Neg. Pressure 10 in. wg	Stiffener Spacing											
	Unstiff.		20 ft		12 ft		10 ft		6 ft		5 ft	
Diameter, in.	GA	R	GA	R	GA	R	GA	R	GA	R	GA	R
4	28	NR	28	A	28	A	28	A	28	A	28	A
6	28	NR	28	A	28	A	28	A	28	A	28	A
8	26	NR	26	A	28	A	28	A	28	A	28	A
10	26	NR	26	A	28	A	28	A	28	A	28	A
12	24	NR	24	A	26	A	28	A	28	A	28	A
14	22	NR	24	A	26	A	26	A	28	A	28	A
16	22	NR	24	A	24	A	26	A	28	A	28	A
18	20	NR	22	A	24	A	24	A	26	A	28	A
20	18	NR	22	A	24	A	24	A	26	A	26	A
22	18	NR	22	A	24	A	24	A	26	A	26	A
24	18	NR	20	A	22	A	24	A	24	A	26	A
30	16	NR	20	B	22	A	22	A	24	A	24	A
36	N/A	N/A	18	C	20	B	22	B	22	A	24	A
42	N/A	N/A	18	C	20	B	20	B	22	B	22	B
48	N/A	N/A	18	E	18	C	20	C	22	B	22	B
54	N/A	N/A	18	E	18	D	18	C	20	C	22	B
60	N/A	N/A	16	F	18	E	18	E	20	C	20	C
66	N/A	N/A	16	G	18	E	18	E	20	D	20	C
72	N/A	N/A	16	G	18	F	18	E	20	E	20	D
78	N/A	N/A	16	G	16	G	18	F	18	E	20	E
84	N/A	N/A	N/A	G	16	G	16	G	18	E	18	E
90	N/A	N/A	N/A	G	16	G	16	G	18	F	18	E
96	N/A	N/A	N/A	G	16	G	16	G	18	G	18	F

Table 3–13 Min. Required Gage for Spiral Seam Duct Under Neg. Pressure

NOTES:

a. N/A – Not Applicable

b. NR – Not Required

c. R – Reinforcement (stiffener) Class

Neg. Pressure 2500 Pa	Stiffener Spacing											
	Unstiff.		6.00 m		3.6 m		3.00 m		1.80 m		1.50 m	
Diameter (mm)	GA	R	GA	R	GA	R	GA	R	GA	R	GA	R
100	0.48	NR	0.48	A	0.48	A	0.48	A	0.48	A	0.48	A
150	0.48	NR	0.48	A	0.48	A	0.48	A	0.48	A	0.48	A
200	0.55	NR	0.55	A	0.48	A	0.48	A	0.48	A	0.48	A
250	0.55	NR	0.55	A	0.48	A	0.48	A	0.48	A	0.48	A
300	0.70	NR	0.70	A	0.55	A	0.48	A	0.48	A	0.48	A
350	0.85	NR	0.70	A	0.55	A	0.55	A	0.48	A	0.48	A
400	0.85	NR	0.70	A	0.70	A	0.55	A	0.48	A	0.48	A
450	1.00	NR	0.85	A	0.70	A	0.70	A	0.55	A	0.48	A
500	1.31	NR	0.85	A	0.70	A	0.70	A	0.55	A	0.55	A
550	1.31	NR	0.85	A	0.70	A	0.70	A	0.55	A	0.55	A
600	1.31	NR	1.00	A	0.85	A	0.70	A	0.70	A	0.55	A
750	1.61	NR	1.00	B	0.85	A	0.85	A	0.70	A	0.70	A
900	N/A	N/A	1.31	C	1.00	B	0.85	B	0.85	A	0.70	A
1000	N/A	N/A	1.31	C	1.00	B	1.00	B	0.85	B	0.85	B
1200	N/A	N/A	1.31	E	1.31	C	1.00	C	0.85	B	0.85	B
1300	N/A	N/A	1.31	E	1.31	D	1.31	C	1.00	C	0.85	B
1500	N/A	N/A	1.61	F	1.31	E	1.31	E	1.00	C	1.00	C
1650	N/A	N/A	1.61	G	1.31	E	1.31	E	1.00	D	1.00	C
1800	N/A	N/A	1.61	G	1.31	F	1.31	E	1.00	E	1.00	D
1950	N/A	N/A	1.61	G	1.61	G	1.31	F	1.31	E	1.00	E
2100	N/A	N/A	N/A	G	1.61	G	1.61	G	1.31	E	1.31	E
2250	N/A	N/A	N/A	G	1.61	G	1.61	G	1.31	F	1.31	E
2400	N/A	N/A	N/A	G	1.61	G	1.61	G	1.31	G	1.31	F

