Design No. 3MU/DI 60-01
VENTILATION DUCT PROTECTION
3M Company
3M™ Fire Barrier™ Duct Wraps: 615 and 615+
3M™ Fire Barrier™ Sealants: Water-Tight 1000-NS Silicone, Water-Tight 1003-SL Silicone (floors only), 2000+ Silicone, and CP 25 WB+
ISO 6944 (1985) Duct A
Stability – 1 hour
Insulation – 1 hour
Integrity – 1 hour
ASTM E 814
F-Rating – 1 hour
T-Rating – 1 hour

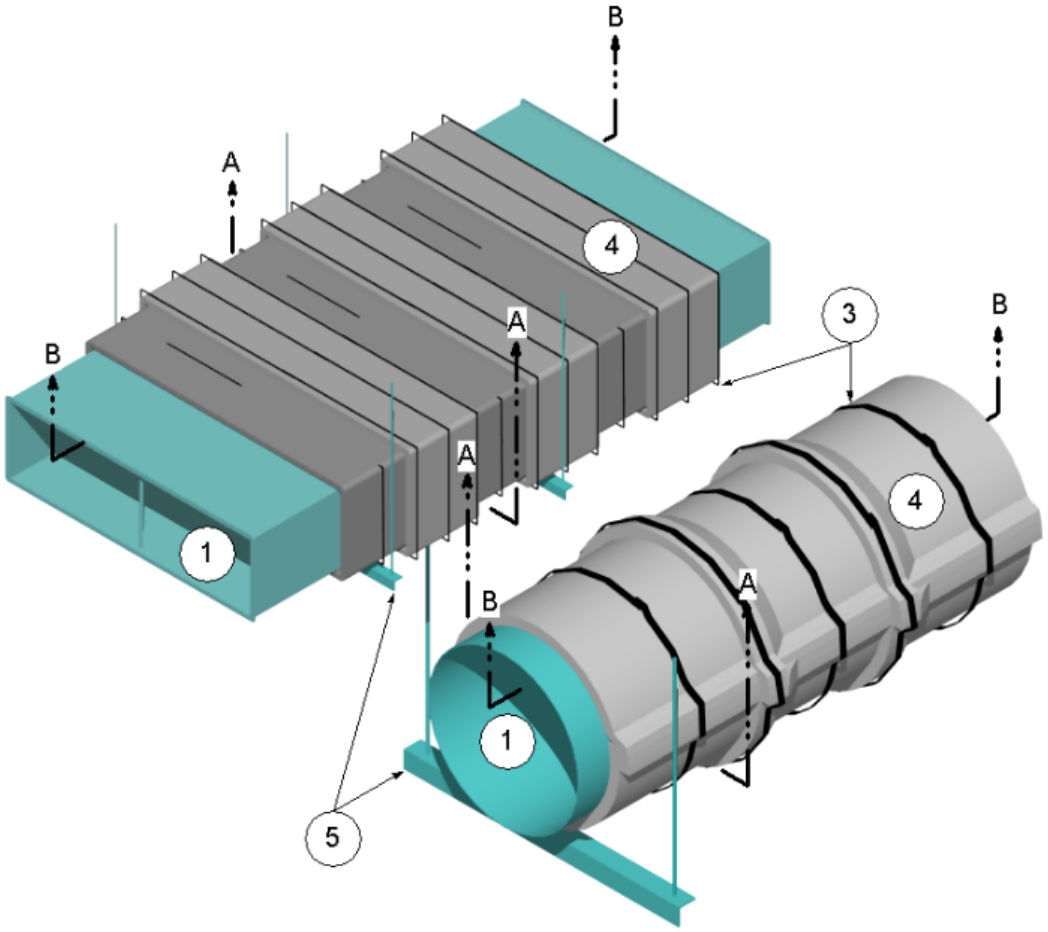


Figure 1

1. VENTILATION DUCT: Refer to Figure 1. Continuous, air-tight, rectangular or circular duct system with either horizontally or vertically oriented shafts constructed of sheet steel with a maximum area and a maximum dimension as referenced in the Table 1. When required, equip the ventilation duct with transition fittings, e.g. elbows, tees, reducers, etcetera.

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Table 1 – Ventilation Duct Requirements					
Ventilation Duct for Items 6, 7 and 8 References	**Shape**	**Minimum Gauge**	**Maximum Dimension (in.)**	**Maximum Diameter (in.)**	**Maximum Area (in.^{2})**
R1	Rectangular	26	12	--	144
R2	Rectangular	24	40	--	400
R3	Rectangular	22	60	--	1440
R4	Rectangular	22	85	--	2040
C1	Circular	20	--	40	1257
C2	Circular	24	--	21	347
C3	Circular	26	--	13	133

A. Construct the ventilation duct using sections affixed to each other with seams or flanges.

B. Reinforce the ventilation duct to IMC, SMACNA or NFPA 90A requirements designed to carry the weight of the ventilation duct assembly covered with insulation (Item 4) under a fire load equivalent to ASTM E 119 time-temperature curve.

C. Rigidly support the ventilation duct in accordance with IMC, SMACNA or NFPA 90A requirements designed to carry the weight of the ventilation duct assembly covered with insulation (Item 4) under a fire load equivalent to ASTM E 119 time-temperature curve or as specified in Item 5.

D. Protect the annular space around the ventilation duct passing through a fire rated wall assembly with an Intertek certified, compatible, 3M, penetration firestop system, refer to Section 8, having the same fire rating as the wall assembly.

