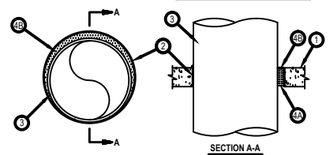
System No. C-AJ-1226

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 3 Hr	F Rating — 3 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating At Ambient — Less Than 1 CFM/sq ft	FH Rating — 3 Hr
L Rating At 400 F — 4 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — Less Than 1 CFM/sq ft
	L Rating At 400 F — 4 CFM/sq ft



SECTION A-A

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/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 32 in. (813 mm).
2. Metallic Sleeve — (Optional) Nom 32 in. (813 mm) diam (or smaller) Schedule 40 (or heavier) steel 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.
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 approx 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 and may extend a max of 4 in. (102 mm) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete 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 approx 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 and may extend a max of 4 in. (102 mm) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete floor.
3. Through-Penetrant — One metallic pipe, tube or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between penetrant and periphery of opening shall be min 0 in. (point contact) to max 1-7/8 in. (48 mm). Penetrant may be installed with continuous point contact. Penetrant to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic penetrants may be used:
   A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 30 in. (762 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.
   E. Conduit — Nom 6 in. (152 mm) diam (or smaller) steel conduit.
   F. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT).
4. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or sleeve or from both surfaces of wall or sleeve as required to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material* — Sealant — Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sleeve or with both surfaces of wall or sleeve. At the point or continuous contact locations between penetrant and concrete or sleeve, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the concrete or sleeve / pipe penetrant interface on the top surface of floor and on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

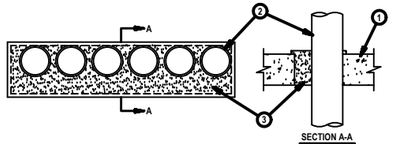
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 07, 2015

System No. C-AJ-1388

F RATING = 2-HR
T RATING = 0-HR



SECTION A-A

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 area of opening 224 sq in. with max dimension of 32 in.
   See Concrete Blocks (CAZT) in the Fire Resistance Directory for names of manufacturers.
2. Conduit One or more nom 4 in diam (or smaller) steel electrical metallic tubing or steel conduit to be installed either concentrically or eccentrically within the firestop system. The space between conduits or tubes shall be min 0 in. (point contact) to max 1/2 in. The annular space between the conduit or tube and periphery of opening shall be min 0 in. (point contact) to max 2-3/4 in. Conduit or tube to be rigidly supported on both sides of floor or wall assembly.
   Conduit - Nom 4 in. diam (or smaller) steel electrical metallic conduit or steel conduit.
3. Fill, Void or Cavity Material* - Foam Min 5 in. thickness of fill material applied within the annulus, extending 1/2 in. above the top surface of the floor or both surfaces of wall and overlapping the concrete 1/2 in. on all sides of the opening.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- CP 620 Fire Foam

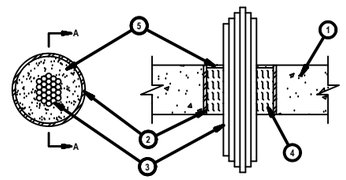
*Bearing the UL Classification Mark

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 23, 2002

System No. C-AJ-3180

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



SECTION A-A

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/m3) concrete floor or min 4-3/4 in. (121 mm) thick reinforced lightweight or normal weight concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 6 in.(152 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Steel Sleeve — (Optional) — Nom 6 in. (152 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe cast or grouted into floor or wall assembly, flush with floor or wall surfaces.
3. Cables — Aggregate cross-sectional area of cables in opening to be max 45 percent of the aggregate cross-sectional area of the opening. Cables to be rigidly supported on both sides of floor or wall assembly. Any combination of the following types and sizes of metallic conductor or fiber optic cable may be used:
   A. Max 500 kcmil single copper connector power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
   B. Max 300 pair No. 24 AWG copper conductor telecommunication cables with polyvinyl chloride (PVC) insulation and jacket material.
   C. Max 7/C copper conductor No. 12 AWG multiconductor power and control cables with polyvinyl chloride (PVC) or cross-linked polyethylene (XLPE) insulation and PVC jacket.
   D. Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in. (13 mm).
   E. Max 3/C copper conductor No. 12 AWG with bare aluminum ground, polyvinyl chloride (PVC) insulated steel, Metal-clad cable.
   F. Max 3/C with ground 2/0 AWG copper conductor SER cable with cross-linked polyethylene (XLPE) insulation and polyvinyl chloride (PVC) jacket.
   G. RGU coaxial cable with polyethylene (PE) insulation and polyvinyl chloride (PVC) jacket having a max outside diameter of ½ in. (13 mm)
   H. Fire Resistive Cables* - Max 1-1/4 in. (32 mm) diam single conductor or multi conductor Type MI cable. A min 1/8 in. (3 mm) separation shall be maintained between MI cables and any other types of cable.
4. Packing Material — Min 4-1/4 in. (108 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.
5. Fill, Void or Cavity Material** — Sealant — Min 1/4 in. (6.4 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant.

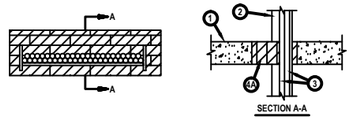
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 13, 2015

System No. C-AJ-4035

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



SECTION A-A

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/m3) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max area of opening is 270 sq in (1742 cm2) with max dimension of 30 in. (762 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Cable Tray* — Max 24 in. (610 mm) wide by max 4 in. (102 mm) deep open-ladder or solid-back cable tray with channel-shaped side rails formed of 0.10 in. (2.54 mm) thick aluminum or 0.060 in. (1.52 mm) thick galv steel and with 1-1/2 in. (38 mm) wide by 1 in. (25 mm) channel shape rungs spaced 9 in. (229 mm) OC or a 0.029 in. (0.74 mm) thick steel solid back, respectively. The annular space between the cable tray and the periphery of the opening shall be min 1 in. (25 mm) to max 4 in. (102 mm). Cable tray to be rigidly supported on both sides of floor or wall assembly.
3. Cables — Aggregate cross-sectional area of cables in cable tray to be max 40 percent of the cross-sectional area of the cable tray. Any combination of the following types and sizes of copper conductor or fiber optic cables may be used:
   A. 1/C, 500 kcmil with thermoplastic insulation and PVC jacket.
   B. 300 pair — No. 24 AWG cable with PVC insulation and jacket.
   C. 24 fiberoptic cable with PVC subunit and jacket.
   D. Three 1/C No. 12 AWG wire, insulated with polyvinyl chloride, in a nominal 3/4 in. (19 mm) flexible metal conduit.
   4. Firestop System — The firestop system shall consist of the following:
   A. Fill, Void or Cavity Material* — Fire blocks installed with the long dimension placed horizontally within the opening, flush with bottom of floor assembly or centered within wall opening. In concrete block walls, fire block to fill entire thickness of wall opening unless wall is solid filled. Blocks to be firmly packed and completely fill the entire width and height of opening. Either one or a combination of the block specified below may be used.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS 657 Fire Block or CFS-BL Firestop Block
   B. Fill, Void or Cavity Material* -Sealant or Putty- Not Shown — Fill material to be forced into interstices of cables and between cables and cable trays to max extent possible on both surfaces of the penetration.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant, FS-ONE MAX Intumescent Sealant or CP618 Firestop Putty Stick.

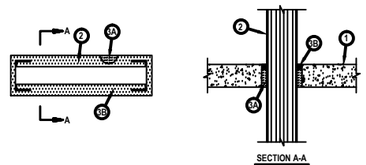
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 14, 2015

System No. C-AJ-6017

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



SECTION A-A

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/m3) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max area of opening is 224 square in. (1445 cm2) with max dimension of 28 in. (711 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Busway+ — Nominal 26 in. (660 mm) wide (or smaller) by 6 in. (152 mm) deep "I" shaped steel enclosure containing factory mounted aluminum bars rated for 600 V, 4000 A. One busway to be installed within the opening, the annular space between the flange tip of the busway and the periphery of the opening shall be 1 in. (25 mm). The annular space between the web of the busway and the periphery of the opening shall be 2 in. (51 mm). Busway to be ridged supported on both sides of floor and wall assembly. The busway shall bear the UL Listing Mark and shall be installed in accordance with all provisions of the National Electrical Code, NFPA No. 70.
3. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 3-1/2 in. (89 mm) thickness of min 4 pcf (64 kg/m3) 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.
   B. Fill, Void or Cavity Material* — Sealant — Min 1 in. (25 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant.

+Bearing the UL Listing Mark

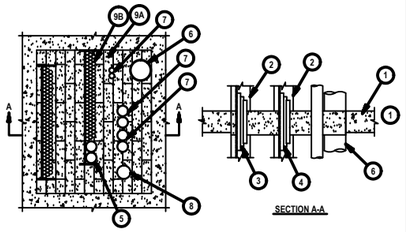
*Bearing UL Classification Mark

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 14, 2015

System No. C-AJ-8110

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



SECTION A-A

System tested with a pressure differential of 2.5 Pa between the exposed and the unexposed surfaces with the higher pressure on the exposed side.

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/m3) concrete floor or concrete wall. Wall may also be constructed of any UL solid or filled Classified Concrete Blocks*. Max area of 720 sq in. (0.46 m2) with max dimension of 30 in. (762 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Cable Tray* — Max of two max 24 in (610 mm) wide by 4 in. (102 mm) deep open-ladder cable tray with channel-shaped side rails formed of 0.10 in. (2.5 mm) thick aluminum or 0.060 in. (5 mm) thick steel and with 1 in. (25 mm) wide by 1 in. (25 mm) deep tubular channel-shaped rungs spaced 9 in. (229 mm) OC. The annular space between the periphery of the opening shall be min 0 in. (point contact) to max 3 in. (76 mm). Annular space between cable trays shall be 5 in. (127 mm) max. Cable tray to be rigidly supported on both sides of floor assembly.
3. Cables — Aggregate cross-sectional area of cables in cable tray to be max 45 percent of the cross-sectional area of the cable tray. Any combination of the following types and sizes of copper conductor cables may be used:
   A. 1/C, 750 kcmil (or smaller) power cable with polyvinyl chloride (PVC) insulation and jacket.
   B. 300 pair - No. 24 AWG telephone cable with PVC insulation and jacket.
   C. 24 fiber optic cable with PVC outer and subunit jacket.
   D. 3/C No. 12 AWG copper conductor steel clad cable with PVC insulation.
4. Cables — Aggregate cross-sectional area of cables in cable tray to be max 30 percent of the cross-sectional area of the cable tray. Any combination of the following types and sizes of copper conductor cables may be used:
   A. 1/C, 750 kcmil (or smaller) power cable with polyvinyl chloride (PVC) insulation and jacket.
   B. 100 pair - No. 24 AWG telephone cable with PVC insulation and jacket.
   C. 7/C No. 12 AWG cable with PVC insulation and jacket.
   D. 3/C (with ground) No. 12 AWG copper conductor non-metallic sheathed cable with PVC insulation and jacket.
5. Optical Fiber/Communication Cable Raceways+ — Nom 2 in. (51 mm) diam (or smaller) optical fiber raceway, formed from PVC. Raceway to be installed in accordance with the National Electrical Code (NFPA No. 70). Max two raceways placed into cable tray.
   See Optical Fiber/Communication Cable Raceways (QAZN) category in the Electrical Construction Materials Directory for names of manufacturers.
6. Metallic Penetrants - One metallic pipe or tubing to be installed within the firestop system. — The min annular space between the copper tube or pipe and the periphery of the opening shall be 0 in. (point contact). The min space between adjacent penetrants shall be 2 in. (51 mm). Tube or pipe to be rigidly supported on both sides of floor assembly. The following types and sizes of metallic pipe or tubing may be used:
   A. Steel Pipe — Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 8 in. (203 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
   D. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic conduit.
   E. Copper Tubing — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing.
   F. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
7. Conduit — Max 2 in. (51 mm) diam (or smaller) steel electrical metallic tubing (EMT) or steel conduit. The annular space between the EMT and the periphery of the opening shall be min 2 in. (51 mm). The min space between adjacent penetrants shall be 1-1/2 in. (38 mm) except that a max of two EMT or conduit may be installed at point contact with one another. EMT or conduit to be rigidly supported on both sides of floor assembly.
8. Cable — 1800 pair - No. 24 AWG 01 ARMM telephone cable with PVC insulation and jacket. The annular space between the cable and the periphery of the opening shall be min 3-1/2 in. (89 mm). The min space between adjacent penetrants shall be 1-1/2 in. (38 mm). Cable to be rigidly supported on both sides of floor assembly.
9. Firestop System — The firestop system shall consist of the following:
   A. Fill, Void or Cavity Material* - Fire Blocks — Blocks installed with 5 in. (127 mm) dimension projecting through opening flush with top surface of floor or centered in wall. Blocks to be firmly packed to fill entire opening. Either one or a combination of the block types specified below may be used.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS 657 Fire Block or CFS-BL Firestop Block
   B. Fill, Void or Cavity Material* — Fill material to be forced into interstices of cables, between cables and cable tray and in obvious openings between blocks and between blocks and the periphery of the opening to the max extent possible on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, FS-ONE MAX Intumescent Sealant, CP618 Firestop Putty Stick or CP 620 Fire Foam.
   C. Wire Mesh — (Not Shown) When the annular space exceeds 4 in. to the periphery, a nom 2 by 2 in. (51 by 51 mm) wire fencing shall be used to keep the blocks in place. The wire fencing shall be fabricated from min No. 16 SWG (0.060 in. or 1.5 mm) galv steel wire. The wire is cut to fit the contour of the penetrating item with a min 3 in. (76 mm) overlap beyond the periphery of the opening. Wire fencing secured to top surface of floor and both surfaces of the wall assembly by means of 1/4 in. (6 mm) diam by 1 in. (25 mm) long steel concrete anchors and 1/4 in. (6 mm) by 1-1/2 in. (38 mm) diam fender washers spaced max 8 in. (203 mm) OC.