Table 3–13M Min. Required Gage for Spiral Seam Duct Under Neg. Pressure

NOTES:

a. N/A – Not Applicable

b. NR – Not Required

c. R – Reinforcement (stiffener) Class

Duct Diameter in Inches	Maximum 2 in. wg Static Positive		Maximum 2 in. wg Static Negative	
	Spiral Seam Gage	Longitudinal Seam Gage	Spiral Seam Gage	Longitudinal Seam Gage
3 thru 8	.025 in.	.032 in.	.025 in.	.040 in.
9 thru 14	.025 in.	.032 in.	032 in.	.040 in.
15 thru 26	.032 in.	.040 in.	.040 in.	.050 in.
27 thru 36	.040 in.	.050 in.	.050 in.	.063 in.
37 thru 50	.050 in.	.063 in.	.063 in.	.071 in.
51 thru 60	.063 in.	.071 in.	N.A.	.090 in.
61 thru 84	N.A.	.090 in.	N.A.	N.A.

Table 3–14 Aluminum Round Duct Gage Schedule

NOTES:

Construction of aluminum duct and fittings shall otherwise correspond in the same relationship as for steel duct.

Sheet material shall be alloy 3003-H14 unless otherwise specified. Aluminum fasteners shall be used. Structural members (if used) shall be alloy 6061-T6 or galvanized steel as related in Table 2-52 (for rectangular duct). Hangers in contact with the duct shall be galvanized steel or aluminum.

N.A. means not readily available or not assigned.

Duct Diameter (mm)	Maximum 500 Pa Static Positive		Maximum 500 Pa Static Negative	
	Spiral Seam Gage (mm)	Longitudinal Seam Gage (mm)	Spiral Seam Gage (mm)	Longitudinal Seam Gage (mm)
75 thru 200	0.64	0.81	0.64	1.02
230 thru 350	0.64	0.81	0.81	1.02
351 thru 650	0.81	1.02	1.02	1.27
651 thru 900	1.02	1.27	1.27	1.60
901 thru 1250	1.27	1.60	1.60	1.80
1251 thru 1500	1.60	1.80	N.A.	2.29
1501 thru 2100	N.A.	2.29	N.A.	N.A.

Table 3–14M Aluminum Round Duct Gage Schedule

NOTES:

Construction of aluminum duct and fittings shall otherwise correspond in the same relationship as for steel duct.

Sheet material shall be alloy 3003-H14 unless otherwise specified. Aluminum fasteners shall be used. Structural members (if used) shall be alloy 6061-T6 or galvanized steel as related in Table 2-52 (for rectangular duct). Hangers in contact with the duct shall be galvanized steel or aluminum.

N.A. means not readily available or not assigned.

3.3 FLAT OVAL DUCT CONSTRUCTION STANDARDS

S3.11 Flat oval duct shall be provided where shown and as shown on the contract drawings.

S3.12 Minimum duct wall thickness shall be as indicated in Table 3-15.

S3.13 Reinforcement for flat sides of oval duct shall be of the same size and spacing interval as specified for rectangular duct or shall be provided to limit wall deflection to ¾ in. (19 mm) and reinforcement deflection to ¼ in. (6.4 mm).

S3.14 Unless otherwise specified, joints and seams shall be similar to those indicated for round duct.

S3.15 Fittings shall conform to the thickness schedules in Table 3-15, shall conform to the seam, joint, and connection arrangements permitted for round duct, and shall be reinforced to conform to S3.13.

S3.16 The duct construction shall be capable of withstanding a pressure 50 percent greater than that of the assigned pressure class without structural failure or permanent deformation.