2. FASTENERS: Refer to Figure 2. Weld minimum 12 gauge (ga.), 4-1/2-in. long, copper-coated steel insulation pins or 12-ga. insulated cup head pins to the ventilation duct (Item 1). Match fastener method with corresponding insulation (Item 4) method.

A. Compression Butt Joint: Refer to 4A Section View B-B. Locate pins at all blanket overlaps, on all sides of the ventilation duct (Item 1), and meet the following requirements.

I. Space pins maximum 12 in. apart in rows across the width of ventilation duct (Item 1). Locate pins maximum 6-3/4 in. from the edges of the rectangular ventilation duct (Item 1).

II. Space the rows of pins maximum 9-1/2 in. apart along the length ventilation duct (Item 1). Where pieces of insulation (Item 4A) are to be butted together, space the pins a maximum of 2 in. apart.

III. After insulation (Item 4A) is installed, place minimum 2.5 in. x 2.5 in. square, galvanized steel, self locking washer clips onto all insulation pins.

IV. After clips are installed, cut off or bend flush with insulation (Item 4) the pins that are too long.

B. Butt Joint with Collar: Refer to 4B Section View B-B. Locate pins at all blanket overlaps, on all sides of the ventilation duct (Item 1), and meet the following requirements.

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I. Space pins maximum 12 in. apart in rows around the circumference for circular ventilation ducts (Item 1) or on all sides for rectangular ventilation ducts (Item 1). For rectangular ventilation ducts (Item 1), locate pins maximum 6-3/4 in. from the edges.

II. Space the rows of pins maximum 9 in. apart along the length ventilation duct (Item 1). Where pieces of insulation (Item 4B) are to be butted together, space pins a maximum of 3 in. apart.

III. After insulation (Item 4B) is installed, place minimum 2.5 in. x 2.5 in. square, galvanized steel, self locking washer clips onto all insulation pins.

IV. After clips are installed, cut off or bend flush with insulation (Item 4B) the pins that are too long.

C. Single End Overlap (Telescope): Refer to 4C Section View B-B. Locate pins at all blanket overlaps, on all sides of the ventilation duct (Item 1), and meet the following requirements.

I. Space pins maximum 12 in. apart in rows across the width of ventilation duct (Item 1). Locate pins maximum 6-3/4 in. from the edges of the rectangular ventilation duct (Item 1).

II. Space the rows of pins maximum 10-1/2 in. apart along the length ventilation duct (Item 1). Where pieces of insulation (Item 4C) are to be butted together, space the pins a maximum 1-1/2 in. apart.

III. After insulation (Item 4C) is installed, place minimum 2.5 in. x 2.5 in. square, galvanized steel, self locking washer clips onto all insulation pins.

IV. After clips are installed, cut off or bend flush with insulation (Item 4C) the pins that are too long.

D. Dual End Overlap (Checkerboard): Refer to 4D Section View B-B. Locate pins at all blanket overlaps, on all sides of the ventilation duct (Item 1), and meet the following requirements.

I. Space pins maximum 12 in. apart in rows across the width of ventilation duct (Item 1). Locate pins maximum 6-3/4 in. from the edges of the rectangular ventilation duct (Item 1).

II. Space the rows of pins maximum 10-1/2 in. apart along the length ventilation duct (Item 1). Where pieces of insulation (Item 4D) are to be butted together, space the pins a maximum of 1-1/2 in. apart.

III. After insulation (Item 4D) is installed, place minimum 2.5 in. x 2.5 in. square, galvanized steel, self locking washer clips onto all insulation pins.

IV. After clips are installed, cut off or bend flush with insulation (Item 4D) the pins that are too long.

3. BANDING: Do not use banding for the installation of insulation method (Item 4A), Compression Butt Joint. Banding is an option to fastener methods (Items 2B, 2C and 2D) but not fastener method (Item 2A). After insulation (Item 4) is installed, apply minimum 1/2 in. wide, 0.015-in. thick stainless steel bands or minimum 1/2 in. wide, 0.020-in. thick carbon steel bands and secured with minimum 1-in. long stainless or carbon steel crimp clamps to be used with corresponding banding type. When needed to ease installation, use filament tape as a temporary hold for the insulation (Item 4) prior to banding. Place banding a maximum 1-1/2 in. from all insulation (Item 4) edges and a maximum of 10-1/2 in. on center (O.C.). Tension the banding to hold the insulation (Item 4) in place without cutting or damaging the insulation (Item 4) or ventilation duct (Item 1).