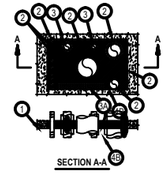
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 15, 2015

System No. C-AJ-8143

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 2 Hr
	FTH Rating — 0 Hr



SECTION A-A

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/m3) concrete floor. Min 5 in. (127 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. Max size of opening is 1440 in.2 (9,290 cm2) with a max dimension of 48 in. (1219 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers
2. Through-Penetrant — One cable tray and one or more pipes, tubes or cable bundles may be installed within the opening. The total number of through-penetrants is dependent on the size of the opening and the types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces are maintained. The annular space between cable tray and all other penetrants shall be min 3 in. (76 mm). The annular space between individual cables and cable bundles shall be a min 1/2 in. (13 mm). The annular space between individual cables and cable bundles and other penetrants shall be a min 1/2 in. (13 mm) except that a min 2 in. (51 mm) shall be maintained between the cables and copper pipes and tubes greater than a nom 3 in. (76 mm) diam and steel and iron pipes and conduits greater than a nom 4 in. (102 mm) diam. The annular space between metallic pipes, conduit and tubes and insulated pipes and tubes shall be a min 2 in. (51 mm). The annular space between nom 3 in (76mm) diam (and smaller) copper pipes and tubes and between nom 4 in (102mm) diam (and smaller) steel and iron pipes and conduits shall be min 1/2 in. (13 mm). The annular space between nom 2 in. (51 mm) diam (and smaller) metallic pipes and conduits shall be min 0 in. (point contact). The annular space between insulated penetrants or the cable tray and the periphery of opening shall be min 1/2 in. (13 mm). The annular space between all other penetrants and the periphery of opening shall be min 0 in. (point contact). A max annular space in the system shall be 12 in. (305 mm). Penetrants to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of penetrants may be used.
   A. Metallic Pipes — The following types of metallic pipes, tubes or conduits may be used:
      1. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tube.
      2. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
      3. Steel Pipe — Nom 24 in. (610 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe.
      4. Iron Pipe — Nom 24 in. (610 mm) diam (or smaller) cast or ductile iron pipe.
      5. Conduit — Nom 4 in. (102 mm) diam (or smaller) electric metallic tubing (EMT) or nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
   B. Cables Bundles — Max 4 in. (102 mm) diam tightly bundled cables. Any combination of the following types and sizes of cables may be used:
      1. Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
      2. Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
      3. Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
      4. Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
      5. Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.
   C. Individual Cables — Any of the following types and sizes of individual (non-bundled) cables may be used:
      1. Max 3/C No. 2/0 AWG (or smaller) copper conductor PVC jacketed aluminum clad or steel clad TECK 90 cable.
      2. Through Penetrating Product* — Any cables, Armored Cable+ or Metal Clad Cable+ currently Classified under the Through Penetrating Product category.
      See Through Penetrating Product (XHJY) category in the Fire Resistance Directory for names of manufacturers.
      3. Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
      4. Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
      5. Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
      6. Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
      7. Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.
      8. Max 4C/750 kcmil (or smaller) aluminum or copper conductor metal clad cable with aluminum or steel armor, with or without PVC jacket.
   D. Cable Tray* — (Not Shown) — Max 24 in. (610 mm) wide by 6 in. (152 mm) deep open-ladder steel or aluminum cable tray. Aggregate cross-sectional area of cable tray to be max 40 percent of the cross-sectional area of the cable tray based on a max 3 in. cable loading depth. Any combination of the types and sizes of cables described in Item 2B may be used. Cable tray to be rigidly supported on both sides of floor or wall assembly.
3. Pipe Insulation — (Optional) - Pipes and tubes of the sizes noted below may be provided with one of the following types of pipe insulations::
   A. Pipe Covering* — Nom 1-1/2 in. (38 mm) thick (or thinner) hollow cylindrical heavy density glass fiber units jacketed on the outside with an all service jacket for pipes with a nom diam of 8 in. (203 mm) (or smaller) or tubes with a nom diam of 4 in. (102 mm) (or smaller). 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.
   See Pipe and Equipment Covering - Materials (RRGU) 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.
   B. Pipe Covering* — Nom 2 in. (51 mm) thick (or thinner) hollow cylindrical heavy density glass fiber units jacketed on the outside with an all service jacket for pipes or tubes with a nom diam of 2 in. (51 mm) (or smaller). 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.
   See Pipe and Equipment Covering - Materials (RRGU) 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.
   C. Tube Insulation-Plastics+ — Nom 1 in. (25 mm) thick (or thinner) acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing for pipes or tubes with a nom diam of 2 in. (51 mm) (or smaller).
   See Plastics (QMFZ) category in the Plastics Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.
4. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m3) mineral wool batt insulation tightly packed into the opening as a permanent form. Packing material to be recessed from top surface of floor or both surfaces of wall to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material - Sealant* — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus flush with the top surface of the floor or both surfaces of the wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 15, 2015

Notes:

1. *Refer to section 16055 of the specifications. For Quality Control requirements, refer to the Quality Control portion of the specification.*
2. *Details shown are typical details. If field conditions do not match requirements of typical details, approved alternate details shall be utilized. Field conditions and dimensions need to be verified for compliance with the details, including but not limited to the following: * Minimum and maximum Width of Joints * Type and thickness of fire-rated construction. The minimum assembly rating of the firestop assembly shall meet or exceed the highest rating of the adjacent construction.*
3. *If alternate details matching the field conditions are not available, manufacturer's engineering judgment drawings are acceptable. Drawings shall follow the International Firestop Council (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments.*
4. *References:*
   - ** 2013 Underwriter's Laboratories Fire Resistance Directory, Volumes 1 & 2*
   - ** NFPA 101 Life Safety Code*
   - ** NFPA 70 - National Electric Code*
   - ** All governing local and regional building codes*
5. *Firestop System installation must meet requirements of ASTM E-814 (UL 1479) tested assemblies that provide a fire rating equal to that of construction being penetrated.*
6. *All rated through-penetration assemblies shall be prominently labeled with the following information:*
   - ** ATTENTION: Fire Rated Assembly*
   - ** UL System # * Product(s) used*
   - ** Hourly Rating (F-Rating)*
   - ** Installation Date*
7. *For outlet boxes requiring protection, use only Wall Opening Protective Materials, category CLIV as classified by Underwriter's Laboratories, Fire Resistance Directory (Volume 1.)*

<Notes to designer (delete this note after reading and replace with title block information)>
1. Any modification to these details could result in an application/system not meeting the UL or Intertek Classification or the intended temperature or fire ratings.
2. Details shown are up to date as of February 2015.
3. For additional information on the details, refer to the most current "Underwriter's Laboratories Fire Resistance Directory (volume 2.)"

JOB NUMBER:

DRAWN:

CHECKED:

ISSUE DATE:

REVISIONS:

TYPICAL FIRESTOP DETAILS

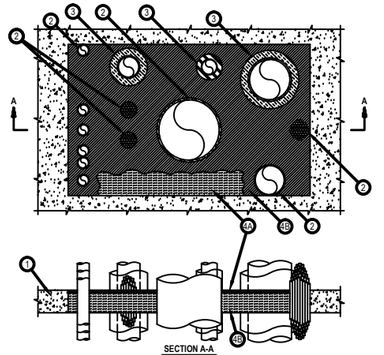
SHEET NAME:

SHEET NUMBER:

E.1.4

System No. F-A-8012

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 2 Hr	F Rating — 2 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 2 Hr
	FTH Rating — 0 Hr



1. Floor Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Max size of opening is 1440 in.2 (9,290 cm2) with a max dimension of 48 in. (1219 mm).
2. Through-Penetrants — One or more pipes, tubes or cable bundles to be installed within the opening. The total number of through-penetrants is dependent on the size of the opening and types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces are maintained. The annular space between cable bundles and other penetrants shall be a min 6 in. (152 mm). The annular space between metallic pipes, conduit and tubes and insulated pipes and tubes shall be a min 2 in. (51 mm). The annular space between nom 2 in. (51 mm) diam (and smaller) metallic pipes, conduit and tubes shall be a min 0 in. (0 mm). The annular space between insulated penetrants and the periphery of opening shall be a min 1/2 in. (13 mm). The annular space between all other penetrants and the periphery of opening shall be a min 0 in. (0 mm) (point contact). A max annular space in the system shall be 12 in. (305 mm). Penetrants to be rigidly supported on both sides of floor assembly. The following types and sizes of penetrants may be used.
   A. Metallic Penetrants — The following types of metallic pipes, tubes or conduits may be used:
      1. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tube.
      2. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
      3. Steel Pipe — Nom 24 in. (610 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe.
      4. Iron Pipe — Nom 24 in. (610 mm) diam (or smaller) cast or ductile iron pipe.
      5. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electric metallic tubing (EMT) or nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
   B. Cables Bundles — Max 4 in. (102 mm) diam tightly bundled cables. Any combination of the following types and sizes of cables may be used:
      1. Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
      2. Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
      3. Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
      4. Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
      5. Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.
   C. Individual Cables — Any of the following types and sizes of individual (non-bundled) cables may be used:
      1. Max 3/C No. 2/0 AWG (or smaller) copper conductor PVC jacketed aluminum clad or steel clad TECK 90 cable.
      2. Through Penetrating Product** — Any cables, Armored Cable+ or Metal Clad Cable+ currently Classified under the Through Penetrating Product category.
         See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
      3. Max 500 kcmil single copper or aluminum conductor power cable with thermoplastic insulation and polyvinyl chloride (PVC) jacket.
      4. Max 300 pair No. 24 AWG copper conductor telecommunication cables with PVC insulation and jacket material.
      5. Max 7/C copper conductor No. 12 AWG multi-conductor power and control cables with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.
      6. Multiple fiber optical communication cables jacketed with PVC and having a max outside diam of 1/2 in.
      7. Max 3/C No. 12 AWG steel clad cable with copper conductors and PVC insulation material.
      8. Max 4C/750 kcmil (or smaller) aluminum or copper conductor metal clad cable with aluminum or steel armor, with or without PVC jacket.
3. Pipe Insulation — (Optional) - Pipes and tubes of the sizes noted below may be provided with one of the following types of pipe insulations.
   A. Pipe Covering* — Nom 1-1/2 in. (38 mm) thick (or thinner) hollow cylindrical heavy density glass fiber units jacketed on the outside with an all service jacket for pipes with a nom diam of 8 in. (203 mm) (or smaller) or tubes with a nom diam of 4 in. (102 mm) (or smaller). 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.
      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 Classifica tion Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
   B. Tube Insulation-Plastics+ — Nom 1 in. (25 mm) thick (or thinner) acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing for pipes or tubes with a nom diam of 2 in. (51 mm) (or smaller).
      See Plastics (QMFZ2) category in the Plastics Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.
4. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m³) mineral wool batt insulation tightly packed into the opening as a permanent form. Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material - Sealant* — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus flush with the top surface of the floor.
      HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP604, CFS-S SIL GG or CFS-S SIL SL Sealant

