Fire and Smoke Dampers

Bob Wasilewski
Project Manager, Technical Resources
SMACNA

FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC SYSTEMS

FIFTH EDITION, SEPTEMBER 2002

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.
4201 Lafayette Center Drive
Chantilly, VA 20151-1209

Caution!

The SMACNA Fire Damper Manual Should Not be Used as the Basis for a Damper Installation

Caution!

SMACNA CANNOT JUDGE ANY Fire/Damper Combination Fire-Smoke Damper Installation as being "Approved" or "Acceptable"

Old UL 555 Test Standards for Fire Dampers (5th Edition)	New UL Test 555 Standards for Fire Dampers (6th Edition, effective July 2002)
Dynamic Closure Test	
• Tested with ambient temperature air utilizing a manual release	• Temperature sensor must release to close damper
• No minimum airflow requirement • No safety factor built into ratings	• Airflow Ratings: 2,000, 3,000, and 4,000 fpm Minimum test requirements: 2,400, 3,400, and 4,400 fpm
• No minimum pressure requirement	• Pressure ratings: 4 in., 6 in., and 8 in. wg Minimum test requirements: 4.5 in., 6.5 in., and 8.5 in. wg
• Unidirectional ratings	• Bidirectional testing required

Old UL 555S Test Standards for Smoke Dampers (3rd Edition)	New UL 555S Test Standards for Smoke Dampers (4th Edition, effective July 2002)
Cycling Test	
• Two position actuators - 5,000 cycles	• Two position actuators - 20,000 cycles
Operation Test	
• Tested with ambient temperature air	• Tested at rated temperature for 15 minutes prior to test
• No minimum airflow requirement • No safety factor built into ratings	• Airflow Ratings: 2,000, 3,000, and 4,000 fpm Minimum test requirements: 2,400, 3,400, and 4,400 fpm
• No minimum pressure requirement	• Pressure ratings: 4 in., 6 in., and 8 in. wg Minimum test requirements: 4.5 in., 6.5 in., and 8.5 in. wg
• Unidirectional ratings	• Bidirectional testing required
• Actuators may be field mounted	• All actuators must be factory installed (effective June 2000)
Leakage Test	
• Tested with ambient temperature air	• Tested with air at rated temperature
• Tested with a unit that has not been exposed to the Operation and/or Dynamic Closure Test	• Tested after Operation Test and/or Dynamic Closure Test
• Four leakage classifications	• 4th Leakage classification eliminated
• Unidirectional ratings	• Bidirectional testing required
• No actuation required	• Test with actuator holding damper closed

CHAPTER 3

CODES AND REGULATIONS

CHAPTER 4

PLANS AND SPECIFICATIONS RESPONSIBILITIES

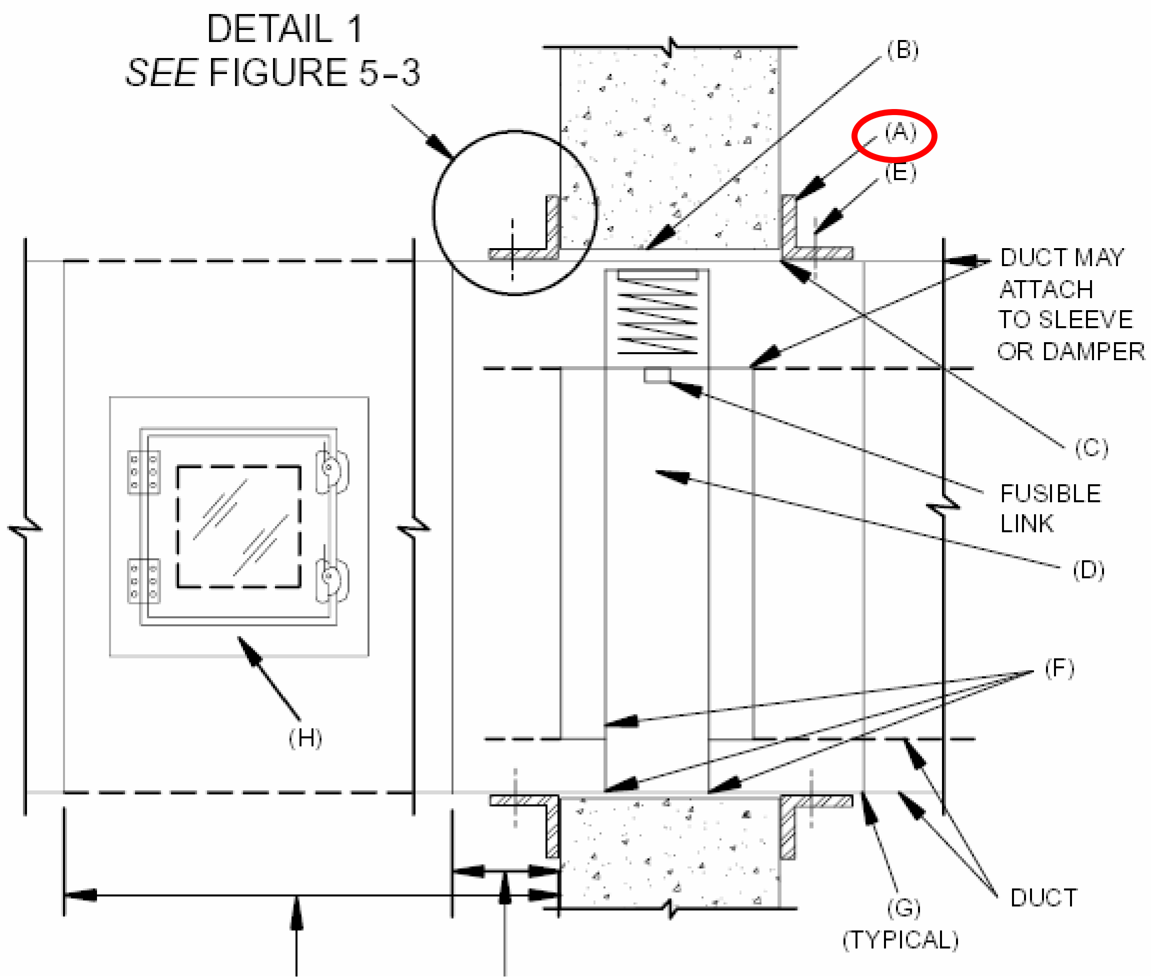
CHAPTER 5

FIRE DAMPER INSTALLATION

TABLE 5-1 REQUIRED FIRE DAMPER INSTALLATIONS

Item	Manufacturer Information to be Provided
1. Damper	a. function b. static or dynamic c. make (mfr.) d. model number
2. Fire Resistance Rating	a. time in hours
3. Approval	a. testing or listing agency
4. Sleeve	a. material b. thickness c. length (maximum) d. maximum distance of sleeve termination from wall (see UL 555)
5. Duct-to-Sleeve (or Frame) Connection	a. method(s) b. locations
6. Damper Attachment to Sleeve	a. method(s) b. locations
7. Retaining Angle	a. size b. material c. fastener locations
8. Maximum Rated Size of Damper	a. dimension
9. Assembly of Multiple Sections	a. methods b. fastener locations
10. Airflow	a. maximum velocity rating b. static pressure rating
11. Damper Orientation for Proper Closure	a. position
12. Illustrations	a. installation arrangement b. clearance category
13. Any Construction Detail Contingent on Approval for Listing by a Rating Authority	a. pertinent data (*e.g.* fusible link rating, opening framing provisions, etc.)

FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



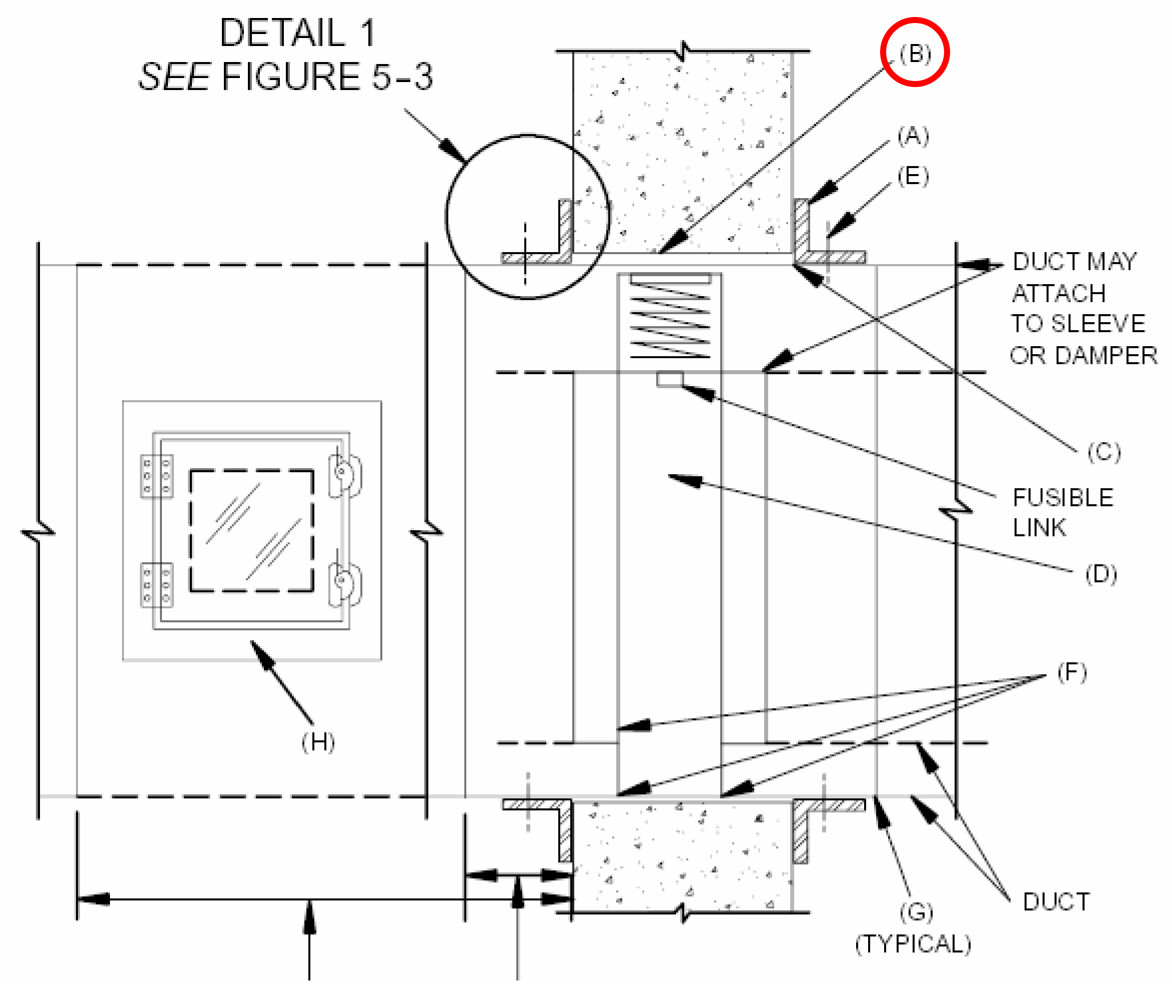
A. Retaining Angles

1. Minimum 1½ × 1½ × 16 ga (40 × 40 × 1.6 mm)

   a. Retaining angles must overlap structure opening 1 inch minimum and cover corners of openings.

   b. 16 gage is the most commonly used thickness for the retaining angles. However manufacturers may allow lighter gage angles on some smaller dampers and may require heavier gage angles on larger dampers. Consult the manufacturer's installation instructions for specifics.

FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



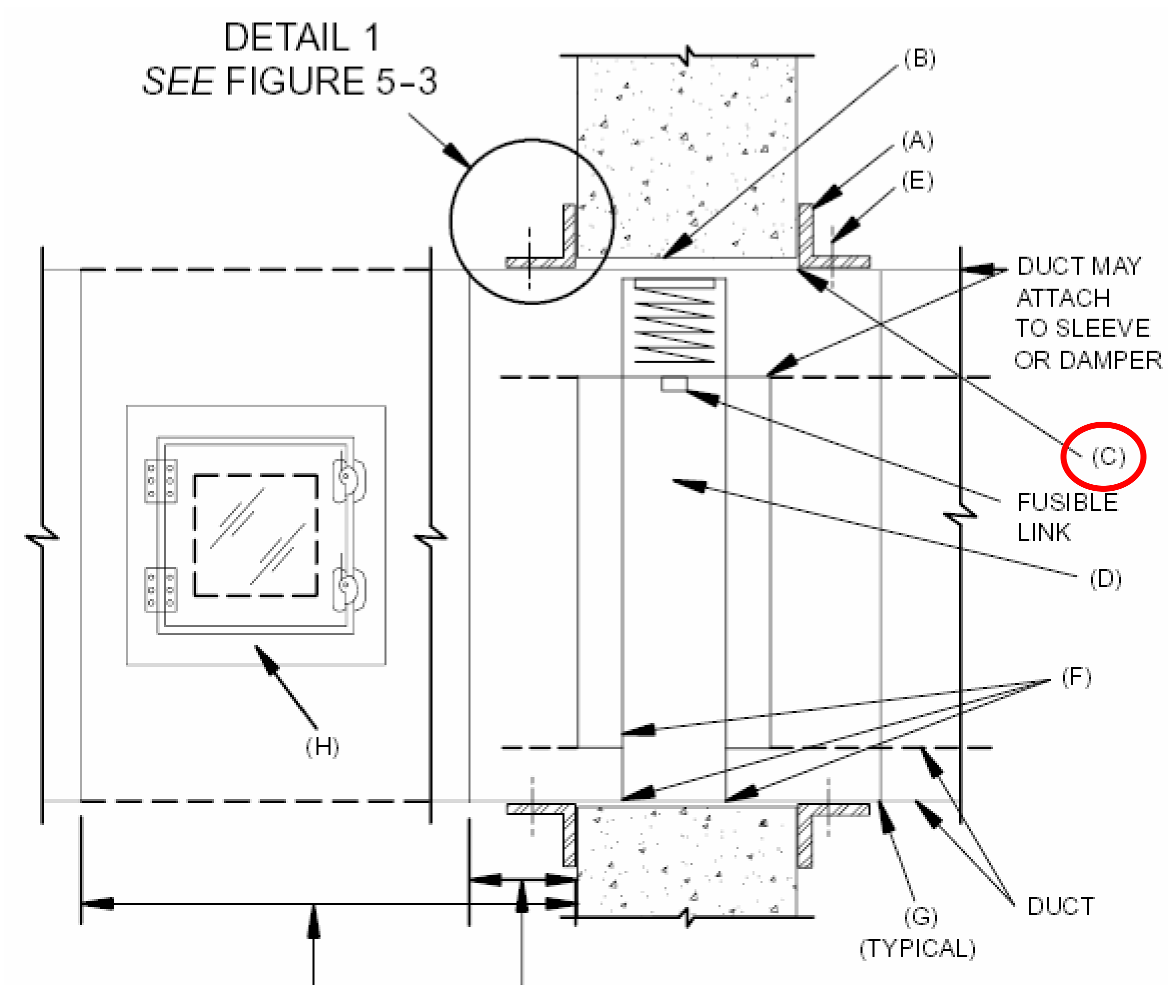
B. Expansion Space

1. Fire Damper Sleeve Clearance within Wall/ Floor Opening

   a. Minimum ⅛ inch per linear foot (10 mm per linear meter) of damper — both dimensions. (¼" (6 mm) minimum)

   b. Clearance requirements for damper sleeves within a wall opening are based on ⅛ inch per foot (10 mm per meter) of width (or height) unless otherwise stated in the listing of the assembly. The sleeve may rest on the bottom of the opening, and need not be centered. (Fractional dimensions shall be taken as the next largest whole foot.)

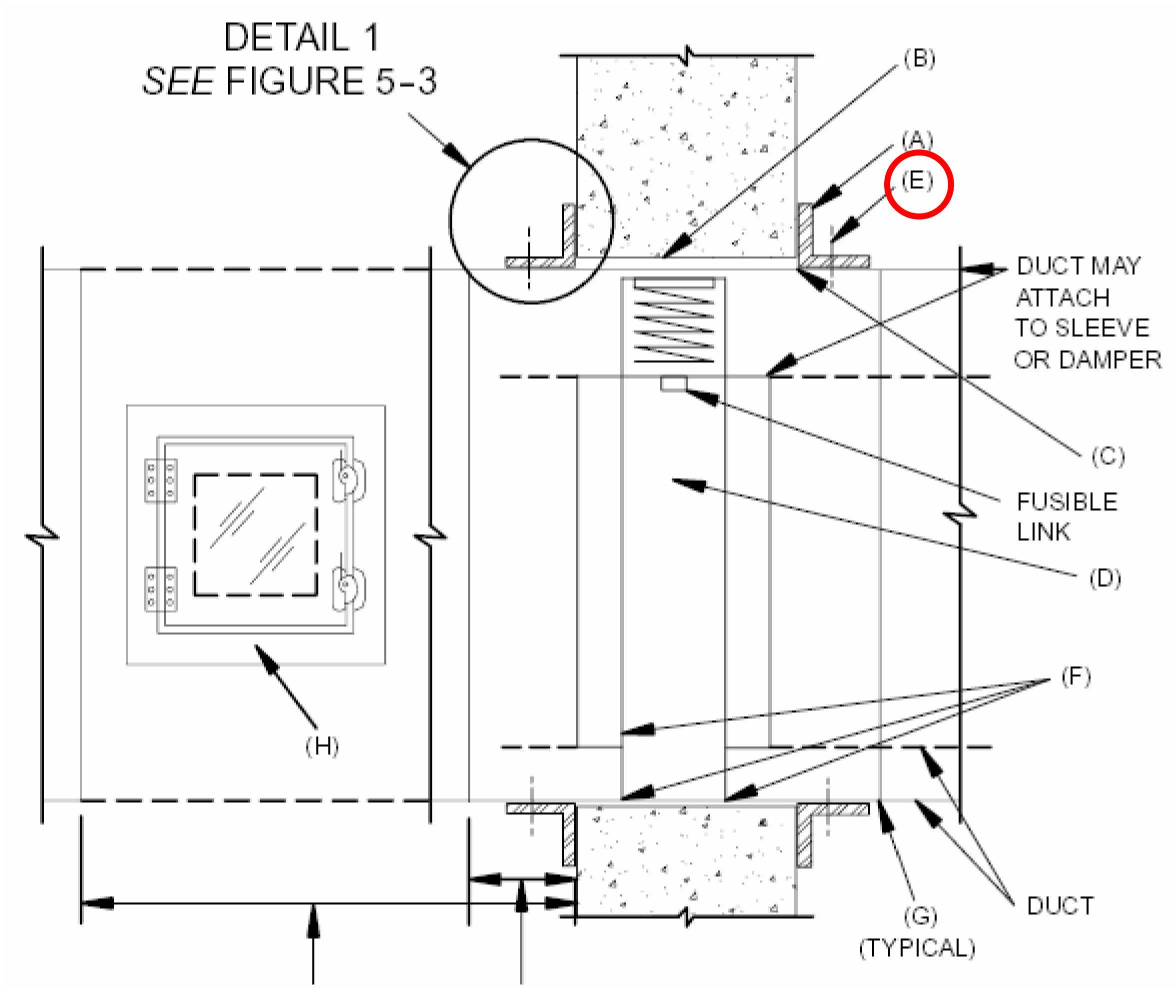
FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



C. Damper Sleeve

1. **Steel Sleeve, see Table 5-2 for details.**

FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS

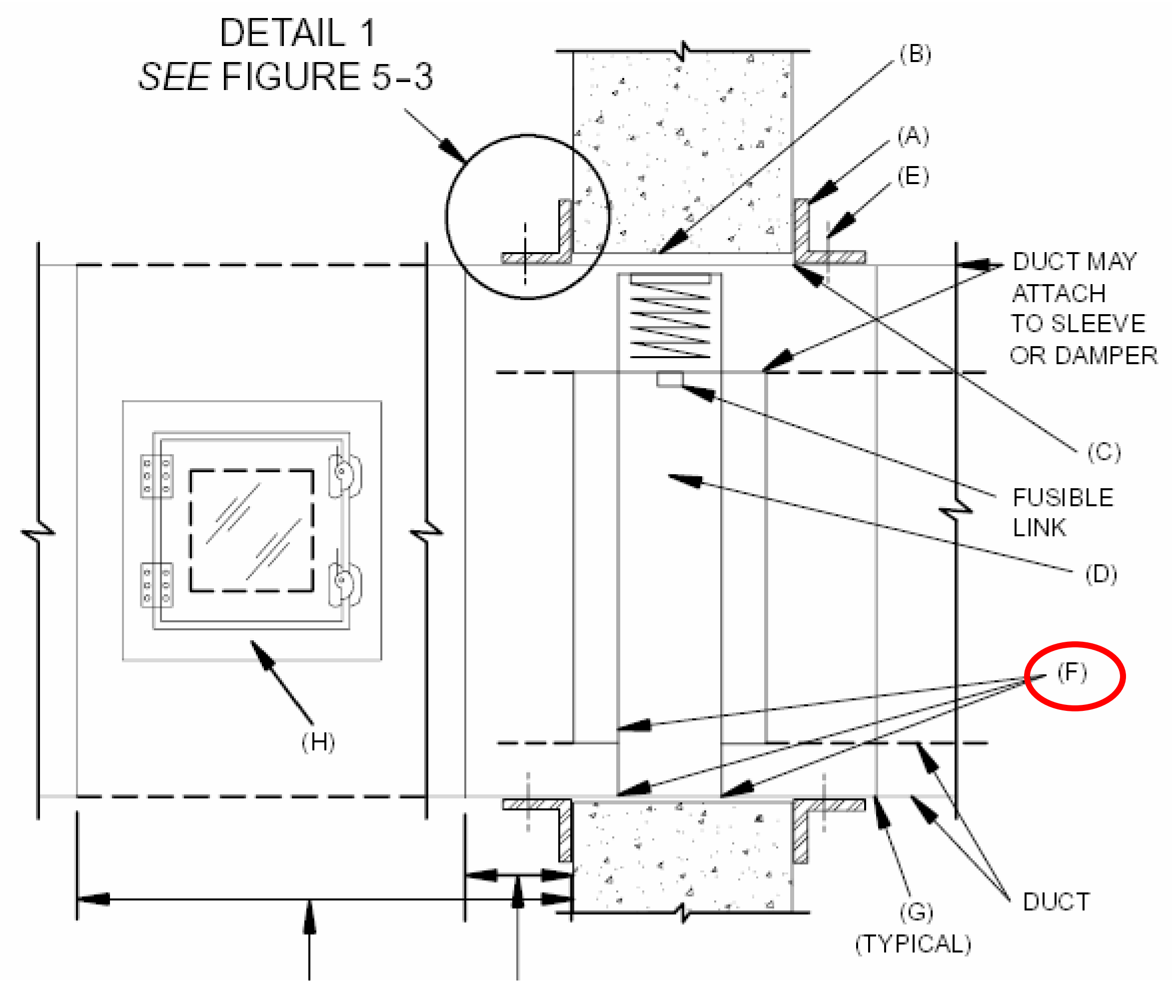


E. Retaining Angles Fastened to Sleeve

1. Secure Retaining Angles to Sleeve ONLY on 8"centers (203 mm) with:

   a. ½" (12 mm) long welds
   b. ¼" (6 mm) bolts and nuts
   c. No. 10 Sheet Metal Screws
   d. Minimum 3⁄16" (5 mm) steel rivets
   e. *Note:* The size and spacing requirements may differ by damper manufacturer. Consult manufacturer's installation instructions for specifics.

FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



F. Damper Attachment to Sleeve

1. Secure Damper to Sleeve on 8" centers (203 mm) with:

   a. ½" (12 mm) long welds

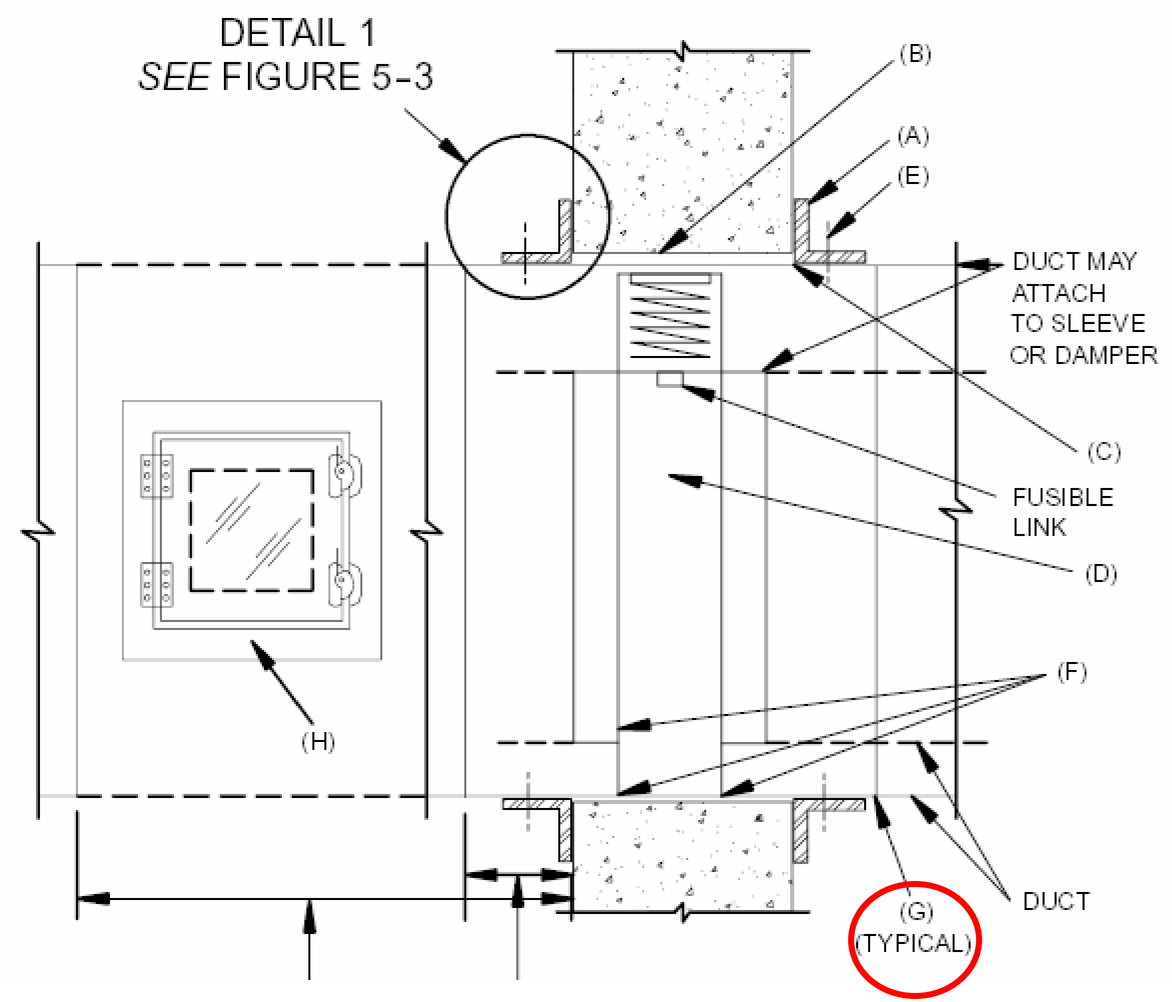
   b. ¼" (6 mm) bolts and nuts

   c. No. 10 Sheet Metal Screws

   d. Minimum 3/16" (5 mm) steel rivets

See note in Item E above.

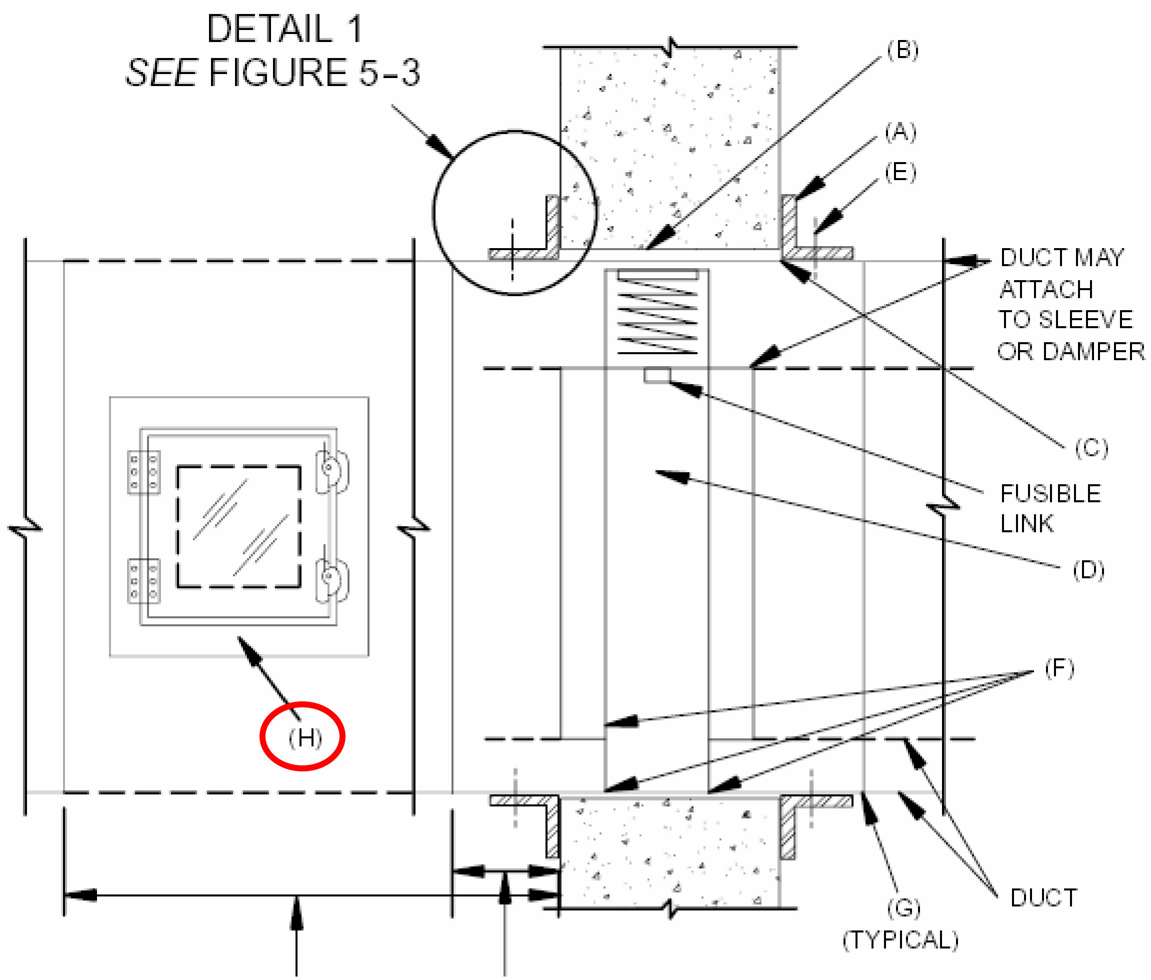
FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



G. Connection to Duct

1. Connect Duct to Sleeve as shown in Table 5-2 and as indicated in Figure 5-2

FIGURE 5-1 BASIC FIRE DAMPER INSTALLATIONS



H. Access Door or Panel

1. **Install as shown in Figure 5-1**

TABLE 5-2 RECOMMENDED MINIMUM SLEEVE THICKNESS FOR FIRE DAMPERS

Type of Connection	Duct	Duct Dimension	Sleeve Gage
Rigid	Round – Rectangular	24 in. (610 mm) maximum diameter 24 in. (610 mm) maximum height and 36 in. (915 mm) maximum width	16+ (1.613+ mm)
Rigid	Round – Rectangular	over 24 in. (610 mm) diameter over 24 in. (610 mm) height and over 36 in. (915 mm) width	14+ (1.994+ mm)
Breakaway (*See* Figure 5-2 on pages 5.5 and 5.6)	Round or Rectangular	12 in. (305 mm) and down 13 – 30 in. (330 – 760 mm) 31 – 54 in. (785 – 1370 mm) 55 – 84 in. (1400 – 2130 mm) 85 in. (2160 mm) and up	26 (0.55 mm) 24 (0.70 mm) 22 (0.85 mm) 20 (1.0 mm) 18 (1.3 mm)

FIG. 5-2 UL DUCT-SLEEVE CONNECTIONS (BREAKAWAY CONNECTIONS)

1. DUCT-SLEEVE CONNECTIONS LISTED IN UL 555, SIXTH EDITION, *STANDARD FOR FIRE DAMPERS*.

PLAIN "S" SLIP — HEMMED "S" SLIP — DOUBLE "S" SLIP — INSIDE SLIP JOINT

STANDING S — STANDING S (ALT.) — STANDING S (Bar Reinforced) — STANDING S (Angle Reinforced)

2. ADDITIONAL DUCT-SLEEVE CONNECTIONS WERE TESTED BY SMACNA AND WITNESSED BY UL IN 1991. THE CONNECTIONS PERFORMED WITHIN THE REQUIREMENTS OF THE UL TEST CRITERIA. *SEE* NOTE 1, FIGURE 5-2 ON PAGE 5.6.

3. FASTENERS MAY BE USED AS FOLLOWS.

(A) JOINTS USING CONNECTIONS SHOWN IN 1. ABOVE WITH A MAXIMUM OF TWO #10 SHEET METAL SCREWS ON EACH SIDE AND ON THE BOTTOM LOCATED IN THE CENTER OF THE SLIP POCKET AND PENETRATING BOTH SIDES OF THE SLIP POCKET.