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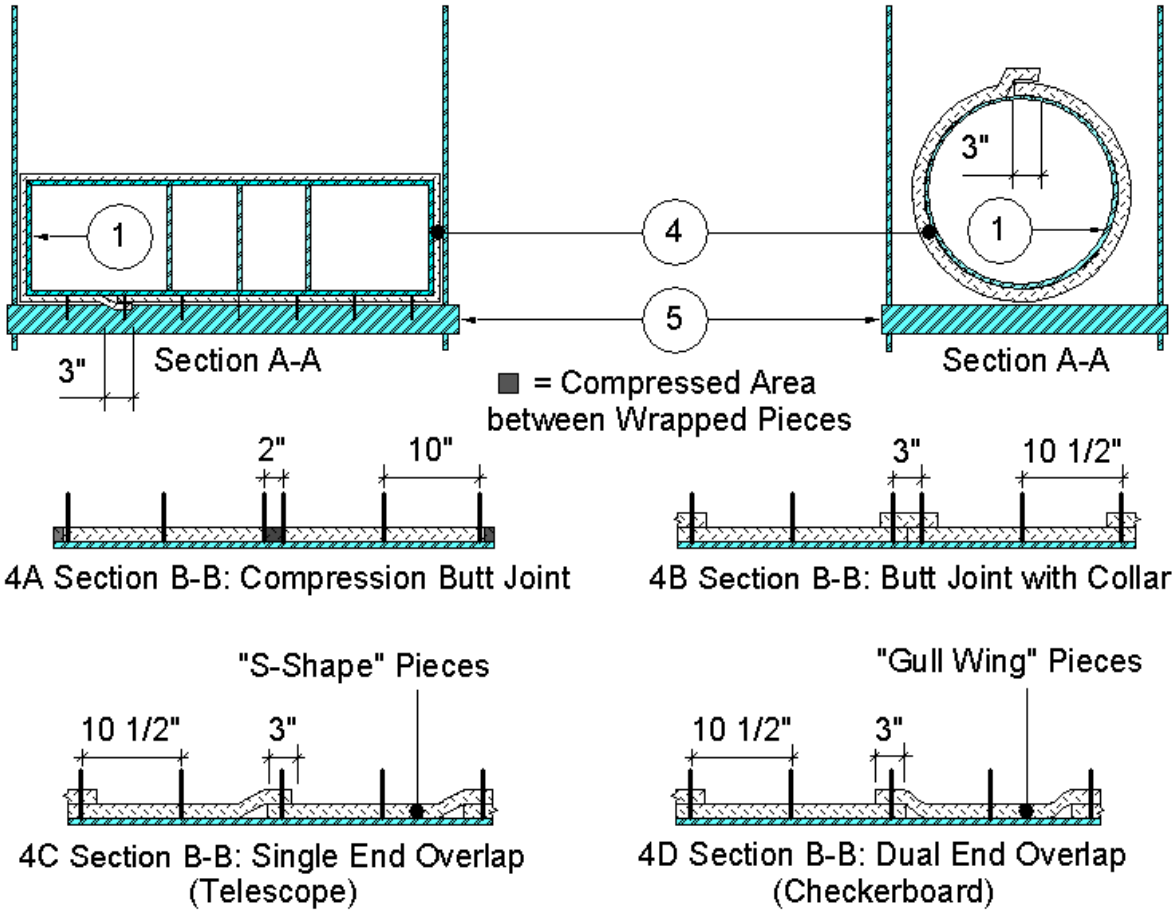


Figure 2

4. CERTIFIED MANUFACTURER: 3M Company

   CERTIFIED PRODUCT: 3M™ Fire Barrier Duct Wrap

   MODEL: 615 or 615+

   INSULATION: Refer to Figure 2. Apply one layer of nominal 1-1/2 in. thick, 6-pound-per-cubic foot (pcf) blanket, made of fibers, encapsulated with foil scrim over the entire surface of the ventilation duct (Item 1) and a collar on each side of the penetration firestop (Item 1D). Apply the insulation in accord with one of the four methods (A, B, C, or D) that follow. Use blanket that is encapsulated with a polypropylene/foil scrim or an aluminized polyester/scrim/foil. Wrap one layer of insulation around the ventilation duct (Item 1) perimeter so that each terminating end of insulation overlaps onto the starting end of insulation a minimum of 3 in. at all transverse joints. Alternate the transverse overlap location so that no two consecutive adjacent overlaps align. Refer to Section View A-A for transverse overlap section view. Cover and seal all visually exposed ends and edges of insulation with nominal 4-in. wide pressure-sensitive aluminum foil tape.

   A. Compression Butt Joint: Refer to 4A Section View B-B. Wrap the ventilation duct (Item 1) with one layer of insulation installed with compression butt joints at all longitudinal joints. Compress each end of each piece of insulation

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together and butt to preceding edge of insulation. Each piece of installed insulation width is 2 in. less than insulation nominal width. (Example: each piece of nominal 24-in. wide insulation when installed is 22-in. wide.) Install the insulation overlap in contact (pressed against) with the insulation being overlapped. Verify all insulation butt joints are a minimum 1-1/2 in. in overall thickness at compression butt joints.

B. Butt Joint with Collar: Refer to 4B Section View B-B. Wrap the ventilation duct (Item 1) with one layer of insulation installed with butt joints at all longitudinal joints. Butt each end of each piece of insulation together with preceding edge of insulation. Each piece of installed insulation width is its nominal width. (Example: each piece of nominal 24-in. wide insulation when installed is 24-in. wide.) Install the insulation overlap in contact (pressed against) with the insulation being overlapped. Place and center 6-in. wide collar of insulation over the butt joint. Overlap 6-in. wide collar onto each adjacent insulation 3-in. Verify all insulation butt joints with collars are a minimum 3 in. in overall thickness.

C. Single End Overlap (Telescope): Refer to 4C Section View B-B. Wrap the ventilation duct (Item 1) with one layer of insulation installed with 3-in. minimum overlaps at all longitudinal joints. Overlap each adjacent insulation edge with the edge of the next piece of insulation. Install the insulation overlap in contact (pressed against) with the insulation being overlapped. Verify all insulation overlaps are nominally 3 in. in overall thickness.

I. Starting at one end of the ventilation duct (Item 1), apply the first piece of insulation around the ventilation duct (Item 1) to overlap fasteners (Item 2C). Refer section view A-A.

II. Position and overlap the leading edge of the second piece of insulation nominally 3 in. over the flush edge of the first piece of insulation. Place the opposite edge of the second piece of insulation flush against the surface of the ventilation duct (Item 1). An “S-shaped” cross section of the insulation is created. Refer to 4C section view B-B.