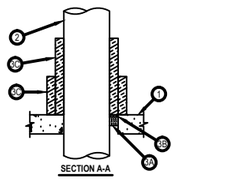
*Bearing the UL Classification Mark

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. December 27, 2013

System No. F-A-1105

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating - 2 Hr	F Rating - 2 Hr
T Rating - 2 Hr	FT Rating - 2 Hr
L Rating At Ambient - Less Than 1 CFM/sq ft	FH Rating - 2 Hr
L Rating At 400 F - 4 CFM/sq ft	FTH Rating - 2 Hr
W Rating - Class 1 (See Item 3B)	L Rating At Ambient - Less Than 1 CFM/sq ft
	L Rating At 400 F - 4 CFM/sq ft



1. Floor Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. As an alternate, any min 2 hr fire rated D700, D800 or D900 Series Floor-Ceiling Design in the UL Fire Resistance Directory having a min 2-1/2 in. (64 mm) thickness of lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete topping over the steel deck may be used. Max diam of opening is 12-3/4 in. (324 mm).
2. Through-Penetrant — One metallic pipe installed concentrically or eccentrically within opening. Annular space between penetrant and periphery of opening shall be min of 0 in. (point contact) to max 2 in. (51 mm). Penetrant to be rigidly supported on both sides of floor assembly. The following types and sizes of penetrants may be used:
   A. Steel Pipe — Nom 10 in. (254 mm) diam (or smaller) Schedule 40 (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 nom 6 in. (152 mm) diam (or smaller) rigid steel conduit.
3. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 2 in. (51 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. When CP 604, CFS-S SIL GG or CFS-S SIL SL sealant is used (see Item 3B), min thickness of packing material is 4 in. (102 mm) and min thickness of floor is 4-1/2 in. (114 mm). Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Materials* - Sealant — Min 1/2 in. (13 mm) thickness of sealant applied within the annulus, flush with top surface of floor.
      HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP 604 Self-Leveling Firestop Sealant, CFS-S SIL GG or CFS-S SIL SL Sealant
      W Rating applies only when CP 604, CFS-S SIL GG or CFS-S SIL SL Sealant is used.
   C. Duct Wrap Material* — Encapsulated duct wrap tightly wrapped around penetrant to extend 24 in. (610 mm) above the floor for penetrants of nom 4 in. (102 mm) diam or smaller, and 36 in. (914 mm) above floor for penetrants greater than a nom 4 in. (102 mm) diam. An additional layer of encapsulated duct wrap tightly wrapped around the first layer of duct wrap to extend 12 in. (305 mm) (914 mm) above floor. All longitudinal seams of both layers of duct wrap and joints between layers of duct wrap are sealed with foil tape. One of the following types and thicknesses of duct wrap may be used:
      C1. Nom 1-1/2 in. (38 mm) or 2 in. (51 mm) thick encapsulated duct wrap.
         UNIFRAX I1 L C — Fyrewrap Duct Insulation or FireWrap Duct 1.5 Insulation
      C2. Nom 1-1/2 in. (38 mm) thick encapsulated duct wrap.
         THERMAL CERAMICS INC — FireMaster FastWrap XL Duct Insulation

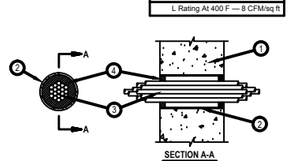
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 15, 2015

System No. W-J-3060

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating At Ambient — 15 CFM/sq ft	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 8 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — 15 CFM/sq ft
	L Rating At 400 F — 8 CFM/sq ft



1. Wall Assembly — Min 4-3/4 in. and 6 in. (121 and 152 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete for 1 and 2 hr ratings , respectively. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 4 in (102 mm). Max diam of opening is 5-1/2 in. (138 mm) when sleeve (Item 2) is employed.
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Steel Sleeve — (Optional) — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) of Schedule 5 (or heavier) steel pipe or min 0.016 thick (28 MSG or 0.4 mm) galv steel sleeve friction fit or cast into wall flush with wall surfaces. When Schedule 5 steel pipe or EMT is used, sleeve may extend up to 18 in. (457 mm) beyond the wall surfaces. As an option when Schedule 5 steel pipe or EMT is used, sleeve may extend continuously beyond one wall surface.
3. Cables — Aggregate cross sectional area of cables to be max 45 percent of the cross sectional area of the opening. Cables installed either concentrically or eccentrically within the firestop system. The annular space between cables and the periphery of the opening shall be min 0 in. (point contact) to max 1 in. (25 mm). When sleeve is continuous on one side of wall (see Item 2), the cable fill may be 0 to 45% and the max annular space within sleeve is not limited. Cables to be rigidly supported on both sides of wall assembly. The following types of cables may be used:
   A. 7/C No. 12 AWG cable with PVC insulation and outer jacket.
   B. Max 25 pair No. 24 AWG telephone cable with PVC insulation and outer jacket.
   C. Max RG 59 (or smaller) coaxial cable with polyethylene insulation and PVC jacket.
   D. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
   E. Multiple 24 fiber optic communication cable with PVC jacket, have a max outside diam of 5/8 in. (16 mm).
   F. Max four pair No. 22 AWG Cat 5 or Cat 6 computer cables.
   G. Through Penetrating Product*—Max three copper connector No. 8 AWG Metal-clad Cable+.
      AFC CABLE SYSTEMS INC
   H. Through Penetrating Product* — Any cables, Metal-Clad Cable+ or Armored Cable+ currently Classified under the Through Penetrating Products category.
      See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly. An additional 1/2 in. (13 mm) bead of fill material shall be applied around the perimeter of sleeve on both sides of the wall when sleeve extends beyond surface of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S Sealant, CP606 Sealant, CFS-S SIL GG Sealant, FS-ONE Sealant, FS-ONE MAX Intumescent Sealant, or CP618 Putty
5. Packing Material — (Not Shown) – Mineral wool forming material may be used as a backer for the fill material (Item 4). When used, it shall be firmly packed into annular space within the sleeve as a permanent form and recessed from end of sleeve to accommodate the required thickness of fill material.

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

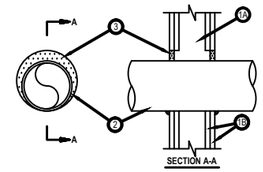
+Bearing the UL Listing Mark

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 22, 2015

System No. W-L-1054

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings —1 and 2 Hr (See Items 1 and 3)	F Ratings — 1 and 2 Hr (See Items 1 and 3)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating at Ambient — Less Than 1 CFM/sq ft	FH Ratings —1 and 2 Hr (See Items 1 and 3)
L Rating at 400 F — Less Than 1 CFM/sq ft	FTH Rating — 0 Hr
	FTH Rating — 0 Hr
	L Rating at Ambient — Less Than 1 CFM/sq ft L Rating at 400 F — Less Than 1 CFM/sq ft



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.
   B. Gypsum Board* — 5/8 in. (16 mm) thick. 4 ft (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 32-1/4 in. (819 mm) for steel stud walls. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls.

   The F and FH Ratings of the firestop system are equal to the fire rating of the wall assembly.
2. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. (57 mm). Pipe may be installed with continuous point contact. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
   A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or 6 in. (152 mm) . diam steel conduit.
   D. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
   E. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) regular (or heavier) copper pipe.
3. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and wall, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe wall interface on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

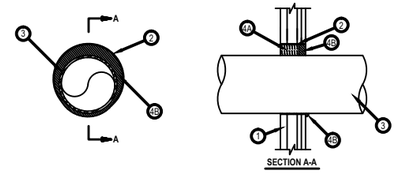
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 23, 2015

System No. W-L-1206

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Items 1 and 4)	F Rating — 1 and 2 Hr (See Items 1 and 4)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 1 and 2 Hr (See Items 1 and 4)
	FTH Rating — 0 Hr



1. Wall Assembly — The fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — "C-T" shaped studs 1-5/8 in. (41 mm) wide by 2-1/2 in. (64 mm) deep, fabricated from 25 MSG galv steel, spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — One layer of nom 1 in. (25 mm) thick, 24 in. (610 mm) wide gypsum liner and one or two layers of nom 5/8 in. (16 mm) thick, 4 ft. (1.27 m) wide gypsum board with square or tapered edges. The gypsum board types, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 10-1/2 in. (267 mm).

1A. Wall Assembly — As an alternate to the above wall assembly, the 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max diam of opening is 10-1/2 in. (267 mm).

   The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Metallic Sleeve — Max 10-1/2 in. (267 mm) diam cylindrical sleeve fabricated from min 0.016 in. (0.41 mm) thick (28 gauge) galv sheet steel and having a min 1 in. (25 mm) lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the opening and releasing the coil to let it uncoil against the circular outouts in the gypsum board layers. Sleeve may also be formed of No. 8 steel wire mesh having a min 1 in. (25 mm) lap along the longitudinal seam.
3. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. An annular space of min 0 in. (0 mm, point contact) to max 1-7/8 in. (48 mm) is required within firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
   A. Steel Pipe — Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 8 in. (203 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or 4 in. (102 mm) diam 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.
   F. Flexible Steel Conduit+ — Nom 2 in. (51 mm) diam (or smaller) flexible steel conduit.
      See Flexible Metal Conduit (DXUZ) category in the Electrical Construction Equipment Directory for names of manufacturers.
4. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 1-5/8 or 2-1/4 in. (41 or 57 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into sleeve on one side of the wall as permanent form for 1 and 2 Hr walls, respectively. Packing material to be recessed from the room side of wall to accommodate the required thickness of fill material. In alternate wall assembly, packing material to be flush with either side of the wall and recessed from the other side of the wall to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material — Sealant* — Min 1-1/2 in. (38 mm) thickness applied within sleeve, flush with the surface of wall. At the point contact location between pipe and wall, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe/wall interface.
      HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

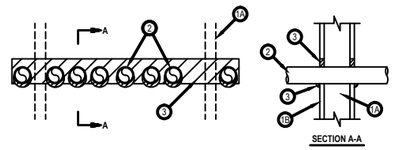
+Bearing the UL Listing Mark

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 22, 2015

System No. W-L-1389

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1and 3)	F Ratings — 1 and 2 Hr (See Items 1 and 3)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Items 1 and 3)
	FTH Rating — 0 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of min 3-5/8 in. (92 mm) wide steel studs spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners, as specified in the individual Wall and Partition Design. Max height of opening is 3-1/2 in. (89 mm). Max width of opening is 32 in. (813 mm).