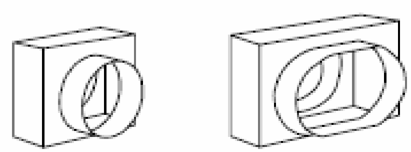
FLAT DRIVE SLIP

(B) JOINTS USING CONNECTORS OF THE TYPE SHOWN IN 1. ABOVE ON THE TOP AND THE BOTTOM AND USING FLAT DRIVE SLIPS NOT EXCEEDING 20 in. (510 mm) DUCT HEIGHT ON THE SIDES (*SEE* SKETCH ABOVE).

(C) JOINTS WHERE ROUND OR OVAL SPIRAL DUCTS ATTACH TO ROUND OR OVAL COLLARS WHICH ARE PART OF THE DAMPER SLEEVE AS SHOWN BELOW. #10 SHEET METAL SCREWS ARE SPACED EQUALLY AROUND THE CIRCUMFERENCE OF THE DUCT PER THE FOLLOWING:

- DUCT DIAMETERS 22 in. (560 mm) AND SMALLER—3 SCREWS.
- DUCT DIAMETERS OVER 22 in. (560 mm) TO AND INCLUDING 36 in. (915 mm)—5 SCREWS.

NOTES:
(1) FOR FLAT OVAL DUCTS, THE DIAMETER SHALL BE CONSIDERED THE LARGEST (MAJOR) DIMENSION OF THE DUCT.
(2) DUCT SEALANT MAY BE USED AS RECOMMENDED BY THE DAMPER MANUFACTURER.



DAMPER/SLEEVE ASSEMBLIES WITH COLLARS FOR ROUND AND FLAT OVAL DUCTS

FIG. 5-2 UL DUCT-SLEEVE CONNECTIONS (BREAKAWAY CONNECTIONS)

(D) TDC AND TDF ROLL-FORMED 4-BOLT FLANGED CONNECTIONS ASSEMBLED PER THE MANUFACTURER'S INSTRUCTIONS USING GASKETS, METAL CLEATS AND FOUR 3/8 in. (9.5 mm) METAL NUTS AND BOLTS.

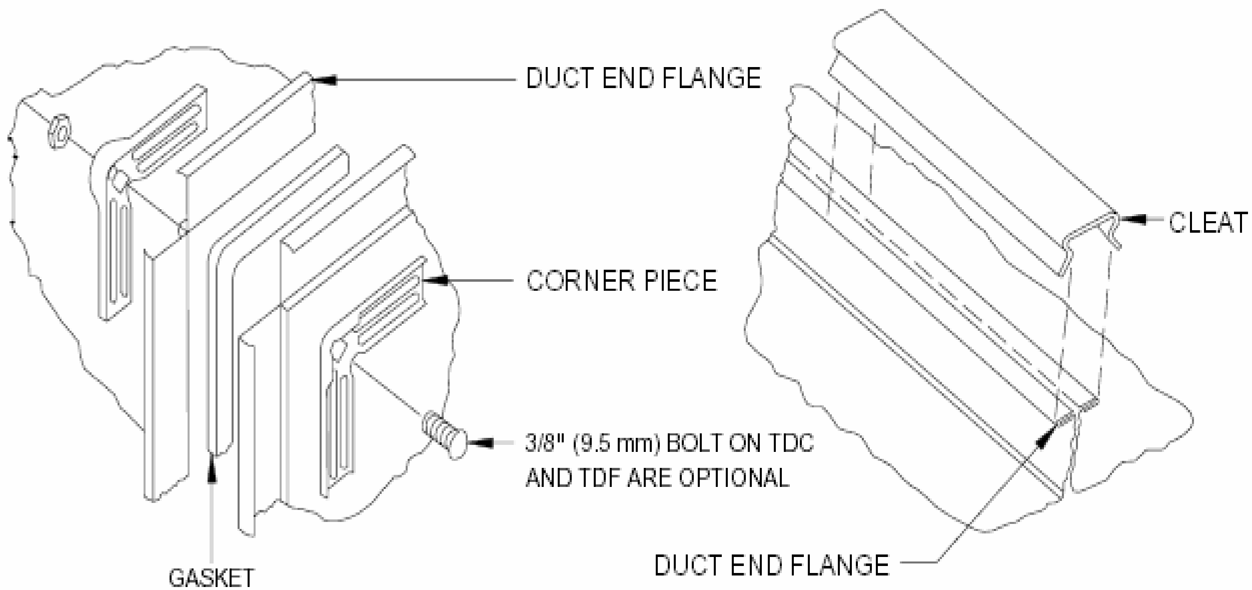
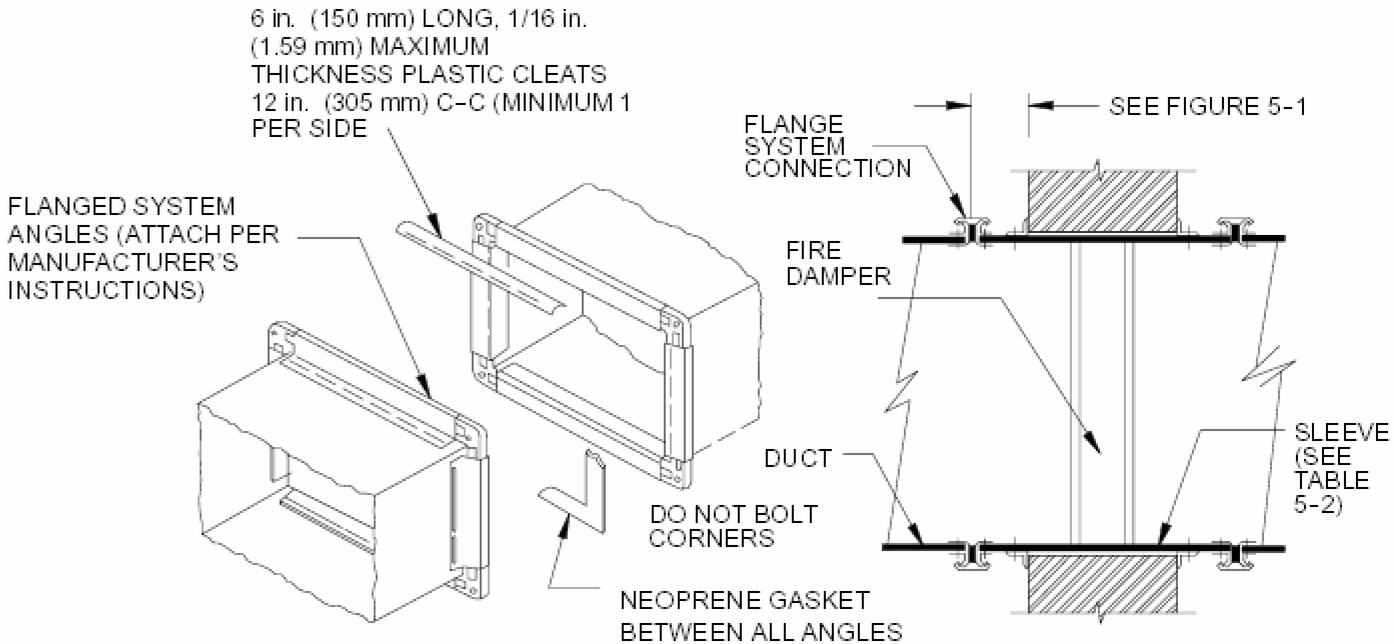


FIG. 5-2 UL DUCT-SLEEVE CONNECTIONS (BREAKAWAY CONNECTIONS)

(E) MANUFACTURED SLIP ON 4-BOLT FLANGED CONNECTIONS ASSEMBLED PER THE MANUFACTURER'S INSTRUCTIONS USING GASKETS AND PLASTIC CLEATS AS SHOWN BELOW.



(UL TESTED CONNECTIONS)