III. Apply all additional pieces of insulation as “S-shaped” cross section of the insulation in compliance with Item 4CII.

D. Dual End Overlap (Checkerboard): Refer to 4D Section View B-B. Verify all insulation overlaps are a minimum 3 in. in overall thickness. Do not align two consecutive insulation end overlaps. Overlap each full-width insulation edge with the edge of the “Gull Wing”, ¯U¯ shaped insulation. Install the insulation overlap in contact (pressed against) with the insulation being overlapped. Verify all insulation overlaps are nominally 3 in. in overall thickness.

I. Wrap the first piece of insulation around the ventilation duct (Item 1) so that the insulation is flush against the surface of the ventilation duct (Item 1). Position the starting end of the insulation to overlap pins (Item 2A) a minimum of 1-1/2 in. while the edges of the insulation overlap the rows of pins (Item 2B) a minimum of 1-1/2 in.

II. Position the second piece of insulation nominally 18 in. from the edge of the first piece of insulation. Install the second piece in the same manner as the first.

III. Cover the ventilation duct (Item 1) that is exposed between the

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edges of the first two pieces of insulation with another piece of insulation. Position the starting end of the insulation to overlap pins (Item 2A) a minimum of 1-1/2 in. while the edges of the insulation overlap the adjacent edges of the two pieces installed insulation a minimum of 1-1/2 in..

5. SUPPORTS: Support the ventilation duct (Item 1) with insulation (Item 4) using a “trapeze” system composed of a minimum 2 x 2 x 1/4-in. steel angle as the trapeze cross-member and minimum 3/8-in. diameter rods. Connect all-thread steel rods (insulation (Item 4) not required) to the trapeze cross-member using nuts and washers. Connect the all-thread steel rods to the bottom of the floor assembly using an attachment method designed to carry the weight of the ventilation duct (Item 1) with insulation (Item 4) under a fire load equivalent to ASTM E119 time-temperature curve. Center ventilation duct (Item 1) with insulation (Item 4) on trapeze cross-member. Space all-thread steel rods a maximum distance of 6 in. from surface of the insulated ventilation duct or allowing all-thread steel rods to contact with the insulation (Item 4) at the minimum distance. Extend trapeze cross-member at least 2-in. past each all-thread steel rod. Space trapeze supports a maximum 60-in. O.C.

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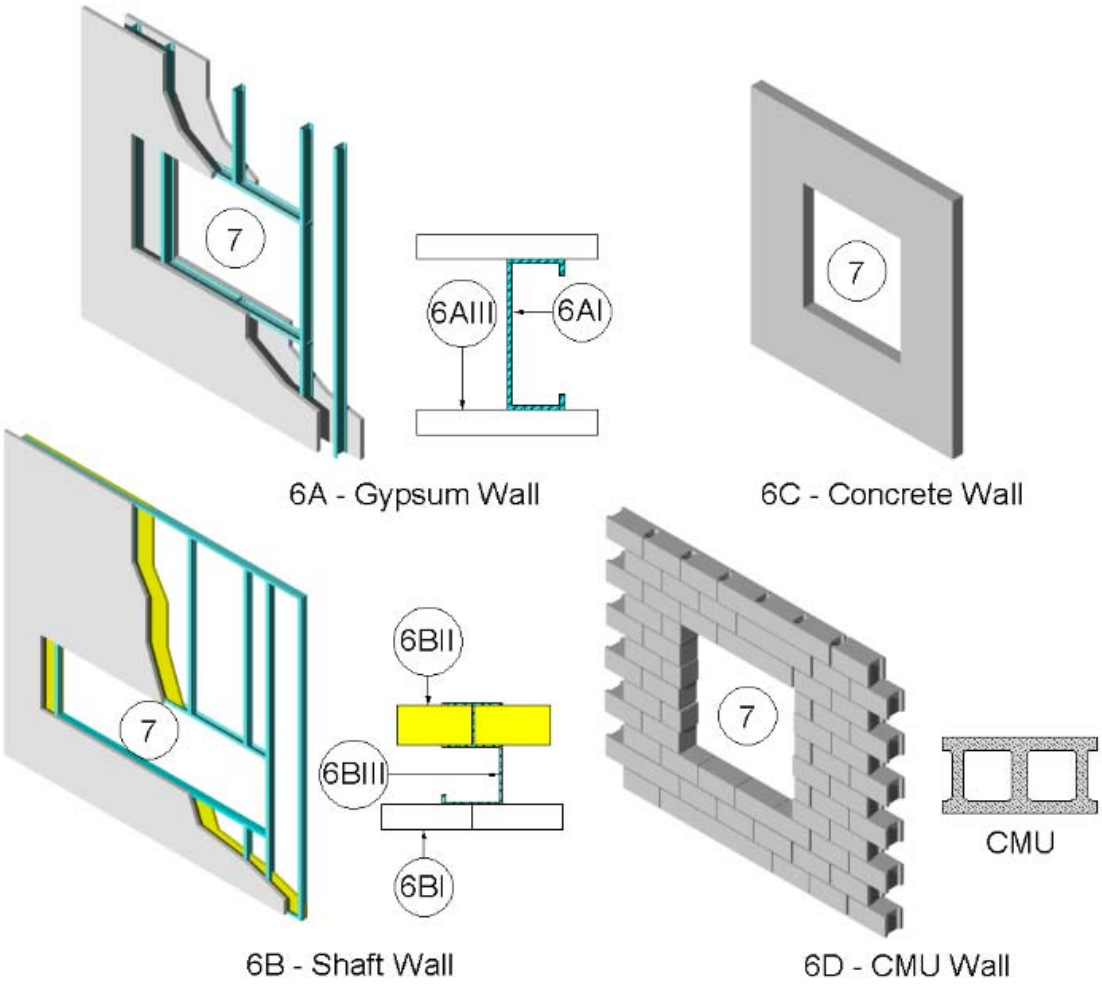