   The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrants — Multiple pipes or conduits installed in single layer array within the firestop system. The annular space between the pipes and conduits and the edges of the opening shall be min 0 in. (0 mm, point contact) to max 1-3/8 in. (35 mm). The separation between pipes and conduits to be a min 0 in. (0 mm, point contact) to a max 1-1/4 in. (32 mm). Pipes and conduits to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
   A. Steel Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
   B. Conduit — Nom 2 in. (51 mm) diam (or smaller) rigid steel conduit or steel electrical metallic tubing (EMT).
3. Fill Void or Cavity Materials* - Sealant — Min 5/8 in. (16 mm) thickness of fill material installed to completely fill annular space between pipes, conduits and gypsum flush with each surface of wall. Min 1/2 in. (13 mm) diam bead of fill material applied to the through penetrant/wall interface at the point contact locations on both sides of the wall. The 2 hour F, FH Ratings apply only when FS-ONE Sealant is used.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — Hilti CP 606 Flexible Firestop Sealant or FS-ONE Sealant, FS-ONE MAX Intumescent Sealant

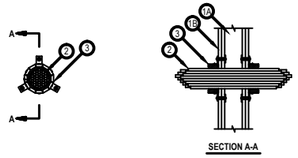
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 22, 2015

System No. W-L-3396

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Ratings - 0, 1 and 2 Hr (See Items 2 and 3)	FT Ratings - 0, 1 and 2 Hr (See Items 2 and 3)
L Rating At Ambient - See Item 3	FH Ratings - 1 and 2 Hr (See Item 1)
L Rating At 400F - See Item 3	FTH Ratings - 0, 1 and 2 Hr (See Items 2 and 3)
	L Rating At Ambient - See Item 3
	L Rating At 400F - See Item 3



1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
   A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board** — Nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Opening in gypsum board to be max 4 in. (102 mm) diam.

      The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.

1A. Sleeve — (Not Shown, Optional) - Nom 4 in. (102 mm) diam (or smaller) sleeve friction fit into wall opening, flush with both wall surfaces. The following types of sleeves may be used: Schedule 5 (or heavier) steel pipe, min 28 ga steel sleeve, or Schedule 40 solid or cellular core polyvinyl chloride (PVC).

2. Cables — Cables may be installed within opening for a 0 to 100 percent visual fill. When PVC sleeve (Item 1A) is used, the aggregate cross-sectional area of cable in opening to be max 45 percent of the cross-sectional area of the opening. Cables to be tightly bundled and rigidly supported on both sides of wall assembly. Any combination of the following types of cables may be used:
   A. Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
   B. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
   C. Max 4/0 AWG Type RHH ground cable.
   D. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
   E. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
   F. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/2 in. (13 mm).
   G. Max 3/C No 12 AWG MC Cable.
      For opening with cables, when the hourly rating of the wall assembly is 1 hr, the T, FT and FTH Ratings are 0 hr. For opening with cables, when the hourly rating of the wall assembly is 2 hr, the T, FT and FTH Ratings are 1 hr.
3. Firestop Device* — Firestop device consisting of a steel collar with plug to be centered over opening and mounted to face of gypsum board on both sides of wall. Each flange of collar is secured to wall with No. 10 by 1-1/2 in. (38 mm) steel laminating screw and min 9/16 in. (15 mm) diam steel washer through prepunched hole in flange. As an alternate, min 3/16 in. (4.8 mm) diam by 2-1/2 in. (64 mm) long steel toggle bolts in conjunction with min 9/16 in. (15 mm) diam steel washers may be used. For openings with cables, plug within collar cut to fit tightly around the cable bundle. For blank openings (no cables), the hourly F and FH Ratings of the firestop system are equal to the hourly rating of the wall in which it is installed.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-CC 4" Firestop Cable Collar
   L Ratings apply to blank the openings only per indicated in Table below.

Opening	CFM (per device)		CFM/Sq Ft Opening	
	Ambient	400F	Ambient	400F
Blank Opening Only (no cables)	Less Than 1	Less Than 1	Less Than 1	4
Max 100% visual fill with Cat 5 and/or Cat 6 cables	1.2	Less Than 1	13.2	8.9

4. Fill, Void or Cavity Material* (Optional, Not Shown) — Fill material applied to fill interstices between and around the cable bundle at both sides of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant, CP 618 Putty

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

Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc. January 23, 2015

<Notes to designer (delete this note after reading and replace with title block information)>

1. Any modification to these details could result in an application/system not meeting the UL or Intertek Classification or the intended temperature or fire ratings.
2. Details shown are up to date as of February 2015.
3. For additional information on the details, refer to the most current "Underwriter's Laboratories Fire Resistance Directory (volume 2.)"

Notes:

1. *Refer to section 16055 of the specifications. For Quality Control requirements, refer to the Quality Control portion of the specification.*
2. *Details shown are typical details. If field conditions do not match requirements of typical details, approved alternate details shall be utilized. Field conditions and dimensions need to be verified for compliance with the details, including but not limited to the following: * Minimum and maximum Width of Joints * Type and thickness of fire-rated construction. The minimum assembly rating of the firestop assembly shall meet or exceed the highest rating of the adjacent construction.*
3. *If alternate details matching the field conditions are not available, manufacturer's engineering judgment drawings are acceptable. Drawings shall follow the International Firestop Council (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments.*
4. *References:*
   - ** 2013 Underwriter's Laboratories Fire Resistance Directory, Volumes 1 & 2*
   - ** NFPA 101 Life Safety Code*
   - ** NFPA 70 - National Electric Code*
   - ** All governing local and regional building codes*
5. *Firestop System installation must meet requirements of ASTM E-814 (UL 1479) tested assemblies that provide a fire rating equal to that of construction being penetrated.*
6. *All rated through-penetration assemblies shall be prominently labeled with the following information:*
   - ** ATTENTION: Fire Rated Assembly*
   - ** UL System # * Product(s) used*
   - ** Hourly Rating (F-Rating)*
   - ** Installation Date*
7. *For outlet boxes requiring protection, use only Wall Opening Protective Materials, category CLIV as classified by Underwriter's Laboratories, Fire Resistance Directory (Volume 1.)*

JOB NUMBER:

DRAWN:

CHECKED:

ISSUE DATE:

REVISIONS:

TYPICAL FIRESTOP DETAILS

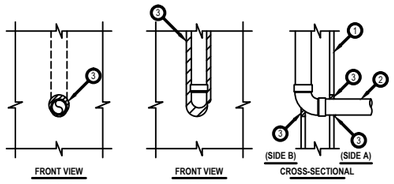
SHEET NAME:

SHEET NUMBER:

E.2.4

System No. W-L-1412

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 Hr	F Rating — 1Hr
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 1Hr
	FTH Rating — 0 Hr



1. Wall Assembly — The 1 hr fire-rated gypsum board/steel stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-5/8 in. (92 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Min 5/8 in. (16 mm) thick gypsum board. Max diam of opening shall be 3 in. (76 mm) on through penetration side. Maximum width of opening on membrane penetration is to be max 3 in. (76 mm).
2. Through Penetrant — One nom 2 in. (51 mm) pipe to be installed concentrically or eccentrically within opening on one side of the wall. On one side of the wall the pipe is allowed to penetrate the membrane continuously in a plane parallel with the wall and the studs. The annular space between the through penetrant and the periphery of opening shall be min 0 in. (0 mm, point contact) to max 3/4 in. (19 mm). Through penetrant to be rigidly supported on the through penetration side of the wall assembly. The following types and sizes of through penetrants may be used:
   A. Steel Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 2 in. (51 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 2 in. (51 mm) diam (or smaller) rigid steel conduit or electrical metallic tubing (ENT).
3. Firestop System — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied with annulus flush with both surfaces of the wall. Additional min 1/4 in. (6 mm) diam bead of fill material applied at the penetrant/gypsum board interface on both sides of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
Jaunary 26, 2015

System No. W-L-2075

F Ratings - 1 & 2 Hr (See Item 4)
T Ratings - 0 and 2 Hr (see Item 4)
L Rating At Ambient - Less Than 1 CFM/Sq Ft
L Rating At 400 F - 4 CFM/Sq Ft

1. Floor or Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 4 in. (102 mm).
2. Metallic Sleeve — (Optional) — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 (or thinner) steel pipe cast into wall assembly with joint compound and installed flush with wall surfaces.
3. Electrical Nonmetallic Tubing+ — Nom 2 in. (51 mm) diam (or smaller) corrugated wall electrical nonmetallic tubing (ENT) constructed of polyvinyl chloride (PVC). Tubing to be rigidly supported on both sides of wall assembly. A nom annular space of 3/4 in. (19 mm) is required within the firestop system.
   See Electrical Nonmetallic Tubing (FKHU) category in the Electrical Construction Materials Directory for names of manufacturers.
4. Fill, Void or Cavity Material* — Sealant — Installed symmetrically on both sides of the wall. The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed. Fill material applied within the annulus, flush with each end of the steel sleeve at the thickness shown in the table below:

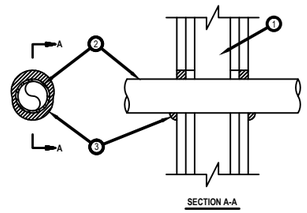
F Rating Hr	T Rating Hr	Fill Mtl Depth In. (mm)
1	0	5/8 (16)
2	2	1-1/4 (32)

   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant
   +Bearing the UL Listing Mark
   *Bearing the UL Classification Marking

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 26, 2015

System No. W-L-2244

F Ratings – 1 and 2 Hr (See Item 1)
T Ratings – 1 and 2 Hr (See Item 1)
L Rating at Ambient - Less Than 1 CFM/sq ft
L Rating at 400 F - 2 CFM/sq ft

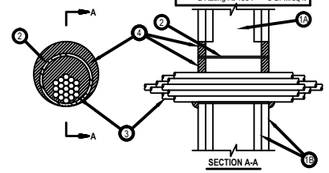


1. Wall Assembly — The 1 and 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Series Design in the UL Fire Resistance Directory. Max diam of opening is 3 in. (76 mm).
   The hourly F and T Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrant — One nonmetallic pipe, conduit or tubing installed either concentrically or eccentrically within the firestop system. The annular space between pipe and periphery of opening shall be min 0 in. (point contact) to a max 5/8 in. (16 mm). Pipe to be rigidly supported on both sides of wall assembly. The following types and sizes of nonmetallic pipes may be used:
   A. Polyvinyl Chloride (PVC) Pipe — Nom 2 in. (51 mm) diam (or smaller) cellular or solid core Schedule 40 (or heavier) pipe for use in closed (process or supply) piping systems.
   B. Chlorinated Polyvinyl Chloride (CPVC) — Nom 2 in. (51 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
3. Fill, Void or Cavity Material* - Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At point contact location, a min 1/2 in. (13 mm) diam bead of fill material shall be applied to the wall/penetrant interface on both surfaces of the wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 22, 2015

System No. W-L-3065

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Item 1)	F Rating — 1 and 2 Hr (See Item 1)
T Rating — 0 and 3/4 Hr (See item 3)	FT Rating — 0 and 3/4 Hr (See item 3)
L Rating At Ambient — 15 CFM/sq ft	FH Rating — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 8 CFM/sq ft	FTH Rating — 0 and 3/4 Hr (See item 3)
	L Rating At Ambient — 15 CFM/sq ft
	L Rating At 400 F — 8 CFM/sq ft