FIGURE 5-3 IMPROPER FIRE DAMPER INSTALLATIONS

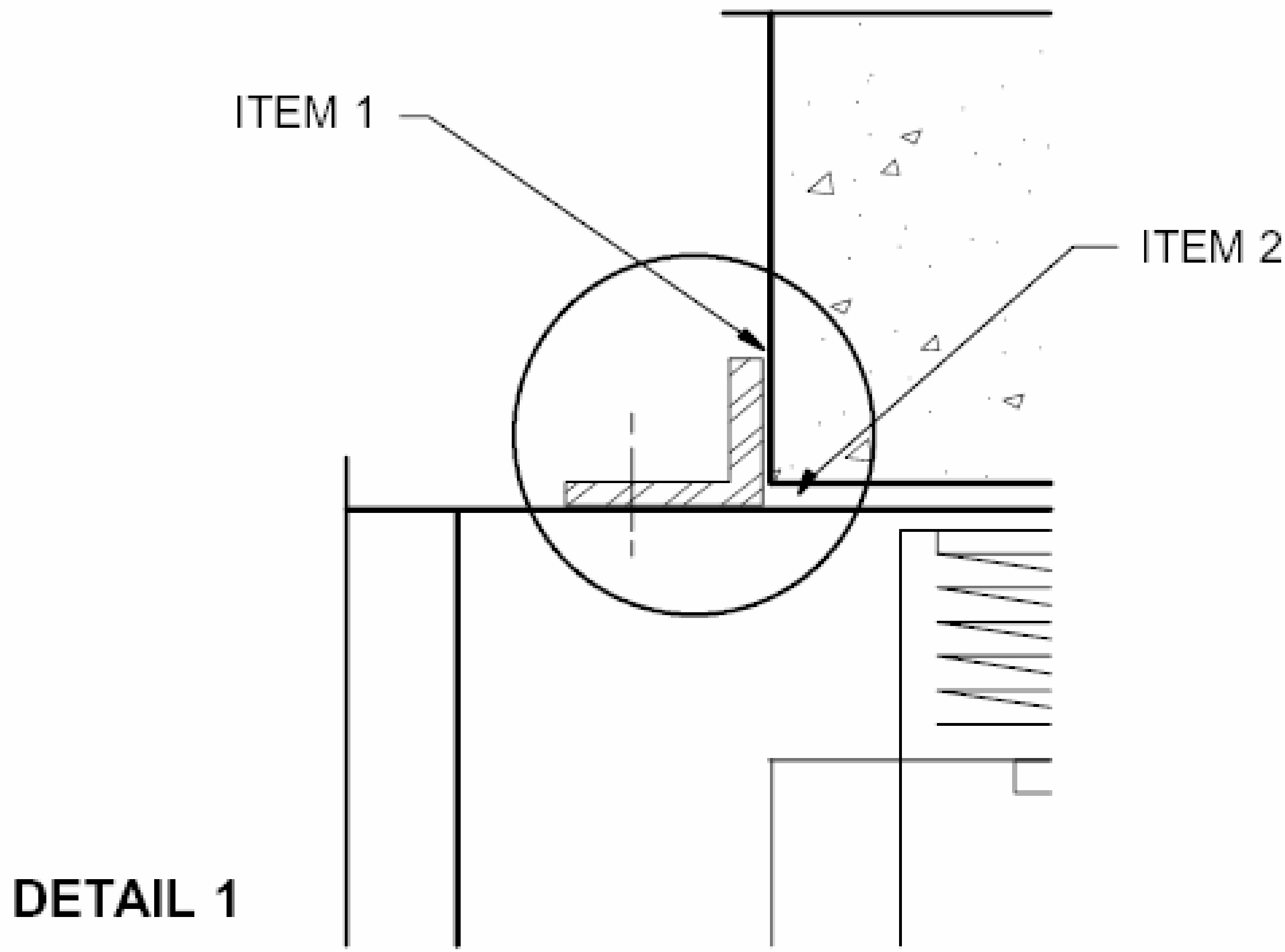
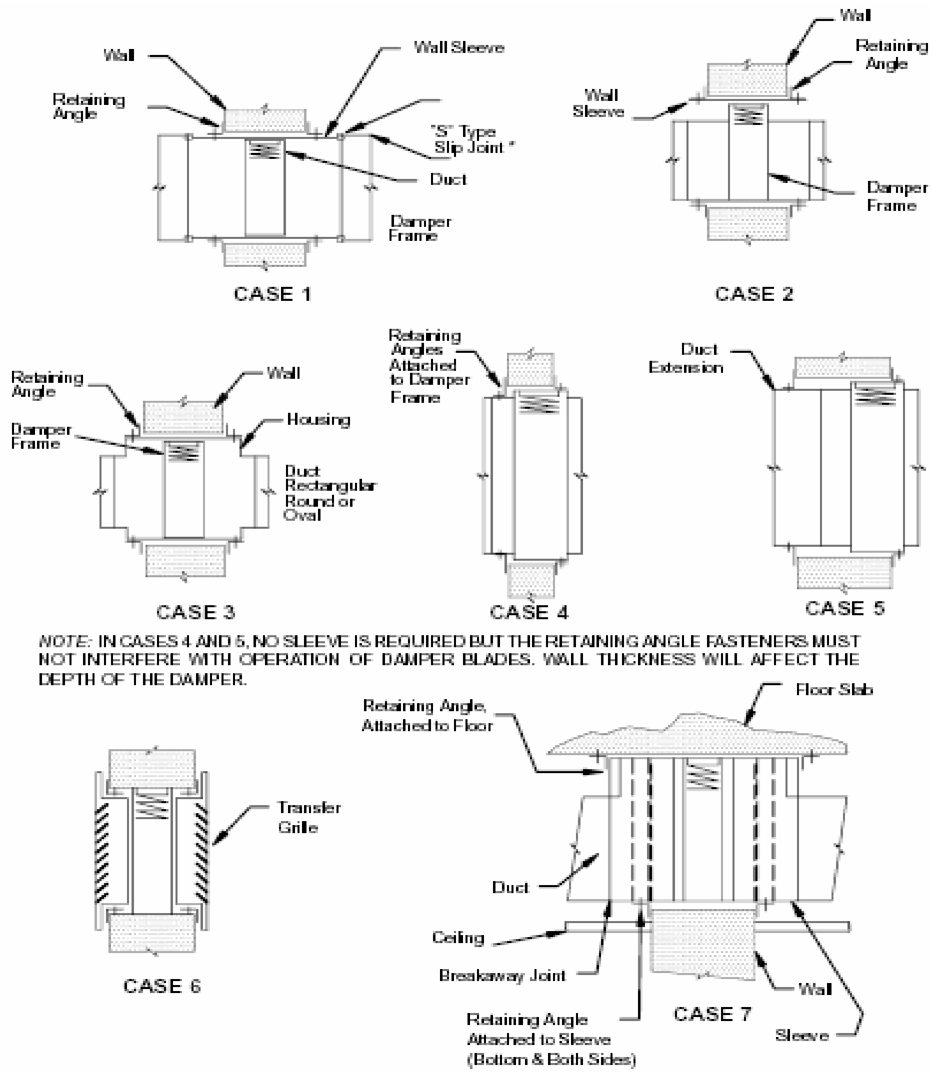
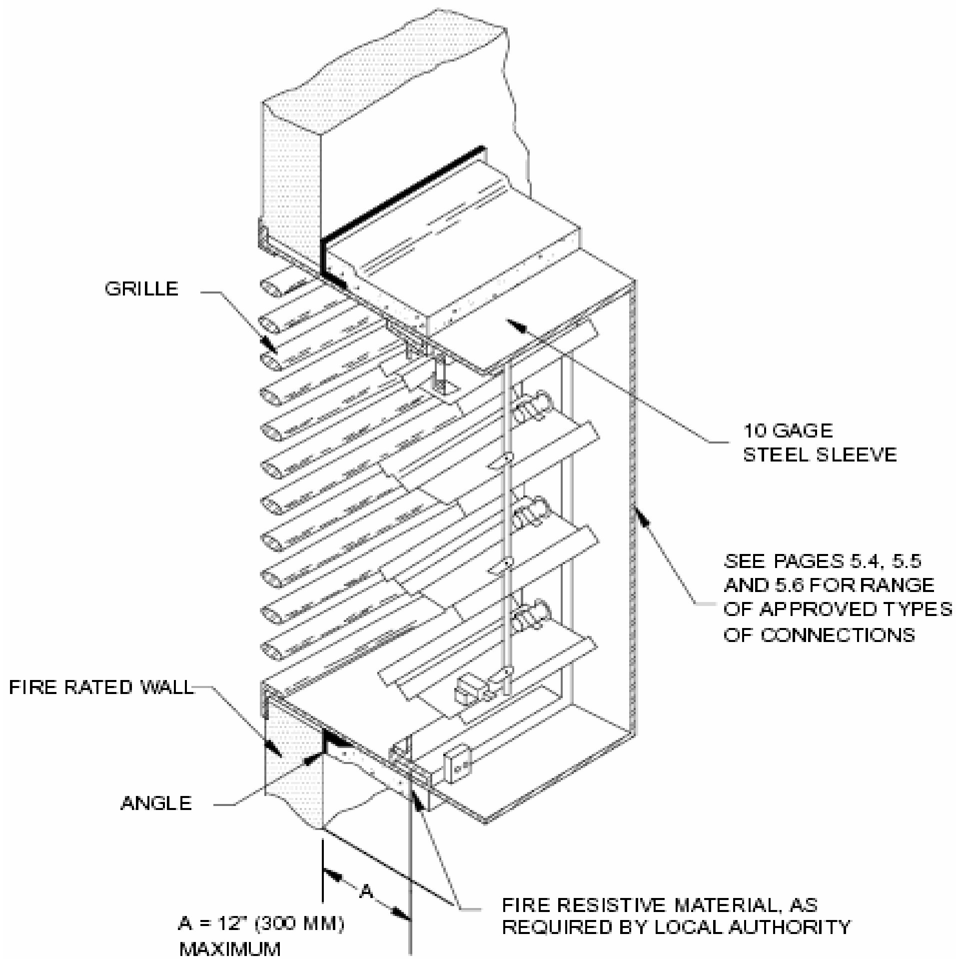


FIGURE 5-4 VERTICAL FIRE DAMPER INSTALLATIONS



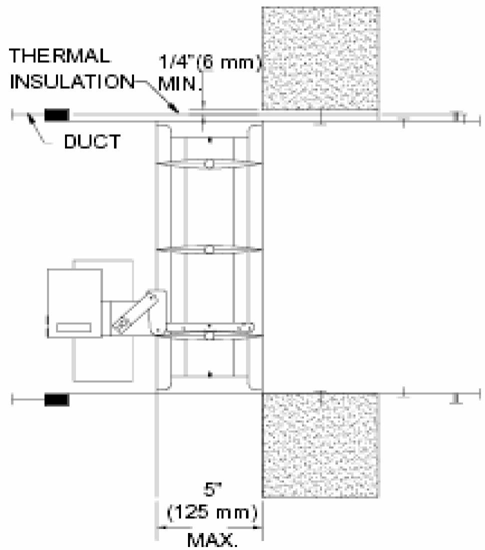
* S Slip is illustrated; see pages 5.5 and 5.6 for range of approved types of connections.

FIGURE 5-5 FIRE DAMPER OUT OF WALL



CAUTION: USE THIS ARRANGEMENT ONLY WHEN PHYSICAL OBSTRUCTIONS PRECLUDE USE OF METHODS SUCH AS THOSE IN FIGURE 5-4. THE USE OF THIS METHOD REQUIRES THE APPROVAL OF THE LOCAL AUTHORITY.