Figure 3

6. SUPPORTING CONSTRUCTION: Refer to Figures 3 and 4. Use one of the following wall or floor assemblies.
   A. GYPSUM WALL ASSEMBLY: Symmetrical one-hour rated gypsum wall assembly, which may also be used as a shaft wall assembly, constructed of the following:
      I. Steel Studs – Minimum 25-ga galvanized steel studs measuring 3-5/8 in. wide with 1-1/4-in. legs spaced maximum 24 in. on center (O.C.). Attach studs with minimum #6 x 3/8-in. steel stud framing screws to floor and ceiling tracks.
      II. Tracks – Channel U-shaped floor and ceiling runners measuring 1/2-in. deep by 3-5/8-in. wide, which are secured to floor and ceiling with 1-in. long fasteners suitable for the mounting to substrate and spaced maximum 18-in. O.C.
      III. Gypsum Board – Cover studs and runners with one layer of 5/8 in. thick, Type X gypsum board on each face. Fasten the layer of gypsum board to steel studs with #6 1-1/8 in. bugle head phillips drywall screws spaced maximum 8 in. O.C. Apply vinyl or casein,

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dry or premixed joint compound to face layers of gypsum board in two coats to all exposed screw heads and gypsum board joints. Embed minimum 2 in. wide paper, plastic or fiberglass tape in first layer of joint compound over joints in gypsum board. Minimum wall assembly thickness of 4-3/4 in. measured from face layer of gypsum board to opposite face layer of gypsum board.

B. SHAFT WALL ASSEMBLY: Asymmetrical one-hour rated gypsum shaft wall assembly constructed of the following:

I. Visual Gypsum Board – Cover studs and runners with one layer of minimum 5/8 in. thick, Type X gypsum board on each face. Fasten gypsum board to steel studs with #6 1-5/8 in. bugle head phillips drywall screws spaced maximum 8 in. O.C. Apply vinyl or casein, dry or premixed joint compound to face layers of gypsum board in two coats to all exposed screw heads and gypsum board joints. Embed minimum 2 in. wide paper, plastic or fiberglass tape in first layer of joint compound over joints in gypsum board. Minimum wall assembly thickness of 6 in. measured from face layer of gypsum board to opposite face layer of gypsum board.

II. Interior Gypsum Board – Cut 1-in. thick Type X gypsum board 1-inch less than floor to ceiling height. Insert the longitudinal edges of the 1-in. thick Type X gypsum board into the C-T or C-H studs. Secure the transverse edge of the 1-in. thick Type X gypsum board to the long leg of J-runner using its tabs or minimum 1-5/8-in. long Type S self-tapping bugle head steel screws spaced maximum 12 in. O.C.

III. Steel Studs – Cut minimum 25-ga galvanized steel C-T or C-H studs measuring minimum 2-1/2 in. wide with minimum 1-1/2-in. flanges 3/4-in. less than floor to ceiling height and spaced maximum 24 in. on center (O.C.) in runners with T or H section abutting long leg of runner.

IV. Runners – Use minimum 2-1/2-in. wide J-runner compatible with studs and having unequal vertical legs: minimum 1-in. short leg and minimum 2-in. long leg. Position J-runners with short leg towards visual face of shaft wall. Attach to floor and ceiling using steel fasteners located a maximum of 2-in. from each end and a maximum of 24 in. O.C.

C. CONCRETE WALL ASSEMBLY: Symmetrical, one-hour rated, solid concrete, wall assembly made from reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m^3) concrete, which may also be used as a shaft wall assembly. Constructed of solid concrete with a minimum concrete thickness measured from exposed face to exposed face using one of the following:

I. lightweight concrete is 3.6 in.;
II. sand-lightweight concrete is 3.8 in.;
III. carbonate aggregate concrete is 4.6 in.; and
IV. siliceous aggregate concrete is 5.0 in.

D. MASONRY WALL ASSEMBLY: Symmetrical, minimum one-hour rated, nominal 8-in. x 8-in. x 16-in. CMU, wall assembly made from lightweight or normal weight (100-150 pcf or 1600-2400 kg/m^3) concrete, which may also be used as a shaft wall assembly.