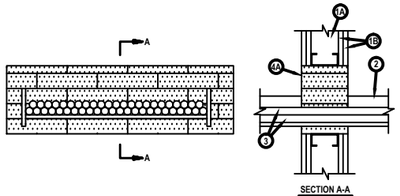


1. Wall Assembly — The 1 or 2 fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board, with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max diam of opening is 5-1/2 in. (138 mm) when sleeve (Item 2) is employed. Max diam of opening is 4 in. (102 mm) when sleeve (Item 2) is not employed.
   The F, FH Ratings of the firestop system are equal to the fire rating of the wall assembly.
2. Metallic Sleeve — (Optional) - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe or min 0.016 in. thick (0.41 mm, No. 28 ga) galv steel sleeve installed flush with wall surfaces. The annular space between steel sleeve and periphery of opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25mm). When Schedule 5 steel pipe or EMT is used, sleeve may extend up to 18 in. (457 mm) beyond the wall surfaces. As an option when Schedule 5 steel pipe or EMT is used, sleeve may extend continuously beyond one wall surface. When cable bundle penetrates wall assembly at an angle of 45 degrees, no metallic sleeve is used.
3. Cables — Aggregate cross-sectional area of cable in opening to be max 45 percent of the cross-sectional area of the opening. The annular space between the cable bundle and the periphery of the opening to be min 0 in. (point contact) to max 1 in. (25 mm). When sleeve is continuous on one side of wall (see Item 2), the cable fill may be 0 to 45% and the max annular space is not limited. Cables to be rigidly supported on both sides of the wall assembly. Cable bundle, using cables described below, may penetrate the wall at an angle not greater than 45 degrees. Any combination of the following types and sizes of copper conductor cables may be used:
   A. Max 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and jacket.
   B. Max 25 pair No. 24 AWG telephone cable with PVC insulation and jacket.
   B1. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
   C. Type RG/U coaxial cable with polyethylene (PE) insulation and PVC jacket having a max outside diameter of ¼ in. (13 mm).
   C1. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
   D. Multiple fiber optical communication cable jacketed with PVC and having a max OD of 5/8 in. (16 mm).
   E. Through Penetrating Products*+ — Max three copper conductor No. 8 AWG .Metal-Clad Cable+.
   AFC CABLE SYSTEMS INC
   F. Max 3/C (with ground)or smaller) No. 8 AWG copper conductor cable with PVC insulation and jacketing.
   G. Max 3/4 in. (19 mm) diam copper ground cable with or without a PVC jacket.
   H. Fire Resistive Cables* - Max 1-1/4 in. (32 mm) diam single conductor or multi conductor Type MI cable. A min 1/8 in. (3 mm) separation shall be maintained between MI cables and any other types of cable.
   I. Max 4/C with ground 300 kcmil (or smaller) aluminum SER cable with PVC insulation and jacket.
   J. Through Penetrating Product* - Any cables, Metal-Clad Cable+ or Armored Cable+ currently Classified under the Through Penetrating Products category.
   K. Maximum 3/C No. 8 AWG metal-clad cable.
   L. Maximum 5/8 diam fiber-optic cable with PVC jacket.
   For cable bundle penetrating the wall assembly at an angle of 45 degrees, the T, FT, FTH Ratings are 0 hr and 3/4 hr for 1 and 2 hr wall assemblies, respectively.
   See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
4. Fill, Void or Cavity Material* — Sealant or Putty — Fill material applied within the annulus, flush with each end of the steel sleeve or wall surface. Fill material installed symmetrically on both sides of the wall. A min 5/8 in. (16 mm) thickness of sealant is required for the 1 or 2 hr F Rating . An additional 1/2 in. (13 mm) diam bead of fill material shall be applied at the interface of sleeve with gypsum board.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S, CP606, FS-One Sealants or FS-ONE MAX Intumescent Sealantor or CP618 Putty
5. Packing Material — (Optional, Not Shown) — Mineral wool forming material may be used as a backer for the fill material (Item 4). When used, it shall be firmly packed into annular space within the sleeve as a permanent form and recessed from end of sleeve to accommodate the required thickness of fill material.
   * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.
   +Bearing the UL Listing Mark

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 23, 2015

System No. W-L-4011

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating At Ambient — 5 CFM/sq ft	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 2 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — 5 CFM/sq ft
	L Rating At 400 F — 2 CFM/sq ft

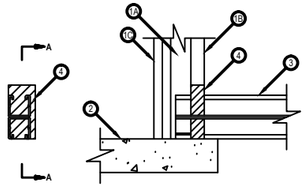


1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 in. (51 mm) by 4 in. (102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. Additional framing member shall be installed in stud cavity containing through-penetrating item to form a rectangular box around penetrant.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (1219 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max size of opening 9 in. (229 mm) by 30 in. (762 mm).
   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
   Min finished wall thickness is 5 in. (127 mm).
2. Cable Tray* — Max 24 in. (610 mm) wide by max 6 in. (152 mm) deep open-ladder or solid-back cable tray with channel-shaped side rails formed of 0.10 in. (2.54 mm) thick aluminum or 0.060 in. (1.54 mm) thick steel and with 1-1/2 in. (38 mm) wide by 1 in. (25 mm) channel shape rungs spaced 9 in. (229 mm) OC or a 0.029 in. (0.74 mm) thick steel solid back, respectively. The annular space between the cable tray and the periphery of the opening shall be min 0 in. (point contact) to max 4 in. (102 mm). Cable tray to be rigidly supported on both sides of floor or wall assembly.
3. Cables — Aggregate cross-sectional area of cables in cable tray to be max 45 percent of the cross-sectional area of the cable tray based on a max 5 in. (127 mm) cable loading depth. Any combination of the following types and sizes of copper conductor cables may be used:
   A. 1/C, 750 kcmil (or smaller) power cable with EPR insulation and PVC jacket.
   B. 300 pair — No. 24 AWG cable with PVC insulation and jacket
   C. Twenty-four fiberoptic cable with PVC subunit and jacket.
   D. Max three 1/C, No. 12 AWG wire, insulated with polyvinyl chloride, in a nom 3/4 in. (19 mm) Flexible Metal Conduit+.
4. Firestop System — The firestop system shall consist of the following:
   A. Fill, Void or Cavity Material* - Fire Blocks — For walls incorporating max 3-5/8 in. (92 mm) steel studs or max 2 in. (51 mm) by 4 in. (102 mm) wood studs, fire block installed with 5 in. (127 mm) dimension projecting through and centered in opening. For walls constructed of larger steel or wood studs, fire block installed with long dimension passing through and centered in opening. Blocks may or may not be cut flush with both surfaces of wall. When multiple layers of gypsum board are used, blocks may be recessed 1/2 in. (13 mm) from surface of wall. Blocks firmly packed within opening. Either one or a combination of the block types specified below may be used.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-657 Fire Block or CFS-BL Firestop Block
   B. Fill, Void or Cavity Material* - Sealant or Putty (Not shown) — Fill material to be forced into interstices of cables and between cables and cable trays to max extent possible on both surfaces of the penetration.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP618 Firestop Putty Stick (Note: L Ratings apply only when FS-One Sealant is used)
   +Bearing the UL Listing Mark
   * Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 23, 2015

System No. W-L-7154

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Items 1 and 2)	F Ratings - 1 and 2 Hr (See Items 1 and 2)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Items 1 and 2)
	FTH Rating - 0 Hr



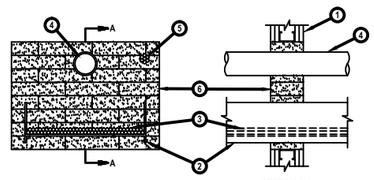
1. Wall Assembly — The 1 or 2 hr fire rated shaft wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Steel Studs — C-H -shaped studs, 2-1/2 in. (64 mm) wide by 1-1/2 in. (38 mm) deep, spaced 24 in. (610 mm) OC.
   B. Gypsum Board* — 1 in. (25 mm) thick gypsum board liner panels, supplied in nom 24 in. (610 mm) widths as specified in the individual Wall and Partition Design. Max area of opening is 8.6 sq in. (55 sq cm) with a max dimension of 6-7/8 in. (175 mm). The opening cutout shall follow the contour of the penetrant when steel angle or steel channel is used.
   C. Gypsum Board* — One or two layers of 5/8 in. (16 mm) thick gypsum board for 1 or 2 hr rated assemblies, respectively, as specified in the individual Wall and Partition Design.
1A. Alternate Wall Assembly — (Not shown) As an alternate to the shaft wall described above, the 1 or 2 hr fire rated wall assembly shall be constructed of the materials and in the manner specified in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of min 2-1/2 in. (64 mm) steel channel studs spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max area of opening is 8.6 sq in. (55 sq cm) with a max dimension of 6-7/8 in. (175 mm). The opening cutout shall follow the contour of the penetrant when steel angle or steel channel is used.
   The hourly F and FH Ratings of the firestop system are equal to the hourly rating of the wall.
2. Floor Assembly — Min 2-1/2 and 4-1/2 in. (64 or 114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete for 1 and 2 hr rated assemblies, respectively. Floor may also be constructed of any min 6 in. (152 mm)) UL Classified Precast Concrete Units*.
   See Precast Concrete Units (CFTV) category in the Fire Resistance Directory for names of manufacturers.
3. Penetrants — One metallic strut, steel angle or steel channel to be installed within the firestop system. An annular space of min 0 in. (point contact) to max 7/8 in. (22 mm) is required within the firestop system. Penetrant to terminate within the stud cavity and shall be secured to floor assembly within 2 in. (51 mm) of the fill material (Item 4) on either side of the fill material with at least one min 1/4 in. (6 mm) diam by min 1-1/4 in. (32 mm) long steel masonry anchor in conjunction with steel washers or Hilti 1/4 in. diam by 1-3/4 in. long KWIK-BOLT 3 steel expansion anchor.
   The following types and sizes of metallic struts, angles or channels may be used:
   A. Steel Strut — Max 1-5/8 by 1-5/8 in. (41 by 41 mm) channel strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   B. Steel Strut — Max 3-1/4 by 1-5/8 in. (83 by 41 mm) H strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   C. Steel Angle — Max 2 by 2 in. (51 by 51 mm) by min 1/8 in. (3.2 mm) thick or max 3 by 3 in. (76 by 76 mm) by min 1/4 in. (6 mm) thick steel angle.
   D. Steel Channel — C6 x 8.2 (or smaller) steel channel.
4. Fill, Void or Cavity Material* - Sealant — Fill material to be installed to completely fill the annular space, flush with the surface of the wall. The thickness of the fill material shall be the thickness of the gypsum board(s) in which it is installed. An additional min 1/2 in. (13 mm) diam bead of sealant to be installed at the point contact location at the penetrant/gypsum board interface.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 27, 2015

System No. W-L-8013

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating At Ambient — 5 CFM/sq ft	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 2 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — 5 CFM/sq ft
	L Rating At 400 F — 2 CFM/sq ft