FIG. 5-6 COMBINATION FIRE/SMOKE DAMPER OUT-OF-WALL INSTALLATION



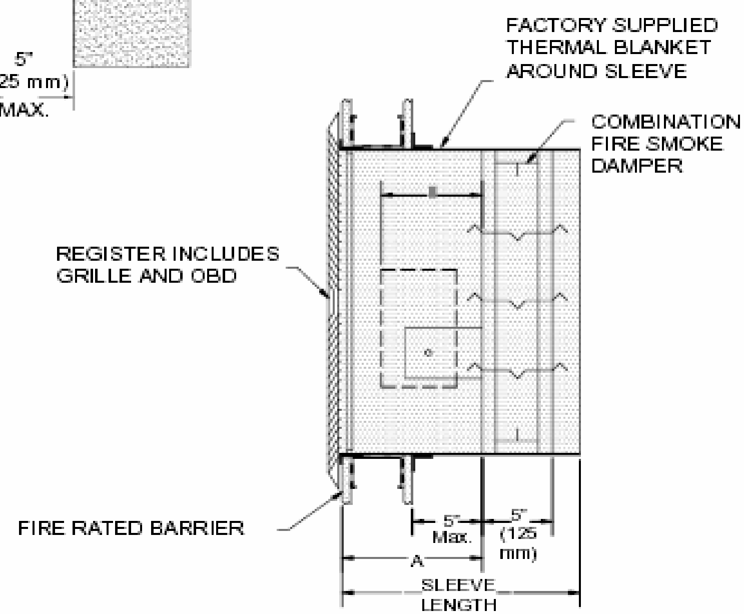


FIGURE 5-7 HORIZONTAL FIRE DAMPER INSTALLATIONS

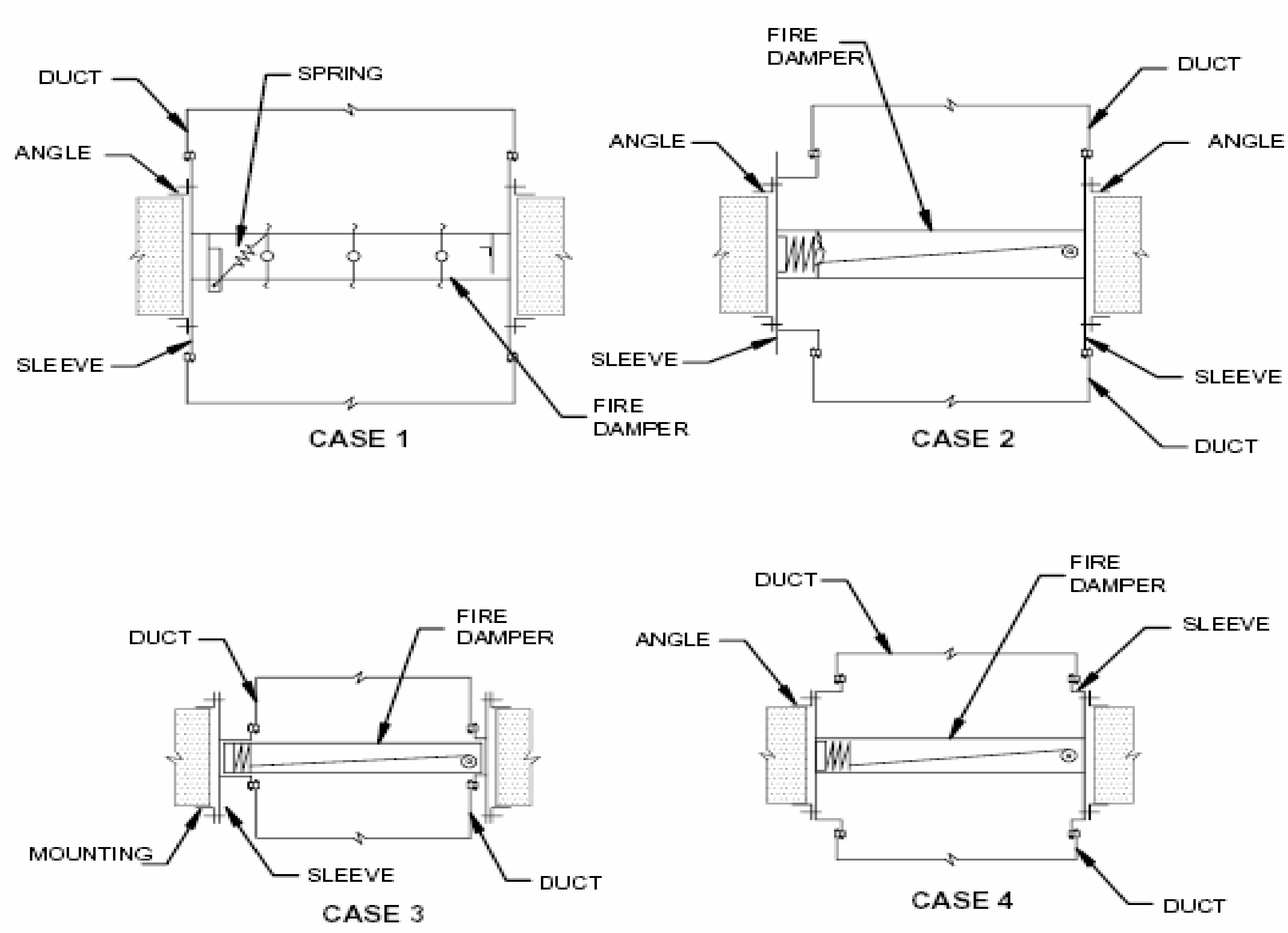


FIGURE 5-8 DUCT LINER INTERRUPTION

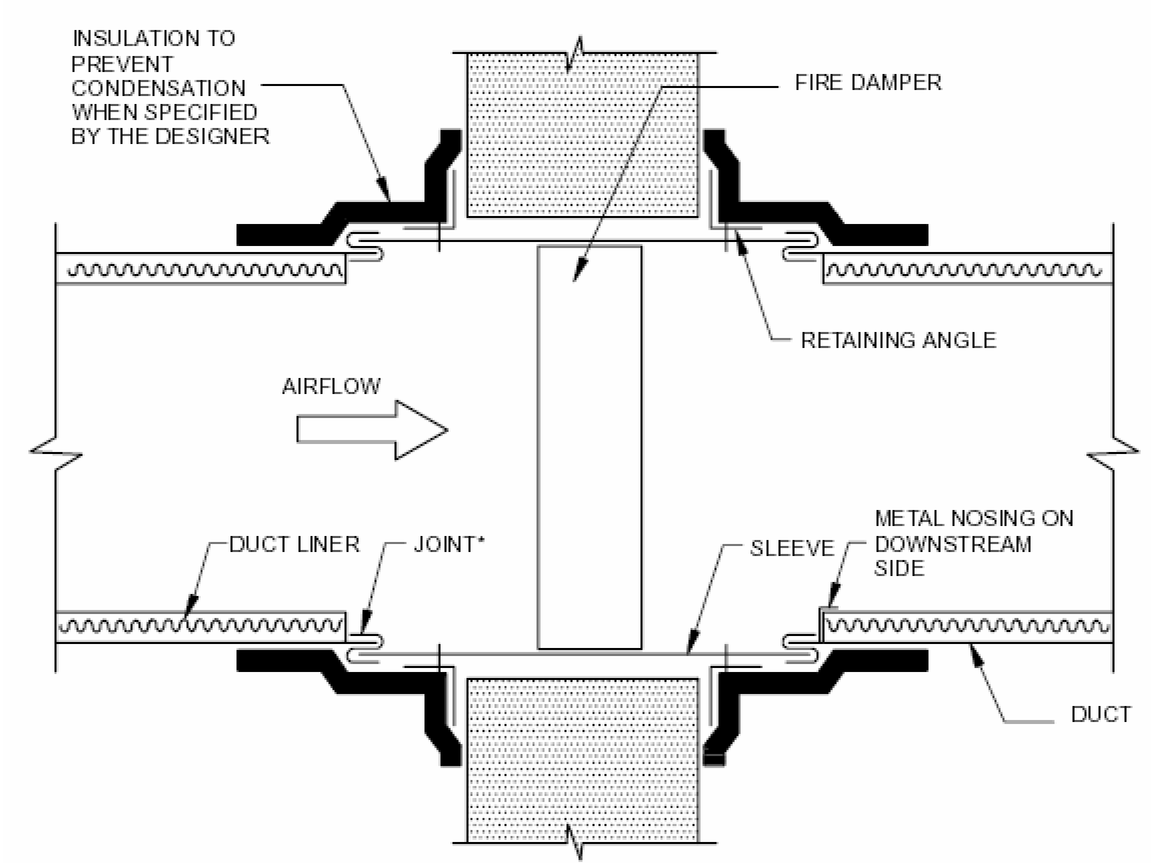


FIGURE 5-9 FIBROUS GLASS DUCT INSTALLATION