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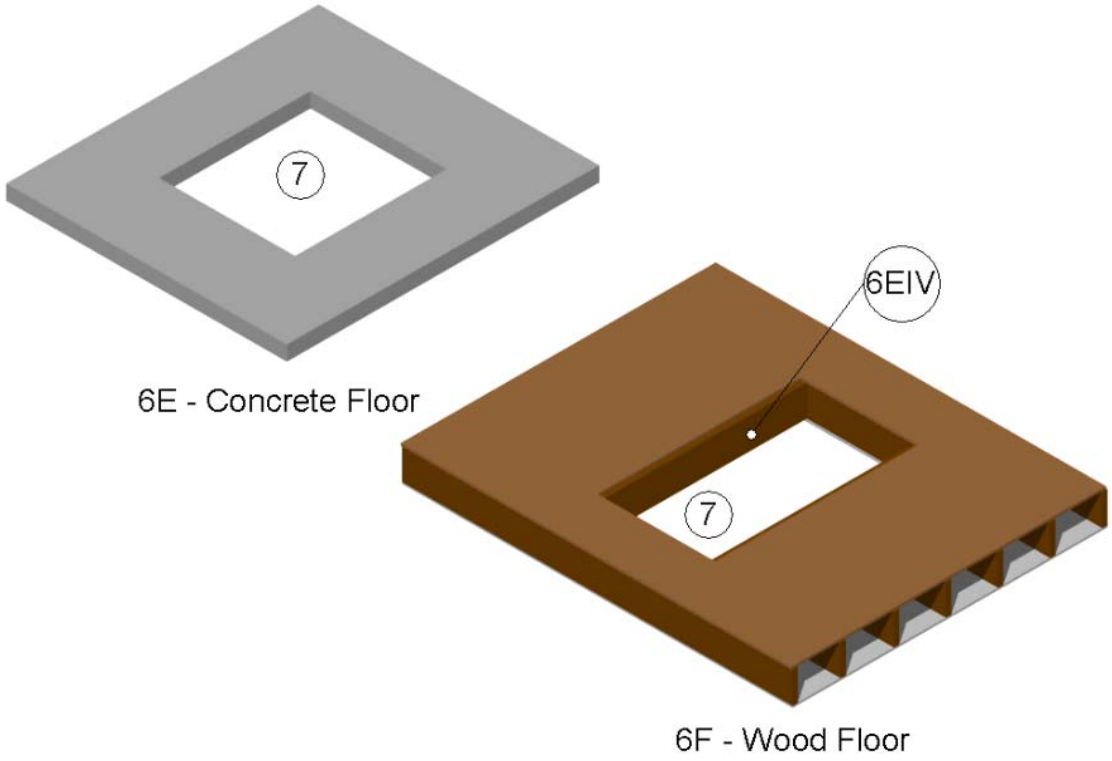


Figure 4

E. CONCRETE FLOOR ASSEMBLY: Symmetrical one-hour rated solid concrete floor assembly made from reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m^3) concrete. Constructed of solid concrete with a minimum concrete thickness measured from exposed face to exposed face using one of the following:
   I. lightweight concrete is 3.6 in.;
   II. sand-lightweight concrete is 3.8 in.;
   III. carbonate aggregate concrete is 4.6 in.; and
   IV. siliceous aggregate concrete is 5.0 in.

F. WOOD FLOOR ASSEMBLY: Asymmetrical ASTM E 119 (UL 263 or NFPA 251) one-hour fire-rated floor assembly having the following components as part of its construction:
   I. Joists – Minimum 2 x 10 wood joists spaced a maximum 18-1/2 in. on center (OC).
   II. Flooring – Minimum 3/4-in. thick plywood attached to the top of wood joists.
   III. Gypsum Board – Minimum one layer of 5/8-in. thick, Type X, gypsum board attached to the bottom of wood joists with minimum #8, 1-5/8-in. long, bugle head screws.
   IV. Reinforcement – When the opening (Item 6G) penetrates the joists, additional 2 x 10 solid wood perimeter framing is required to maintain the floor assembly's strength at that location.

7. OPENING: – Refer to Figures 3 and 4. Create an opening in the supporting construction (wall or floor assembly). Determine the opening shape and size to

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house the ventilation duct's (Item 1), whether with or without insulation (item 4) passing through the opening, shape and size. Position the penetrating item (Item 1) concentrically or eccentrically in the opening so that the annular space ranges from minimum to maximum as in Table 2.

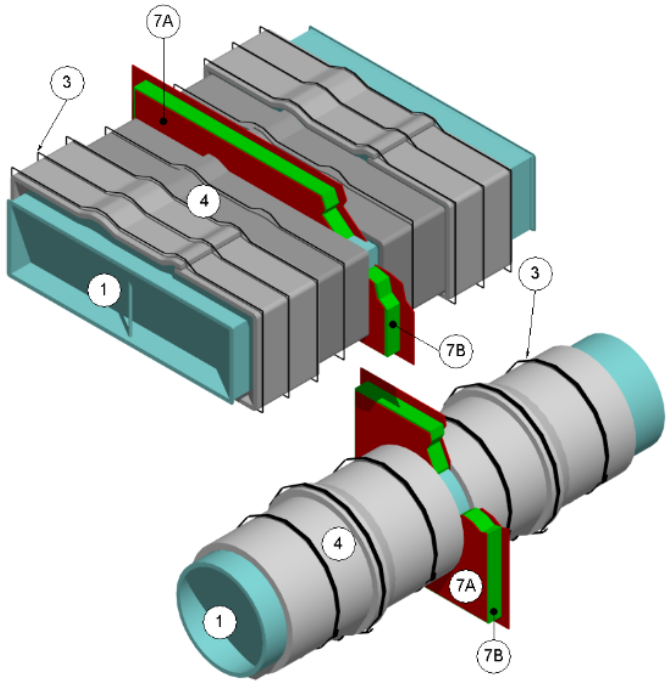
Make the opening with in accord with the following:

A. For gypsum wall assemblies (Item 6A) and shaft wall assembles (Item 6B), frame the opening with steel studs (Item 6AI) and tracks (Item 6AII).

