPES	Z	0-A3-3030, 0-A3-3031, 0-A3-3001, 10-3-3042
	3	F-A 5016, C-AJ-5090, F-A-5018		3	C-AJ-5090, C-AJ-5061
	4	C-BJ-5006		4	C-BJ-5006, W-J-5028
	1	C-AJ-6006, C-AJ-6017, F-A-6002, C- AJ-6036	ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, C-AJ-6036
ELECTRICAL BUSWAY	2	C-AJ-6006, C-AJ-6017, F-A 6042, C- AJ-6036		2	C-AJ-6006, C-AJ-6017, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017		3	C-AJ-6006, C-AJ-6017
MECHANICAL	1	C-AJ-7046, C-AJ-7051, C-AJ-7084	MECHANICAL	1	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	2	C-AJ-7046, C-AJ-7051, C-AJ-7085		2	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
NON-INSULATED	3	C-AJ-7046, C-AJ-7051	NON-INSULATED	3	C-AJ-7046, C-AJ-7051
MECHANICAL	N1/A **	N1/A **	MECHANICAL	1	W-J-7029, W-J-7124
DUCTWORK WITHOUT DAMPERS INSULATED	N/A**	N/A***	DOCTWORK WITHOUT DAMPERS INSULATED	2	W-J-7091, W-J-7112, W-J-7124
	1	C-AJ 8099, C-AJ-8056, C-AJ-8143		1	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
MIXED PENETRANTS	2	C-AJ-8099, C-AJ-8056, C-AJ-8143	MIXED PENETRANTS	2	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	3	C-AJ-8099, C-AJ-8056		3	C-AJ 8041, C-AJ 8056, W-J 8007, C-AJ 8099
		C-AJ-6095		- 4 GVP	C-AJ 8095, W-J 8007
TYPE OF PENETRANT	F- RATING	BASIS OF DESIGN UL SYSTEM	TYPE OF PENETRANT	F- RATING	BASIS OF DESIGN UL SYSTEM
	(ПК) 1	E-C-1009 E-C-1059 E-C-1168		(ПК) 1	W-L-1054 W-L-1058 W-L-1164 W-L-1506
METAL PIPES OR		1 0 1003,1 0 1003,1 0 1100	METAL PIPES OR	2	W-L -1054, W-L -1058, W-L -1164, W-L -1506
CONDUIT	2	F-C-1009, F-C-1059, F-C-1168	CONDUIT	4	W-L-1110. W-L-1111. W-L-1165
	1	F-C-2232, F-C-2030, F-C-2160, F-C-	NON-METALLIC PIPE OR CONDUIT	1	W-L-2078, W-L-2075, W-L-2128
CONDUIT	2	F-C-2029, F-C-2030, F-C-2128, F-C-		2	W-L-2078, W-L-2075, W-L-2128
SINGLE OR BUNDLED CABLES	2	2160	SINGLE OR BUNDLED CABLES	4	W-L-2184, W-L-2245 W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-
	1	F-U-3012, F-U-3110, F-U-3044		1	L-3414, W-L-3396 W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-
	2	F-C-3012, F-C-3110		2	L-3414, W-L-3396 W-L-3385, W-L-3277
				4	W-L-3139. W-L-3334
	1	F-C-5004, F-C-5037, F-C-5036 F-C-5004, F-C-5037	CABLE TRAY	1	W-L-4011, W-L-4019, W-L-4081
				2	W-L-4011, W-L-4019, W-L-4081
INSULATED PIPES				4	W-L 8014
			INSULATED PIPES	1	W-L-5028, W-L-5029, W-L-5047
	2			2	W-L-5028, W-L-5029, W-L-5047 W-L-5073
NON-INSULATED MECHANICAL DUCTWORK WITHOUT			NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L 7017, W-L-7040, W-L-7042, W-L-7155
	1	F-C-7013		2	W-L-7040, W-L-7042, W-L-7155
DAMPERS INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS MIXED PENETRANTS	1	N/A**	INSULATED MECHANICAL	1	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	2	N/A**		2	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	1	F-C-8009, F-C-8014, F-C-8026		1	W-L-1095, W-L-8013
			MIXED PENETRANTS	2	W-L-1095, W-L-8013
			1	4	W-L-8014

COMPOSITE METALDECK FLOORS							
TYPE OF PENETRANT	FLOOR COVERAGE	F-RATING (HR)	BASIS OF DESIGN UL SYSTEM				
	2-1/2"	2	F-A-0040				
CIRCULAR BLANK OPENINGS	4-1/2"	2	F-A-0040, F-A-0041				
	2-1/2"	2	F-A-1192, F-A-1193				
SINGLE METALLIC PIPE OR CONDUIT (STEEL, IRON, COPPER)	4-1/2"	3	F-A-1192, F-A-1193				
	4-1/2"	2	F-A-1194				
	2-1/2'	2	F-A-2310, FA-2311				
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS_ERP_ENT)	4-1/2"	2	F-A-2313, F-A-2314, F-A-2315, F-A-2316				
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4-1/2"	3	F-A-2310, FA-2311, F-A-2312				
SINGLE/CABLE BUNDLES	2-1/2"	3	F-A-3071, F-A-3072				
	2-1/2"	2	F-A-5069, F-A-5070, F-A-5071				
SINGLE INSULATED PIPES	4-1/2"	3	F-A-5069, F-A-5070, F-A-5071				
MIXED PENETRANTS	4-1/2"	3	F-A-8055				

END OF SECTION