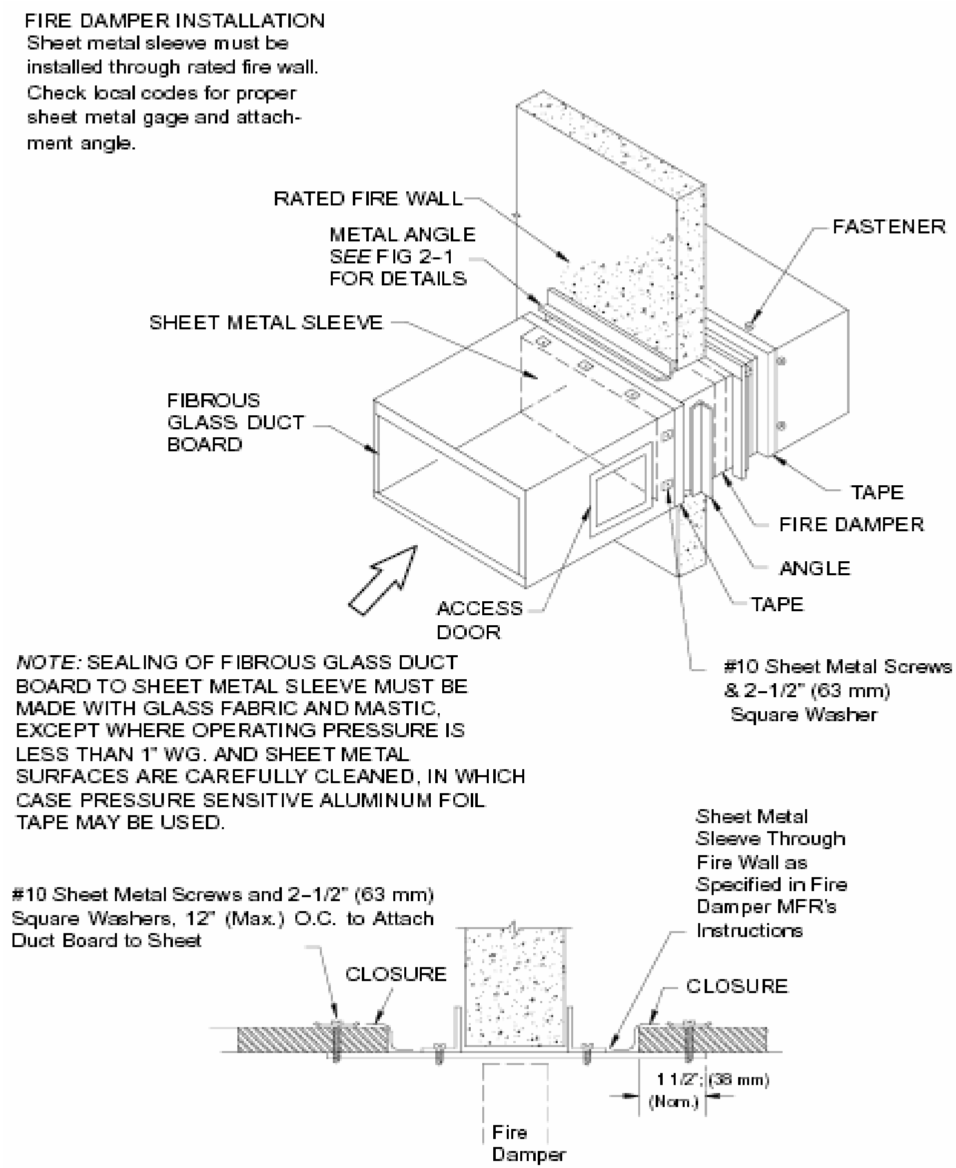


FIGURE 7-1 CURTAIN FIRE DAMPERS

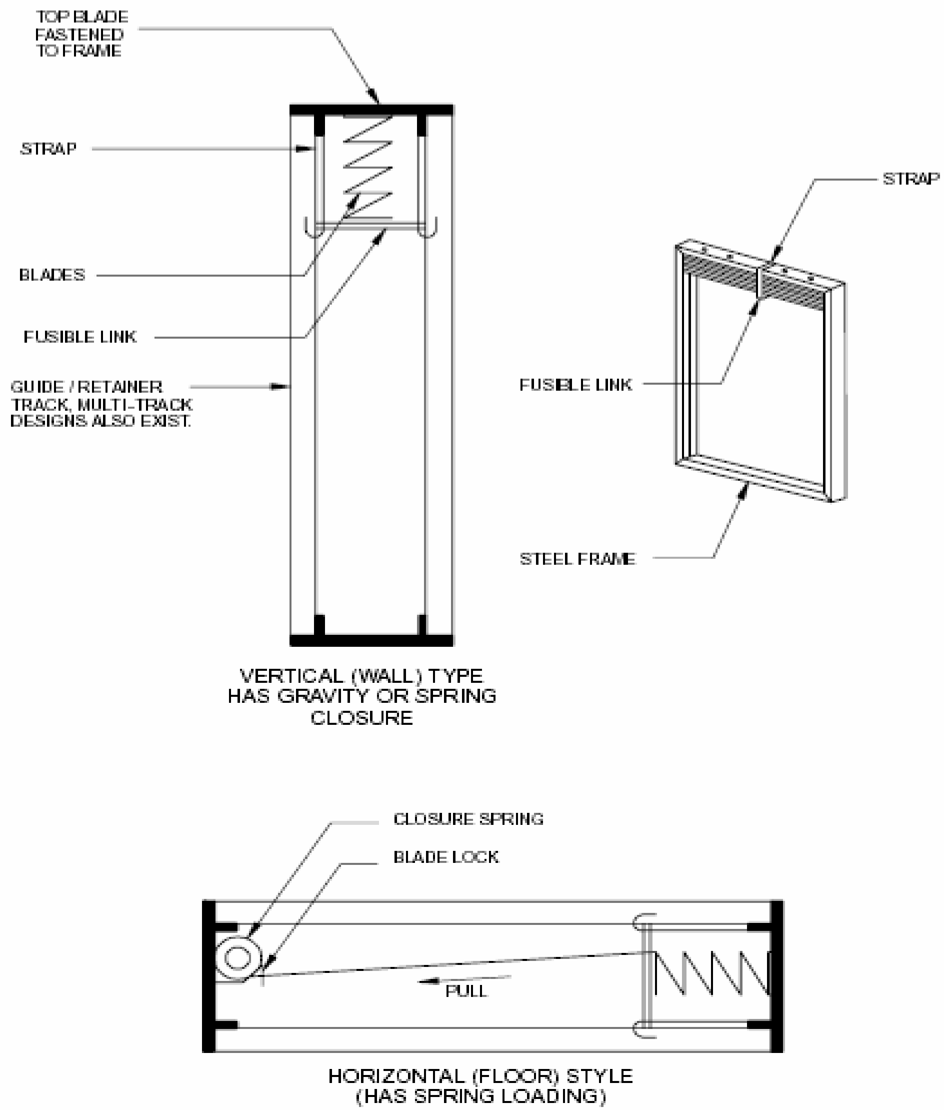


FIGURE 7-2 FIRE DAMPER STYLES

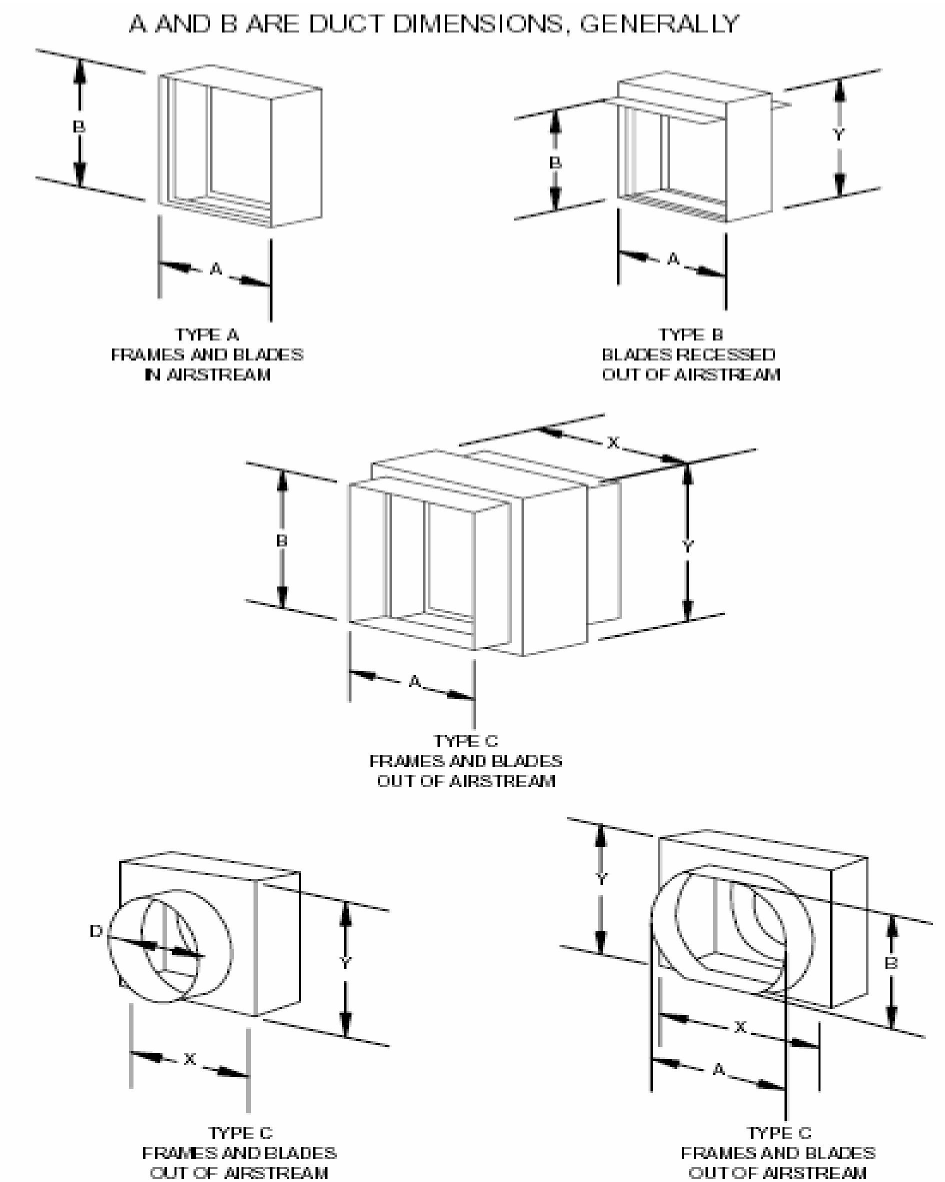


FIGURE 7-3 SMOKE DAMPER

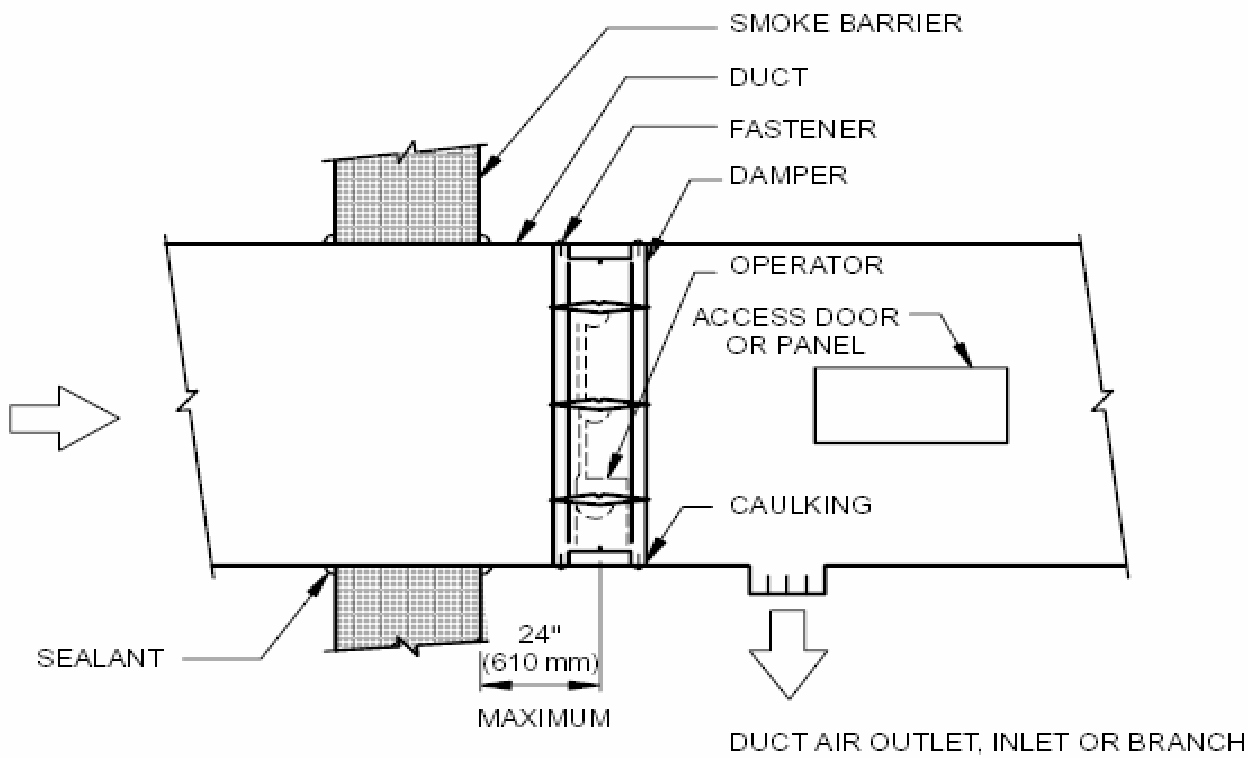
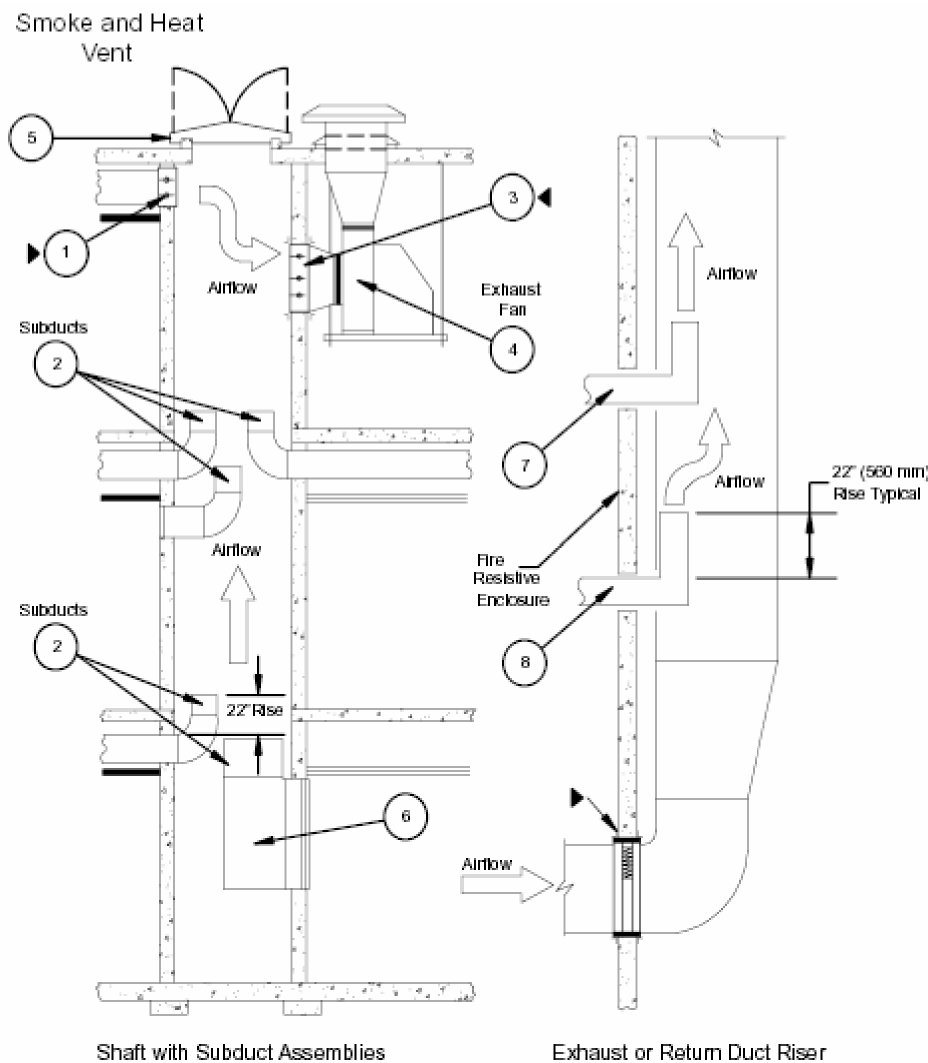