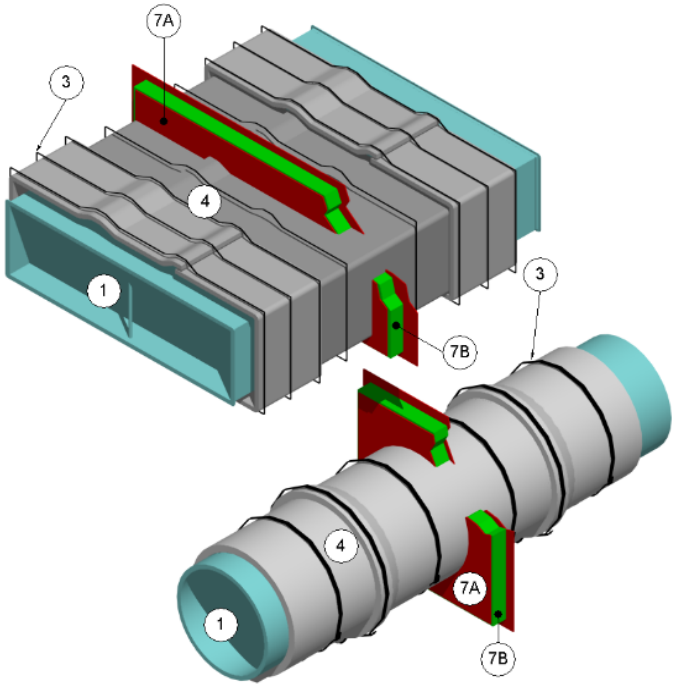
Table 2 – Opening Information

Ventilation Duct Requirements Refer to Table 1	Maximum		Annular Space	
	Cross Sectional Area (in.^{2})	Dimension (in.)	Minimum (in.)	Maximum (in.)
R1	506	22.5	1	3-1/2
R2	1035	50.5	1	3-1/2
R3	2432	70.5	1	3-1/2
R4	2492	89	1	3
C1	1555	44.5	1	3-1/2
C2	511	25.5	1	3-1/2
C3	241	17.5	1	3-1/2

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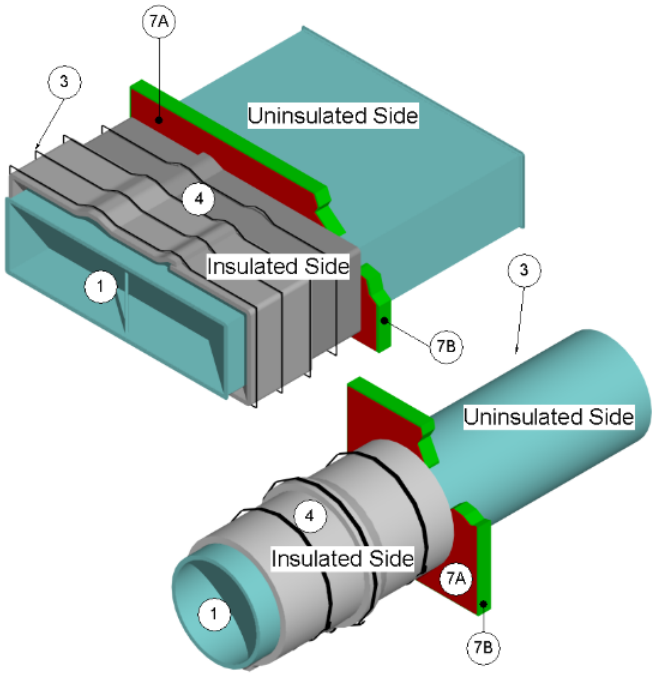
Symmetrical Firestops for Horizontal Ventilation Ducts
without Insulation Through Wall Assemblies



Symmetrical Firestops for Horizontal Ventilation Ducts
with Insulation Through Wall Assemblies

Figure 5

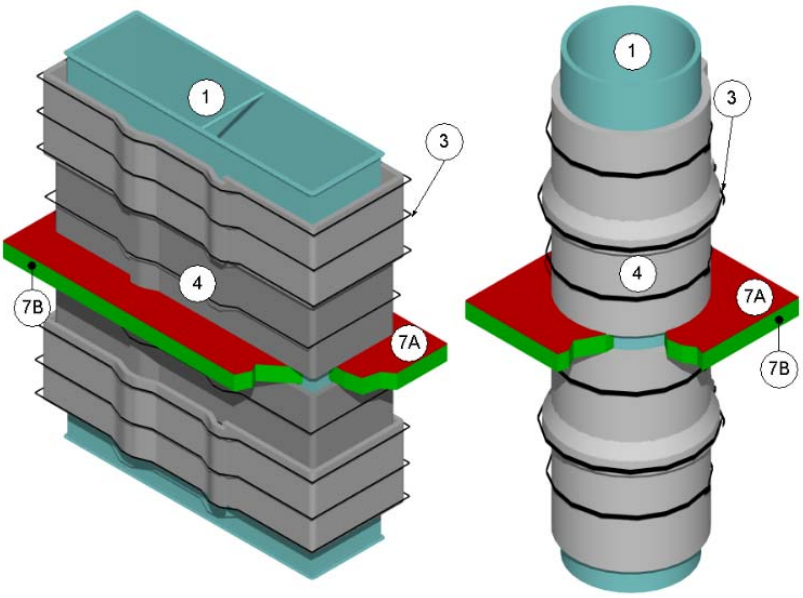
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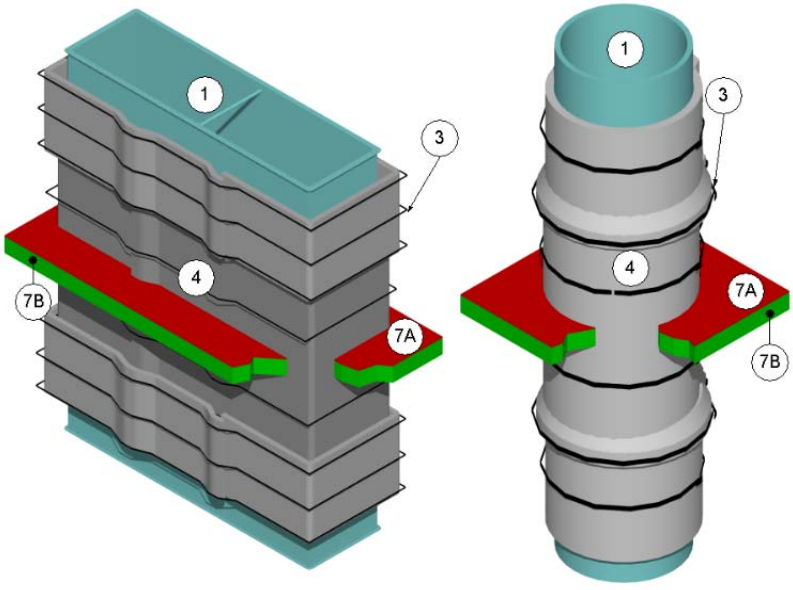
Asymmetrical Firestops for Horizontal Ventilation Ducts
without Insulation Through or Into Shaft Assemblies