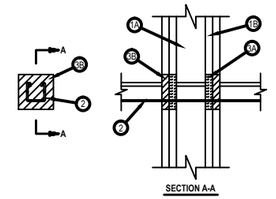
System tested with a pressure differential of 2.5 Pa between the exposed and the unexposed surfaces with the higher pressure on the exposed side.
1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 in. (51 mm) by 4 in. (102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. Additional studs installed to completely frame the opening.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (1219 mm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max area of opening is 352 sq in. (2271 sq cm) with max dimension of 22 in. (559 mm) wide.
   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Cable Tray* — Max 18 in. (457 mm) wide by max 6 in. (152 mm) deep open-ladder or solid-back cable tray with channel-shaped side rails formed of 0.065 in. (1.65 mm) thick aluminum or 0.060 in. (1.52 mm) thick steel and with 1-1/2 in. (38 mm) wide by 1 in. (25 mm) channel shape rungs spaced 9 in. (229 mm) OC or a 0.029 in. (0.74 mm) thick steel solid back, respectively. One cable tray to be installed in the opening. The max annular space between the cable tray and the periphery of the opening shall be min 1 in. (25 mm) to max 7 in. (178 mm) Cable tray to be rigidly supported on both sides of floor or wall assembly.
3. Cables — Aggregate cross-sectional area of cables in cable tray to be max 30 percent of the cross-sectional area of the cable tray. Any combination of the following types and sizes of copper conductor cables may be used:
   A. 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and PVC jacket.
   B. 100 pair - No. 24 AWG cable with PVC insulation and jacket.
   C. 1/C, 750 kcmil (or smaller) with PVC insulation and jacket.
4. Through-Penetrants — One or more pipe or tube to be installed within the opening. The total number of through-penetrants is dependent on the size of the opening and types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces and the spacings between the pipes are maintained. The space between the pipe or tube and the periphery of the opening shall be min 1-1/2 in. (38 mm) to max 9-1/4 in. (235 mm). Pipe or tube to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of non-metallic or metallic pipes, or tubes may be used:
   A. Polyvinyl Chloride (PVC) Pipe — Max 3 in. (76 mm) diam Schedule 40 solid core PVC pipe (or smaller) for use in closed (process or supply) or vented (drain, waste or vent) piping system.
   B. Steel Pipe — Nom 6 in. (152 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe.
   C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or 6 in. (152 mm) diam steel conduit.
   D. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
   E. Copper Tube — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tube.
4A. Pipe Covering — (Not Shown) Nom 1-1/2 in. (38 mm) thick hollow cylindrical heavy density (min 3.5 pcf) (56kg/m3) 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.
   See Pipe and Equipment Covering and 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 may be used.
5. Cables — Max 1-1/2 in. (38 mm) diam tight bundle of cables installed within the opening and rigidly supported on both surfaces of wall. The space between the cables and periphery of the opening shall range from 1-3/16 in. (30.2 mm) min to a max of 1-1/2 in. (38 mm). Any combination of the following types and sizes of cables may be used:
   A. 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and jacket.
   B. 25 pair — No. 24 AWG cable with PVC insulation and jacket.
   C. Type R GU/59 coaxial cable with PVC outer jacket.
   D. 24 fiber optic cable with PVC sub unit and outer jacket.
6. Firestop System — The firestop system shall consist of the following:
   A. Fill, Void or Cavity Material* — Fire Blocks For walls incorporating max 3-5/8 in. (92 mm) steel studs or max 2 (51 mm) by 4 in. (102 mm) wood studs, fire block installed with 5 in. (127 mm) dimension projecting through and centered in opening. For walls constructed of larger steel or wood studs, fire block installed with long dimension passing through and centered in opening. Blocks may or may not be cut flush with both surfaces of wall. When multiple layers of gypsum board are used, blocks may be recessed 1/2 in. (13 mm) from surface of wall. Blocks to be firmly packed in opening. Either one or a combination of the block types specified below may be used.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS 657 Fire Block or CFS-BL Firestop Block
   B. Fill, Void or Cavity Material* — Sealant or Putty - Fill material to be forced into interstices of cables, between cables and cable trays, around each penetrant and where obvious voids are observed to max extent possible on both surfaces of the penetration.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant, FS-ONE MAX Intumescent Sealant, CP 618 Putty Stick or CP620 Fire Foam

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

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 26, 2015

System No. W-L-7130

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Item 1)
	FTH Rating - 0 Hr



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — One or two layers of gypsum board, as specified in the individual Wall and Partition Design. Max area of rectangular opening is 15 sq in. (96 cm2) with max dimension of 5 in. (127 mm). In lieu of rectangular opening max diam of circular opening is 3 in. (76 mm).
   The F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly.
2. Through Penetrants — One metallic strut, cable, rod or angle service support to be installed within the firestop system. An annular space of min 1/8 in. (3 mm) to max 7/8 in. (22 mm) is required within the firestop system. Strut, cable, rod or angle service support to be rigidly supported on both sides of floor or wall assembly. The strut, cable, rod or angle service support may be installed at an angle not greater than 45 degrees from the perpendicular. The following types and sizes of metallic strut, cable, rod or angle service support may be used:
   A. Steel Strut — Max 1-5/8 by 1-5/8 in. (41 by 41 mm) channel strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   B. Steel Strut — Max 3-1/4 by 1-5/8 in. (83 by 41 mm) H strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   C. Cable — Max 3/8 in. (9.5 mm) diam unjacketed galv steel cable.
   D. Threaded Rod — Max 1 in. (25 mm) diam galv steel threaded rod.
   E. Steel Angle — 2 by 2 by 1/8 in. (51 by 51 by 3 mm) thick steel angle.
3. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 1/2 in. (13 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be located between penetrant and periphery of opening, and within channels of struts. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material. When through penetrant is oriented perpendicular to wall or when Type FS-ONE Sealant (Item 3B) is used, packing material is optional.
   B. Fill, Void or Cavity Material* - Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus and within the channel struts, flush with both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, CP 606 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.

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 27, 2015

Notes:

1. *Refer to section 16055 of the specifications. For Quality Control requirements, refer to the Quality Control portion of the specification.*
2. *Details shown are typical details. If field conditions do not match requirements of typical details, approved alternate details shall be utilized. Field conditions and dimensions need to be verified for compliance with the details, including but not limited to the following: * Minimum and maximum Width of Joints * Type and thickness of fire-rated construction. The minimum assembly rating of the firestop assembly shall meet or exceed the highest rating of the adjacent construction.*
3. *If alternate details matching the field conditions are not available, manufacturer's engineering judgment drawings are acceptable. Drawings shall follow the International Firestop Council (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments.*
4. *References:*
   - ** 2013 Underwriter's Laboratories Fire Resistance Directory, Volumes 1 & 2*
   - ** NFPA 101 Life Safety Code*
   - ** NFPA 70 - National Electric Code*
   - ** All governing local and regional building codes*
5. *Firestop System installation must meet requirements of ASTM E-814 (UL 1479) tested assemblies that provide a fire rating equal to that of construction being penetrated.*
6. *All rated through-penetration assemblies shall be prominently labeled with the following information:*
   - ** ATTENTION: Fire Rated Assembly*
   - ** UL System # * Product(s) used*
   - ** Hourly Rating (F-Rating)*
   - ** Installation Date*
7. *For outlet boxes requiring protection, use only Wall Opening Protective Materials, category CLIV as classified by Underwriter's Laboratories, Fire Resistance Directory (Volume 1.)*

<Notes to designer (delete this note after reading and replace with title block information)>
1. Any modification to these details could result in an application/system not meeting the UL or Intertek Classification or the intended temperature or fire ratings.
2. Details shown are up to date as of February 2015.
3. For additional information on the details, refer to the most current "Underwriter's Laboratories Fire Resistance Directory (volume 2.)"

JOB NUMBER:

DRAWN:

CHECKED:

ISSUE DATE:

REVISIONS:

TYPICAL FIRESTOP DETAILS

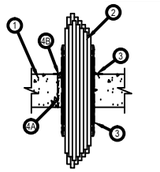
SHEET NAME:

SHEET NUMBER:

E.3.4

System No. C-AJ-3285

ANSI/ULL1479 (ASTM E814)	CAN/ULC S115
F Rating — 3 Hr	F Rating — 3 Hr
T Ratings — 1, 1-1/2 and 3 Hr (See Item 2)	FT Ratings — 1, 1-1/2 and 3 Hr (See Item 2)
L Rating At Ambient — Less Than 1 CFM (See Items 2 and 4)	FH Rating — 3 Hr
L Rating At 400 F — Less Than 1 CFM (See Items 2 and 4)	FTH Ratings — 1, 1-1/2 and 3 Hr (See Item 2)
	L Rating At Ambient — Less Than 1 CFM (See Items 2 and 4)
	L Rating At 400 F — Less Than 1 CFM (See Items 2 and 4)



1. Floor or Wall Assembly — Reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete. Min 4-1/2 in. (114 mm) thick floors and min 5 in. (127 mm) thick walls. Wall may also be constructed of any UL Classified Concrete Blocks*. Floor may also be constructed of any min 6 in. (152 mm) thick UL Classified hollow-core Precast Concrete Units*. Opening in floor or wall to be max 3 in. (76 mm) diam for 2 in. (51 mm) device and max 5 in. (127 mm) diam for 4 in. (102 mm) device.
See Concrete Blocks (CAZT) and Precast Concrete Units (CFTV) categories in the Fire Resistance Directory for names of manufacturers.
2. Cables — Within the loading area for each firestop device, the cables may represent a 0 to 100 percent visual fill. Cables to be tightly bundled within the device and rigidly supported on both sides of floor or wall assembly. Any combination of the following types of cables may be used:
A. Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
B. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
C. Max 4/0 AWG Type RHH ground cable.
D. Max four pair No. 22 AWG Cat 6 computer cables.
E. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
F. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/2 in. (13 mm).
G. Max 20/C No. 22 AWG shielded printer cable with PVC jacket.
H. Through-Penetrating Product* - Two copper conductors No. 18 AWG (or smaller) Power or Non Power Limited Fire Alarm Cable with or without a jacket under a metal armor.
AFC CABLE SYSTEMS INC
I. Max. 1/4 in. (6 mm) diam S-Video Cable consisting of two max No. 24 AWG 75 ohm coax or twisted pair cable with PE insulation and PVC jacket.
The hourly T, FT and FTH Ratings for blank opening (no cables) are 3 hr. The hourly T, FT and FTH Ratings for opening with cables are 1-1/2 hr except that, when cable type 2A, 2B, 2C, 2E or 2H is used, the T, FT and FTH Ratings are 1 hr. See Table below for L Ratings.

Max Cable Fill	Cable Type	L Rating, CFM/Sq Ft		L Rating, CFM	
		Ambient	400°F	Ambient	400°F
0%	—	1	2	Less than 1	Less than 1
100%	Any cables (Item 2) in any combination	7	7	Less than 1	Less than 1

3. Firestop Device* — Firestop device consists of a corrugated steel tube with an inner plastic housing, intumescent material rings, tightly twisted inner fabric smoke seal, flanges and gasket material (not shown). Firestop device to be installed in accordance with the accompanying installation instructions. Device slid into floor or wall such that ends project an equal distance from the approximate centerline of the assembly. As an option, in floors, steel sleeve of device may be installed flush with bottom of floor. The annular space between the device and the periphery of the opening shall be min 0 in. (point contact). Device provided with flange(s) that are spun clockwise onto device threads, over gasket material butting tightly to top side of floor or both sides of floor or wall. In floors, when one device flange is used, device flange to be secured to floor with min two 1-1/4 in. (32 mm) long masonry screws or anchors. As an alternate to gasket material, sealant (Item 4B) may be used.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 653 2" Speed Sleeve and CP 653 4" Speed Sleeve
4. Firestop System — The firestop system shall consist of the following:
A. Packing Material — Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into annular space between firestop device and opening as a permanent form. Packing material to be installed flush with bottom of floor and recessed from top surface of floor or from both surfaces of wall to accommodate the required thickness of fill material.
B. Fill, Void or Cavity Material* — Sealant — As an alternate to gasket material (see Item 3), min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with top surface of floor or with both surfaces of wall. For L Ratings when sealant is used, an additional 1/4 in. (6 mm) bead of fill material is required at the device/floor or device/wall interface on top side of floor or both sides of wall assembly prior to installing flange(s).
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S Sealant, CP604 Sealant, CP 606 Sealant, CFS-S SIL GG, CFS-S SIL SL (floors only), FS-ONE Sealant or FS-ONE MAX Intumescent Sealant.