S3.17 Duct wall deflection at atmospheric pressure, with reinforcements and connections in place, shall not exceed ¼ in. (6.4mm) on widths of 36 in. (914 mm) or less or ½ in. (13 mm) on greater widths, *see* criteria in Chapter 11.

S3.18 Supports shall conform to those permitted for rectangular duct, with the overall dimensions taken as references.

3.4 COMMENTARY

Flat oval duct combines the advantages of round duct and rectangular duct because it may fit in spaces where there is not enough room for round duct, and it can be joined using the techniques of round duct assembly.

Spiral flat oval duct is machine-made from round spiral lockseam duct and is available in varying sizes and aspect ratios. It can also be made with longitudinal seams.

Flat oval duct has considerably less flat surface that is susceptible to vibration and requires less reinforcement than a corresponding size of rectangular duct. The deflection of the flat oval duct under pressure is related to the flat span rather than the overall width of the duct.

Any round duct fitting can have an equivalent fitting made in flat oval. As in rectangular duct, a hard bend elbow denotes the bend in the plane of the duct width, whereas an easy bend elbow denotes the bend in the plane of the duct height. Any branch fitting can be made with the branch tap either round or flat oval. The tap of the flat oval fitting can be located anywhere on the circumference of the fitting body. If the diameter of a round tap is greater than the height of the flat oval body, a transition can be made from flat oval to round, providing an equivalent area at the base of the transition.

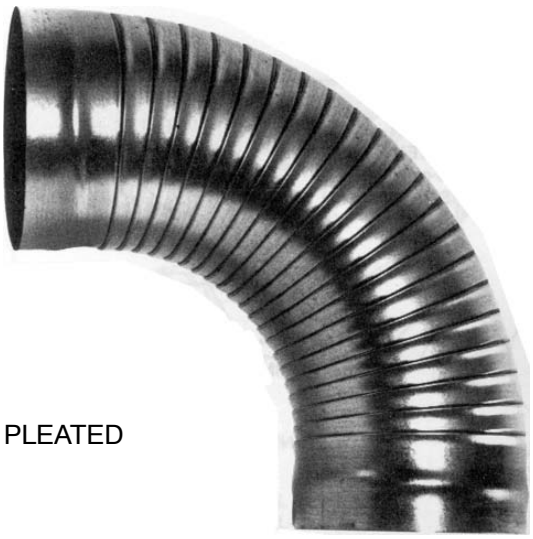
Flat oval duct is for positive pressure applications only unless special designs are used.

Major Dimension Duct Width (in)	Longitudinal Seam	Spiral Seam	Fitting Gage
To 24	20	24	20
30	20	22	20
36	20	22	20
42	18	22	18
48	18	22	18
54	18	20	18
60	18	20	18
66	16	20	16
71 and up	16	18	16

Table 3–15 Flat Oval Duct Gage
Positive Pressure To 10 in. wg

Major Dimension Duct Width (mm)	Longitudinal Seam (mm)	Spiral Seam (mm)	Fitting Gage (mm)
To 600	1.00	0.70	1.00
750	1.00	0.85	1.00
900	1.00	0.85	1.00
1000	1.31	0.85	1.31
1200	1.31	0.85	1.31
1300	1.31	1.00	1.31
1500	1.31	1.00	1.31
1650	1.61	1.00	1.61
1775 and up	1.61	1.31	1.61