Figure 6

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Asymmetrical Firestops for Vertical Ventilation Ducts
without Insulation Through Floor Assemblies



Asymmetrical Firestops for Vertical Ventilation Ducts
with Insulation Through Floor Assemblies

Figure 7

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Table 3 – ASTM E 814 Fire Ratings ONLY for Figure 6 (ISO 6944 ratings not applicable): *Asymmetrical Firestops for Horizontal Ventilation Ducts without Insulation Through or Into Shaft Assemblies*		
All other Figures and Assemblage References have ASTM E 814, 1-Hour F-Rating & T-Rating and ISO 6944 (1985) Duct A, 1-Hour Stability, Insulation & Integrity Rating		
Fire Exposure	**F-Rating (Hours)**	**T-Rating (Hours)**
"Uninsulated Side" Designation on Drawing	1	1
Insulated Side	1	0

8. PENETRATION FIRESTOP: The following firestop assemblies have be firestop between the supporting construction (Item 6) and the ventilation duct (Item 1) or the ventilation duct (Item 1) protected with the insulation (Item 4). Use a symmetrical wall penetration firestop, an asymmetrical shaft penetration firestop, or an asymmetrical floor penetration firestop constructed of the following components:

   A. CERTIFIED MANUFACTURER: 3M Company

      CERTIFIED PRODUCT: 3M™ Fire Barrier Duct Wrap Insulation

      MODEL: 615 or 615+

      PACKING MATERIAL: Fill the entire annular space's width and a minimum depth of 4-in. with minimum 4-pcf density mineral wool or certified insulation without the encapsulation (foil scrim).

      Cut the packing material into strips not less than one and one half (1-1/2) times the width of the annular space to be filled. Compress packing material nominally 33% and insert packing material into the annual space.

      For wall assemblies, recess the surface of packing material nominally 5/8 in. from surfaces of both faces of the supporting construction (Item 6).

      For floor and shaft wall assemblies, recess the surface of packing material nominally 5/8 in. from the visual surface of the supporting construction (Items 6).

   B. CERTIFIED MANUFACTURER: 3M Company

      CERTIFIED PRODUCT: 3M™ Fire Barrier™ Sealant

      MODEL: Water-Tight 1000-NS Silicone, Water-Tight 1003-SL Silicone (floors only), 2000+ Silicone, or CP 25 WB+

   FILL, VOID OR CAVITY MATERIAL: Install minimum 5/8-in. depth of fill material into the recess over the entire surface of the packing material (Item 7A). Screed the fill material flush with the surface of the supporting construction (Item 6). Overlap a minimum of 1/4 in., the fill material onto face of supporting construction (Item 6).

   C. CERTIFIED MANUFACTURER: 3M Company

      CERTIFIED PRODUCT: 3M™ Fire Barrier Duct Wrap Insulation

      MODEL: 615 or 615+

   D. COLLAR: Required for R4 ventilation ducts (Item 1) in Table 1. After the ventilation duct (Item 1) is covered with insulation (Item 4), install a collar, which is another layer of minimum 24-in. wide, minimum 6-pcf density, insulation (Item 4) over the insulated ventilation duct (Item 1) on each side of the supporting construction (Item 6). Match and use the same installation method as used to install the insulation (Item 4) applied to

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the ventilation duct (Item 1) creating two (2) layers of insulation (Item 4) on the ventilation duct (Item 1) adjacent to the supporting construction (Item 6). Abut one perimeter edge of each collar to the exposed surface supporting construction (Item 6).

E. STEEL ANGLE: Required for R4 ventilation ducts (Item 1) in Table 1. Before the ventilation duct (Item 1) is covered with insulation (Item 4) and after the packing material (Item 7A) and fill material (Item 7B) are installed, install a nominal 16-ga 2 x 1-1/2-in.steel angle around the perimeter of the ventilation duct (Item 1) with notched ends to create a continuous frame. Place the 1-1/2-in. leg of the steel angle flush against the surface of the supporting construction (Item 6). Attach the 2-in. leg of the steel angle to the ventilation duct (Item 1) using self drilling, 12-24x2 hex head, screws with a #5 point, spaced a maximum of 6 in. O.C.

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