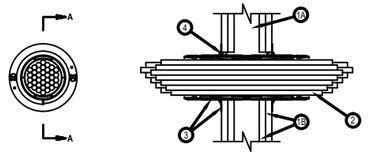
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 14, 2015

System No. W-L-3334

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1, 2, 3 and 4 Hr (See Item 1)	F Ratings - 1, 2, 3 and 4 Hr (See Item 1)
T Ratings - 0, 1/2, 1, 1-1/2, 2 Hr (See Items 2 and 3)	FT Ratings - 0, 1/2, 1-1/2, and 2 Hr (See Items 2 and 3)
L Rating At Ambient - See Item 2	FH Ratings - 1, 2, 3 and 4 Hr (See Item 1)
L Ratings At 400 F - See Item 2	FTH Ratings - 0, 1/2, 1, 1-1/2, and 2Hr (See Items 2 and 3)
	L Rating At Ambient - See Item 2
	L Ratings At 400 F - See Item 2



SECTION A-A

1. Wall Assembly — The 1, 2, 3 or 4 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC for 1 and 2 hr wall assemblies. Steel Studs to be 3-5/8 in. (92 mm) for 3 and 4 hr wall assemblies. Steel studs to be min 3-1/2 in. (89 mm) wide when 3/4 in. (19 mm) thick gypsum board is used (see Item 1B).
B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Alternately, for 1 and 2 hr rated walls only, min one layer of nom 3/4 in. (19 mm) thick gypsum board on each side of wall as specified in the individual Wall and Partition Design may be used. Opening in gypsum board to be max 2-1/2 in. (64 mm) diam for 2" device and max 4-1/2 in. (114 mm) diam for 4" device.
The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.
2. Cables — Within the loading area for each firestop device, the cables may represent a 0 to 100 percent visual fill. Cables to be tightly bundled within the device and rigidly supported on both sides of wall assembly. Any combination of the following types of cables may be used:
A. Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
B. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
C. Max 4/0 AWG Type RHH ground cable.
D. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
E. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
F. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/2 in. (13 mm).
G. Max 20/C No. 22 AWG shielded printer cable with PVC jacket.
H. Through-Penetrating Product* - Two copper conductors No. 18 AWG (or smaller) Power or Non Power Limited Fire Alarm Cable with or without a jacket under a metal armor.
AFC CABLE SYSTEMS INC
I. Max. 1/4 in. (6 mm) diameter S-Video Cable consisting of 2 max 24 AWG 75 ohm coax or twisted pair cable with PE insulation and PVC jacket.
J. Max 3/C No 12 AWG MC Cable.
K. Through Penetrating Product* — Any cables, Armored Cable+ or Metal Clad Cable+ currently Classified under the Through Penetrating Product category. See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
When the hourly rating of the wall assembly is 1 hr, the T, FT and FTH Ratings are 0 hr. When the hourly rating of the wall assembly is 2 hr, the T, FT and FTH Ratings are 1 hr except that, when item 2J or 2K is used, the T, FT and FTH Ratings are 1/2 hr . When the hourly rating of the wall assembly is 3 or 4 hr, the T, FT and FTH Ratings are 1-1/2 and 2 hr, respectively.
L Ratings apply only when device flanges are used. L Ratings vary depending on whether the gasketing material (see Item 3) or the sealant (Item 4) is used. See Table below for L Ratings.

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 27, 2015

System No. W-L-3334 (Cont.)

Max Cable Fill	Cable Type	L Rating, CFM/Sq Ft				L Rating, CFM			
		Ambient		400°F		Ambient		400°F	
		Sealant	Gasket	Sealant	Gasket	Sealant	Gasket	Sealant	Gasket
0%	—	Less than 1	1.0	Less than 1	2.7	Less than 1	Less than 1	Less than 1	Less than 1
100%	Item 2D only	4.9	4.9	1.3	3.5	Less than 1	Less than 1	Less than 1	Less than 1
100%	Any cables (Item 2) in any combination	9.2	9.2	9.6	11.8	1.2	1.2	1.3	1.6

3. Firestop Device* — Firestop device consists of a corrugated steel tube with an inner plastic housing, intumescent material rings, twisted inner fabric smoke seal, flanges and gasketing material (not shown). Firestop device to be installed in accordance with the accompanying installation instructions. As an option, the inner fabric seal may remain open except that, to attain the L Rating, the inner fabric seal shall be twisted to completely close off the opening within device. Device slid into wall such that ends project an equal distance from the approximate centerline of the wall assembly. The annular space between the device and the periphery of the opening shall be min 0 in. (point contact). Device provided with flanges that are spun clockwise onto device threads, over gasketing material butting tightly to both sides of wall. As an alternate to gasket material, sealant (Item 4) may be used. Device flanges are optional, except that when ½ in. (19 mm) gypsum board (see Item 1B) is used, device flanges shall be used and for 3 and 4 hr fire rating, device flanges shall be used. When the device flanges are not used, the T, FT and FTH Ratings for the firestop system are 0 hr.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 653 2" Speed Sleeve and CP 653 4" Speed Sleeve
4. Fill, Void or Cavity Material* - Sealant — As an alternate to gasket material (see Item 3), min 1/2 in. (13 mm) thickness of fill material applied within the annulus between firestop device and wall, flush with both surfaces of wall, and an additional 1/4 in. (6 mm) bead applied around periphery of device. When device flanges are used, gypsum drywall compound may be used in place of the fill material. Sealant is required when device flanges are not used (see Item 3).
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE, FS-ONE MAX Intumescent Sealant, or CP 606 Sealant

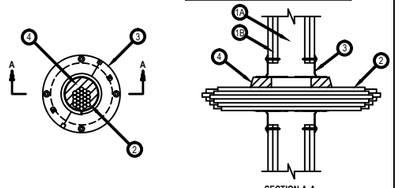
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.
+Bearing the UL Listing Mark

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 27, 2015

System No. W-L-3393

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Ratings - 0, 3/4 and 1 Hr (See Items 2 and 3)	FT Ratings - 0, 3/4 and 1 Hr (See Items 2 and 3)
L Rating At Ambient - See Item 4	FH Ratings - 1 and 2 Hr (See Item 1)
L Rating At 400F - See Item 4	FTH Ratings - 0, 3/4 and 1 Hr (See Items 2 and 3)
	L Rating At Ambient - See Item 4
	L Rating At 400F - See Item 4



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Opening in gypsum board to be max 8 in. (203 mm) diam for 4" device and max 6 in. (152 mm) diam for 2" device.
The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.
2. Cables — Within the loading area for each firestop device, the aggregate cross-sectional area of cables to be min 0 to max 60 percent fill. Cables to be tightly bundled within the device and rigidly supported on both sides of wall assembly. Any combination of the following types of cables may be used:
A. Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
B. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
C. Max 4/0 AWG Type RHH ground cable.
D. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
E. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
F. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/2 in. (13 mm).
G. Max 3/C No 12 AWG MC Cable.
For opening with cables, when the hourly rating of the wall assembly is 1 hr, the T, FT and FTH Ratings are 0 hr. For opening with cables, when the hourly rating of the wall assembly is 2 hr, the T, FT and FTH Ratings are 1 hr except that when item 2C is used, the T, FT and FTH Ratings are 3/4 hr.
3. Firestop Device* — Firestop device consists of a corrugated steel tube with a flange at each end that is spun clockwise onto device threads, butting tightly to both sides of wall. Each flange is secured to face of wall with min four No. 10 by 1-1/2 in. (38 mm) steel laminating screws through prepunched holes in flange. Device is designed to allow installation before or after the cable penetrants are in place. Device slid into wall such that ends project an equal distance from the approximate centerline of the wall assembly. The annular space between the device and the periphery of the opening shall be min 0 in. (point contact) to max 2 in. (51 mm). For blank openings (no cables) in 2 hr rated walls, the T, FT and FTH Ratings for the firestop system are 1 hr. For blank openings (no cables) in 1 hr rated walls, the T, FT and FTH Ratings are 0 hr.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-SL RK 2" and 4" Firestop Sleeve
4. Fill, Void or Cavity Material* - Plug — Nom 2 or 4 in. (51 or 102 mm) plug sized for the firestop device (Item 3) friction fit within the sleeve flush with the end of the sleeve on both sides of the wall assembly. Plug cut to fit around the cable bundle and installed tightly within the sleeve.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-PL Firestop Plug

The following L Ratings are covered. Cable bundle shall be centered within the device.

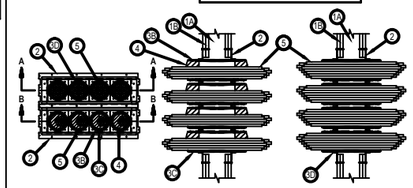
	CFM (per device)		CFM/Sq Ft Opening	
	Ambient	400°F	Ambient	400°F
Blank Opening (no cables)	1.3	1.1	3.8	3.0
Max 33% aggregate cable fill	2.8	1.2	8.1	3.3

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 25, 2013

System No. W-L-3395

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Items 1 and 2)	F Ratings - 1 and 2 Hr (See Items 1 and 2)
T Rating - 1/4 Hr	FT Rating - 1/4 Hr
L Rating At Ambient - See Item 5	FH Ratings - 1 and 2 Hr (See Items 1 and 2)
L Rating At 400F - See Item 5	FTH Ratings - 1/4 Hr
	L Rating At Ambient - See Item 5
	L Rating At 400F - See Item 5



1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described within the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
A. Studs — Wall framing shall consist of steel channel studs. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Designs in the UL Fire Resistance Directory and shall incorporate the following construction features:
A. Studs — Wall framing shall consist of steel channel studs. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Maximum size of opening in gypsum board is dependent on the mounting of the gangplate firestop device (Item 2). Openings for gangplates that are surface mounted to the gypsum board may be oriented vertically or horizontally. Openings for gangplates that are stud mounted direct to the wall studs prior to gypsum board layers are oriented horizontally. Maximum opening sizes are specified in Table below.

FIRESTOP DEVICE (Item 2)	MAXIMUM OPENING SIZE GANGPLATE MOUNTING			
	SURFACE MOUNTED		STUD MOUNTED	
24" PLATE :				
SINGLE	20-1/2" x 5-1/2" x 140)	(521	23" x 6-3/4" 171)	(584 x
DOUBLE (STACKED)	20-1/2" x 13-1/4" x 337)	(521	23" x 14-1/4" 362)	(584 x
16" PLATE :				
SINGLE	15" x 5-1/2" x 140)	(381	15-3/16" x 6-3/4" x 171)	(386
DOUBLE (STACKED)	15" x 13-1/4" x 337)	(381	15-3/16" x 14-1/4" x 362)	(386