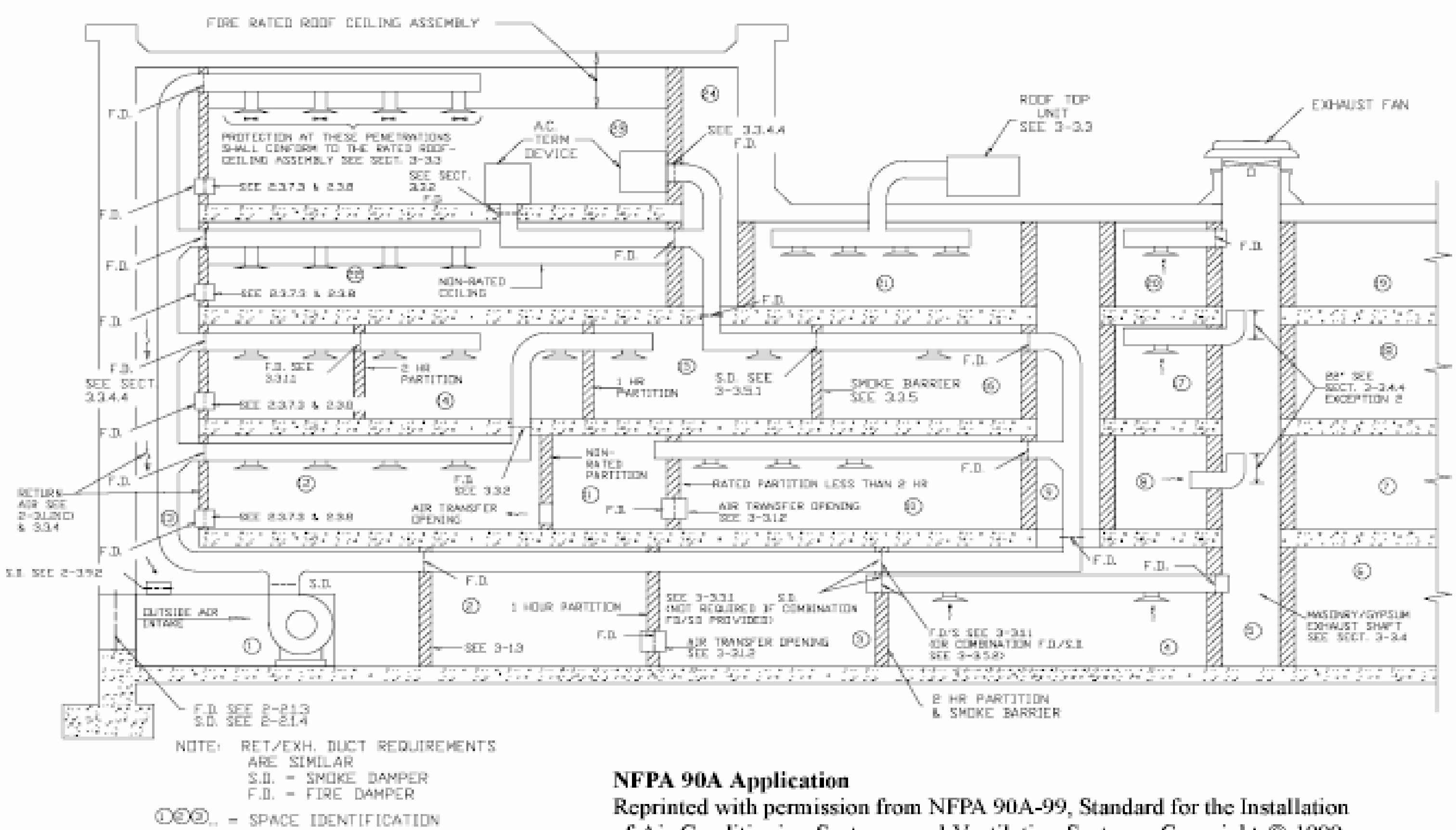
TABLE 7-1 COMBINATION FIRE/SMOKE DAMPER CHECKLIST

❑	1. Controls
❑	a. Pneumatic
❑	b. Electric/Electronic
❑	1. Voltage
❑	2. Operator position or configuration
❑	c. Position indication switches
❑	d. Re-openable or purge operation
	Note: UL555S requires that damper operators be factory mounted by the damper manufacturer. Field installation of damper operators is NOT permitted unless specifically approved by the damper manufacturer.
❑	2. Sleeves
❑	a. Length, gage connections — see Table 5-2, Figure 5-2
❑	b. Access doors — see Figure 5-1
❑	3. Leakage Rating
❑	a. Class I, II, III

FIGURE 12-1 SUBDUCTS



NFPA 90A APPLICATION



NFPA 90A Application

Reprinted with permission from NFPA 90A-99, Standard for the Installation of Air Conditioning Systems, and Ventilating Systems. Copyright © 1999; National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

APPENDIX D

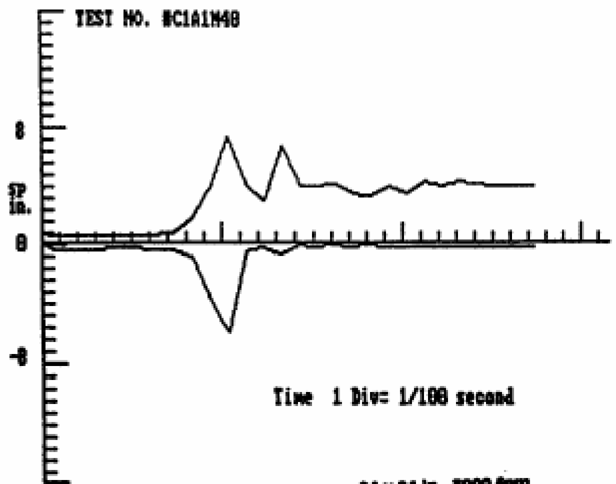
ACCEPTANCE TESTS GUIDE

APPENDIX E

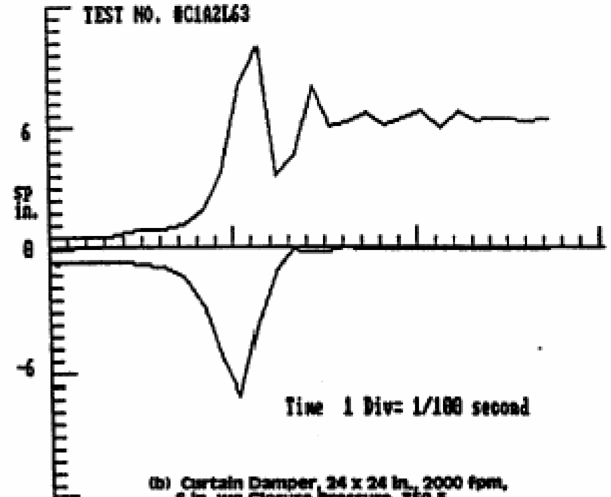
SMOKE DETECTORS IN DUCT APPLICATIONS

APPENDIX F

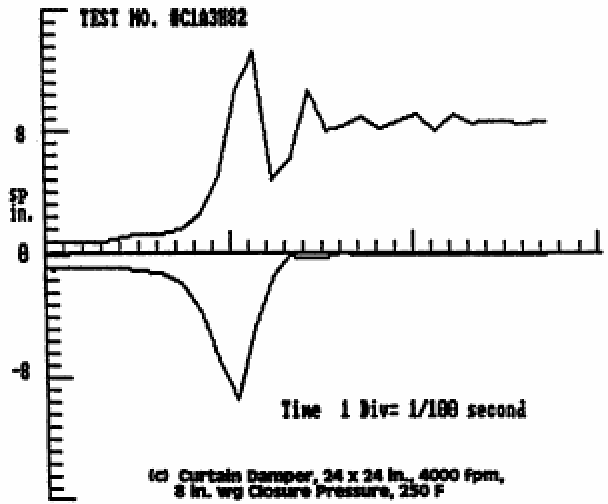
SMOKE MANAGEMENT



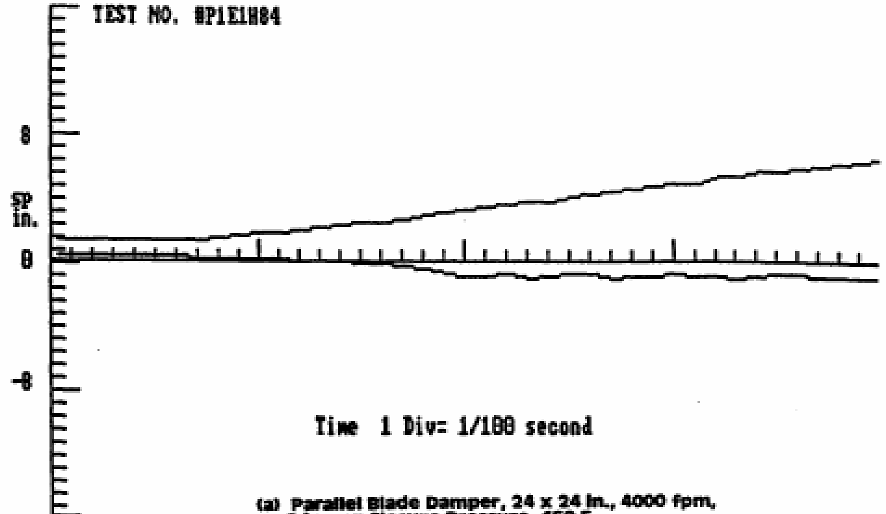
(a) Curtain Damper, 24 x 24 in., 3000 fpm,
4 in. wg Closure Pressure, Ambient Air



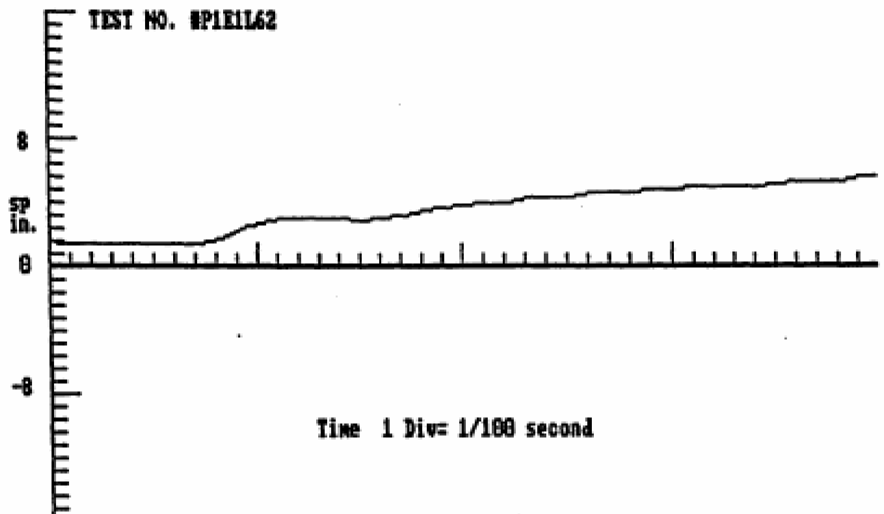
(b) Curtain Damper, 24 x 24 in., 2000 fpm,
6 in. wg Closure Pressure, 350 F



(c) Curtain Damper, 24 x 24 in., 4000 fpm,
8 in. wg Closure Pressure, 250 F



(a) Parallel Blade Damper, 24 x 24 in., 4000 fpm,
8 in. wg Closure Pressure, 450 F



(b) Parallel Blade Damper, 24 x 24 in., 2000 fpm,
6 in. wg Closure Pressure, 250 F