The hourly F and FH Ratings of the firestop system are dependent upon the hourly rating of the wall in which it is installed.
2. Firestop Device* — The firestop device consists of a steel plate sandwich construction with three (16" device size) or four (24" device size) circular opening ports which are each nom 4 in. (102 mm) diam. The firestop device is intended to be oriented vertically or horizontally and mounted to the face of the opening on both sides of wall. The 16" and 24" firestop devices when oriented horizontally are attached to the 16 in. (406 mm) and 24 in. (610 mm), respectively, center to center spaced wall studs at each side of opening, over the gypsum board. As an option, up to two devices may be installed adjacent to each other with a nom 13/16 in. (2 cm) overlap to protect larger sized openings (see Item 1B, double device). As an option, single and double 16" and 24" gang plates may be attached directly against the studs prior to installation of the gypsum board layers. When 16" gang plate is installed horizontally in 24" stud cavity, attachment of plate to wall studs is optional. As an option, two devices may be installed end to end in adjacent stud cavities, over the gypsum board layers or directly attached to the wall studs when installed in accordance with the Hilti Installation Instructions and min one layer of gypsum board each side of wall is continuous across the two stud cavities. Each device shall be secured to gypsum board with min No. 10 by 1-1/2 in. (38 mm) steel drywall screws through prepunched holes around periphery of steel device plates; min three (16" gang plate) or four (24" gang plate) screws are used at each long dimension and three screws at each end. When device is secured direct to studs prior to installation of gypsum board layers, the fasteners along each long dimension of opening are spaced max 2-1/2 in. (64 mm) from corners and max 6 in. (152 mm) on center unless otherwise noted in Hilti Installation Instructions. Min screw length is 3/4 in. (19 mm) where device is secured direct to studs and at the overlapping plate to plate joint for double devices. The device shall be installed in accordance with the accompanying installation instructions. When the hourly rating of the wall assembly is 1 hr, blank gang plates (no cables) may be installed vertically or horizontally for single gang plate openings only, and double gang plates are limited to installation horizontally with fasteners at ends of plates penetrating into wall studs.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-SL GP 16" and 24" Firestop Gangplate
3. Firestop Device — Within each circular opening port of the CFS-SL GP firestop gang plates (Item 2), one of the following firestop devices shall be installed. Any combination of these firestop devices may be used within each gang plate.
3A. Firestop Device* — Rectangular steel plate designed to close port openings with no penetrants. Plate is field installed in accordance with Hilti Installation Instructions. Flanges of gang plate over port opening are removed by loosening GP nuts. the steel plate cap installed with prepunched holes aligned with GP fasteners, and the flanges of GP then reinstalled and nuts reinstalled to fighten the plates in position.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-SL GP CAP Firestop Gangplate CAP
3B. Firestop Device* — Firestop device consists of a corrugated steel tube. The device flanges are removed by spinning counterclockwise and are not used. Device tube slid into gang plate port opening and centered within wall such that ends of device tube project an approximate equal distance from the gang plate on each side of wall. The two integral screws within the flange of the gang plate port at each side of wall are tightened to firmly bear against the device sleeve to retain it in position. Device is designed to allow installation before or after the cable penetrants (if employed) are in place. Device is used in combination with the firestop plugs described in Item 4.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-SL RK 4" Firestop Sleeve
3C. Firestop Device* — Firestop device consists of a corrugated steel tube. The device flanges are removed by spinning counterclockwise and are not used. Device tube slid into gang plate port opening and centered within wall such that ends of device tube project an approximate equal distance from the gang plate on each side of wall. The two integral screws within the flange of the gang plate port at each side of wall are tightened to firmly bear against the device sleeve to retain it in position. Device is used in combination with the firestop plugs described in Item 4.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-SL SK 4" Firestop Retrofit Sleeve
3D. Firestop Device* — Firestop device consists of a corrugated steel tube with an inner plastic housing, intumescent material rings and twisted inner fabric smoke seal. The device flanges are to be spun counterclockwise and removed since they are not used. Device tube slid into gang plate port opening and centered within wall such that ends of device tube project an approximate equal distance from the gang plate on each side of wall. The two integral screws within the flange of the gang plate port at each side of wall are tightened to firmly bear against the device sleeve to retain it in position. The inner fabric seal shall be twisted to completely close off any unused opening within the device.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 653 4" Speed Sleeve
4 Fill, Void or Cavity Material* - Plug — Plugs are required to be used with the CFS-SL RK and SK firestop devices (Items 3B and 3C). Nom 4" diam plug friction fit within the device sleeve flush with each end of the device on both sides of wall. Plug cut to fit around the cable bundle (if used) and installed tightly within the device sleeve.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-PL Firestop Plug 4"
5. Cables — Within the loading area for each firestop device (Items 3B through 3D), a tightly bundled cable may be installed. The aggregate cross-sectional area of cables shall be min 0 to max 60 percent fill for each CFS-SL RK and CFS-SL SK firestop device (Items 3B and 3C). For the CP 653 Speed Sleeve firestop device (Item 3D), the cables can be used for a 0 to 100 percent visual fill. Cables to be rigidly supported on both sides of wall assembly. Any combination of the following types of cables may be used:
A. Max 100 pair No. 24 AWG (or smaller) copper conductor telecommunication cable with polyvinyl chloride (PVC) jacketing and insulation.
B. Max 7/C No. 12 AWG copper conductor control cable with PVC or XLPE jacket and insulation.
C. Max 4/0 AWG Type RHH ground cable.
D. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
E. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
F. Fiber optic cable with polyvinyl chloride (PVC) or polyethylene (PE) jacket and insulation having a max diam of 1/2 in. (13 mm).
G. Max 3/C No 12 AWG MC Cable.
The L Ratings are dependent on the type and number of devices within the gang plate and the cable type and fill. For devices with cable bundle, the cable bundle shall be nominally centered within the device to attain the L Ratings. The L Ratings in CFM per GP device (Table 1) and in CFM per ft2 of opening (Table 2) are specified below:

Table 1 - CFM per CFS-SL GP Gangplate Device at Ambient and 400F

	TYPE AND NUMBER OF DEVICES IN CFS-SL GP (CAP - ITEM 3A; DEVICES - ANY COMBINATION OF ITEMS 3B THROUGH 3D EXCEPT AS NOTED)				
	CAP(S) ONLY	CAP(S) AND ONE DEVICE	CAP(S) AND TWO DEVICES	CAP (OPT) AND THREE DEVICES	FOUR DEVICES
BLANK OPENING (NO CABLES) :	LESS THAN 1	1	2	2.5	3.5
OPENINGS WITH ANY COMBINATION OF ITEM 5 CABLES FOR MAX 33% AGGREGATE FILL IN DEVICE TYPES 3B AND 3C, AND/OR MAX 100% VISUAL CABLE FILL IN DEVICE TYPE 3D	-	2	4	6	8
	CAP(S) ONLY	CAP(S) AND ONE CP 653 DEVICE (ITEM 3D)	CAP(S) AND TWO CP 653 DEVICES (ITEM 3D)	CAP (OPT) AND THREE CP 653 DEVICES (ITEM 3D)	FOUR CP 653 DEVICES (ITEM 3D)
OPENINGS WITH MAX 100% VISUAL CABLE FILL WITH CABLE TYPE 5D ONLY AND CP 653 ONLY	-	1.5	3	4	5.5

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
August 27, 2013

System No. W-L-3395

Table 2 - CFM per FT2 of Opening at Ambient and 400F

	TYPE AND NUMBER OF DEVICES IN CFS-SL GP (CAP - ITEM 3A; DEVICES - ANY COMBINATION OF ITEMS 3B THROUGH 3D EXCEPT AS NOTED)				
	CAP(S) ONLY	CAP(S) AND ONE DEVICE	CAP(S) AND TWO DEVICES	CAP (OPT) AND THREE DEVICES	FOUR DEVICES
BLANK OPENING (NO CABLES) :	1.2	1.3	2.6	3.2	4.5
OPENINGS WITH ANY COMBINATION OF ITEM 5 CABLES FOR MAX 33% AGGREGATE FILL IN DEVICE TYPES 3B AND 3C, AND/OR MAX 100% VISUAL CABLE FILL IN DEVICE TYPE 3D	-	2.6	5.1	7.7	10.2
	CAP(S) ONLY	CAP(S) AND ONE CP 653 DEVICE (ITEM 3D)	CAP(S) AND TWO CP 653 DEVICES (ITEM 3D)	CAP (OPT) AND THREE CP 653 DEVICES (ITEM 3D)	FOUR CP 653 DEVICES (ITEM 3D)
OPENINGS WITH MAX 100% VISUAL CABLE FILL WITH CABLE TYPE 5D ONLY AND CP 653 ONLY	-	1.9	3.8	5.1	7.0

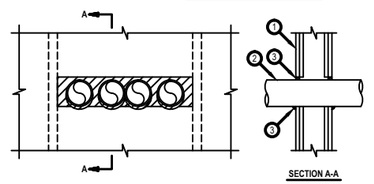
*Bearing the UL Classification Mark

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
August 27, 2013

System No. W-L-1408

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0 and 1/4 Hr (See Item 1)	FT Ratings —0 and 1/4 Hr (See Item 1)
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Ratings — 0 and 1/4 Hr (See Item 1)



1. Wall Assembly — The 1 and 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
A. Studs — Wall framing shall consist of min 3-5/8 in. (92 mm) wide steel studs spaced max 24 in. (610 mm) OC.
B. Gypsum Board* — Thickness, type, number of layers and fasteners, as specified in the individual Wall and Partition Design. Max area or opening is 114 in.2 (735 cm²) with max height of 5 in. (127 mm) and max width of 23 in. (584 mm).
The hourly F, FH Ratings of the firestop system are equal to the hourly rating of the wall. The hourly T, FT, FTH Ratings of the firestop system is 0 hr and 1/4 hr when installed in 1 hr and 2 hr fire rated wall assemblies, respectively.
2. Through Penetrants — Multiple pipes or conduits installed in single layer array within the firestop system. The annular space between the pipes and conduits and the edges of the opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25 mm). The separation between pipes and conduits to be a min 0 in. (0 mm, point contact) to a max 1-1/2 in. (38 mm). Pipes and conduits to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
A. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
B. Conduit — Nom 4 in. (102 mm) diam (or smaller) rigid steel conduit or steel electrical metallic tubing (EMT).
3. Fill Void or Cavity Materials* - Sealant — Min 5/8 in. (16 mm) thickness of fill material installed to completely fill annular space between pipes, conduits and gypsum flush with each surface of wall. Min 1/2 in. (13 mm) diam bead of fill material applied to the through penetrant/wall interface at the point contact locations on both sides of the wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — 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.

HILTI
Hilti Firestop Systems

Reproduced by HILTI, Inc. Courtesy of Underwriters Laboratories, Inc.
January 26, 2015

Notes:

1. *Refer to section 16055 of the specifications. For Quality Control requirements, refer to the Quality Control portion of the specification.*
2. *Details shown are typical details. If field conditions do not match requirements of typical details, approved alternate details shall be utilized. Field conditions and dimensions need to be verified for compliance with the details, including but not limited to the following: * Minimum and maximum Width of Joints * Type and thickness of fire-rated construction. The minimum assembly rating of the firestop assembly shall meet or exceed the highest rating of the adjacent construction.*
3. *If alternate details matching the field conditions are not available, manufacturer's engineering judgment drawings are acceptable. Drawings shall follow the International Firestop Council (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments.*
4. *References:*
   - ** 2013 Underwriter's Laboratories Fire Resistance Directory, Volumes 1 & 2*
   - ** NFPA 101 Life Safety Code*
   - ** NFPA 70 - National Electric Code*
   - ** All governing local and regional building codes*
5. *Firestop System installation must meet requirements of ASTM E-814 (UL 1479) tested assemblies that provide a fire rating equal to that of construction being penetrated.*
6. *All rated through-penetration assemblies shall be prominently labeled with the following information:*
   - ** ATTENTION: Fire Rated Assembly*
   - ** UL System # * Product(s) used*
   - ** Hourly Rating (F-Rating)*
   - ** Installation Date*
7. *For outlet boxes requiring protection, use only Wall Opening Protective Materials, category CLIV as classified by Underwriter's Laboratories, Fire Resistance Directory (Volume 1.)*

<Notes to designer (delete this note after reading and replace with title block information)>
1. Any modification to these details could result in an application/system not meeting the UL or Intertek Classification or the intended temperature or fire ratings.
2. Details shown are up to date as of February 2015.
3. For additional information on the details, refer to the most current "Underwriter's Laboratories Fire Resistance Directory (volume 2.)"

JOB NUMBER:

DRAWN:

CHECKED:

ISSUE DATE:

REVISIONS:

TYPICAL FIRESTOP DETAILS

SHEET NAME:

SHEET NUMBER:

E.4.4