Table 3–15M Flat Oval Duct Gage
Positive Pressure To 2500 Pa



PLEATED

STAMPED

ADJUSTABLE

SEGMENTED

SEGMENTED
STANDING SEAM

FIGURE 3–4 ROUND DUCT ELBOWS

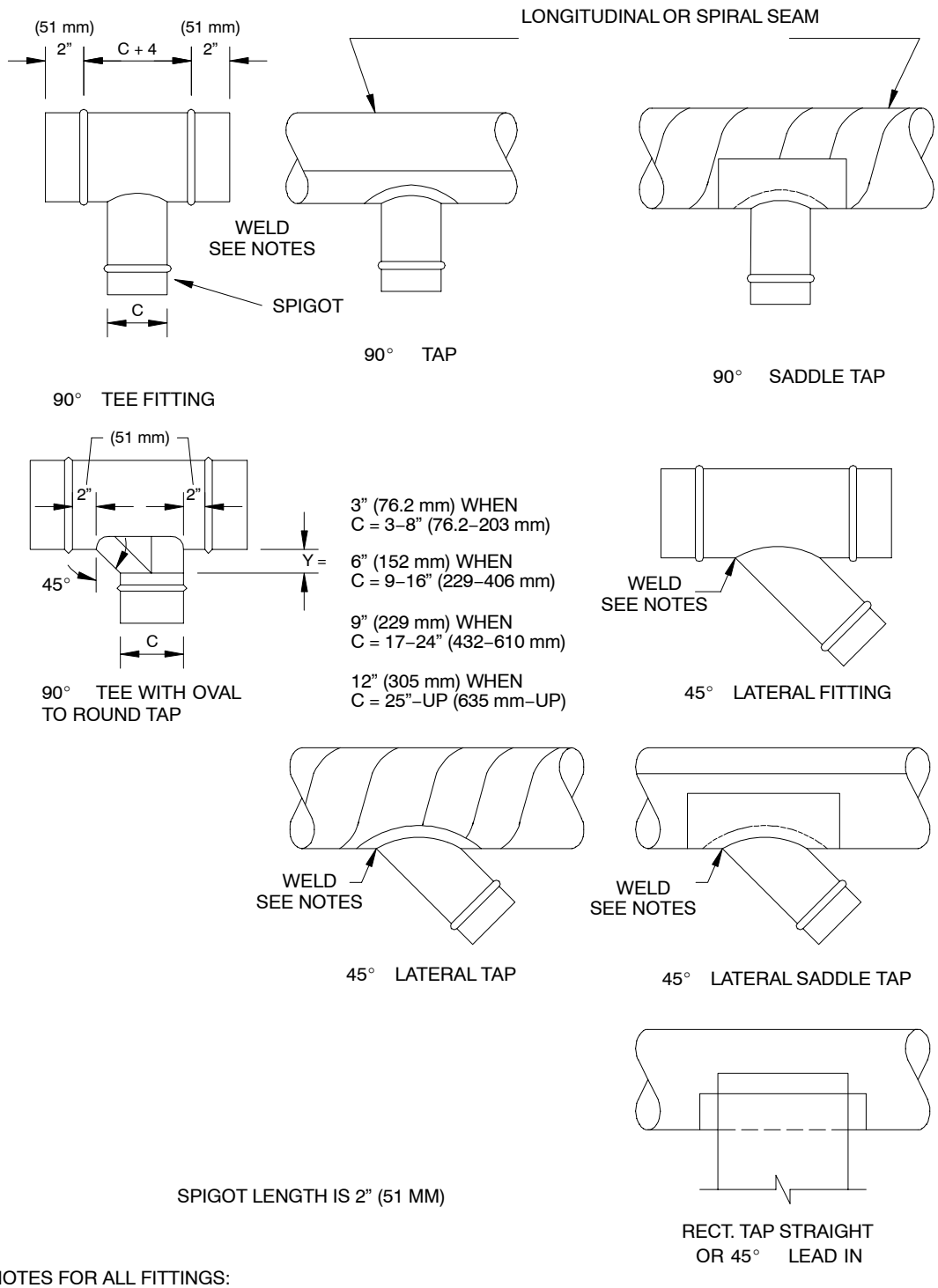
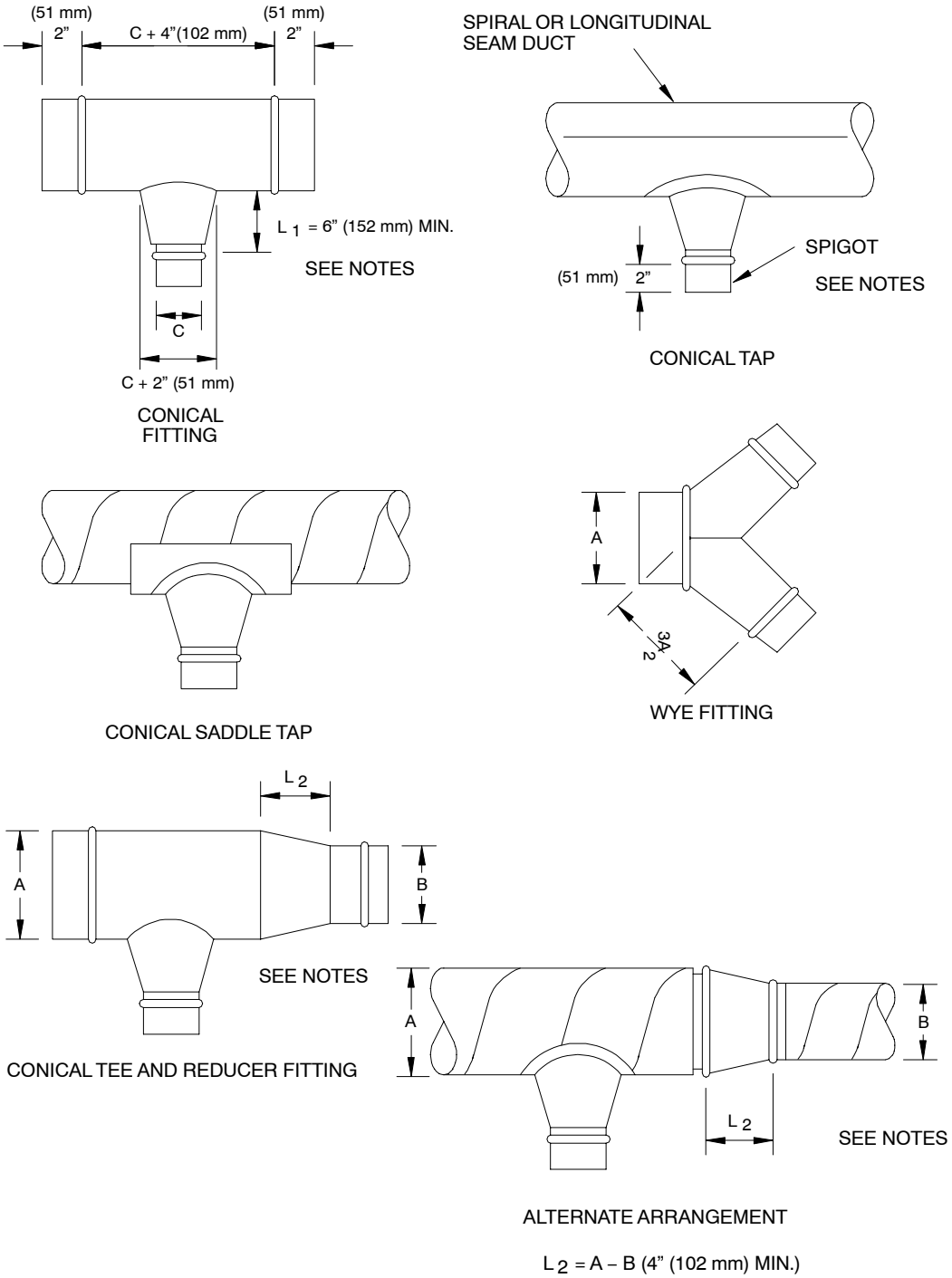
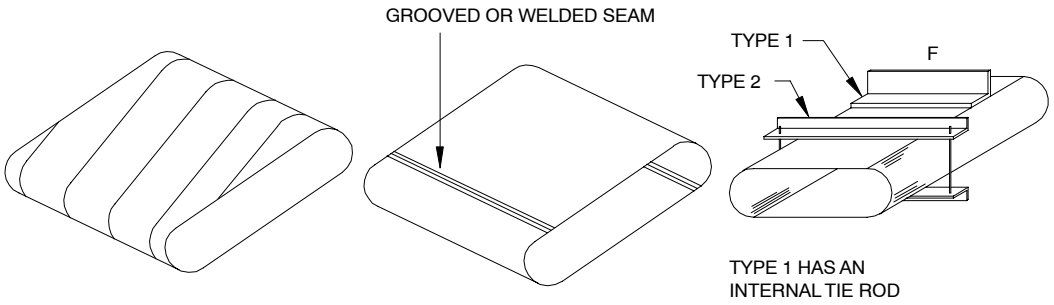


FIGURE 3–5 90° TEES AND LATERALS

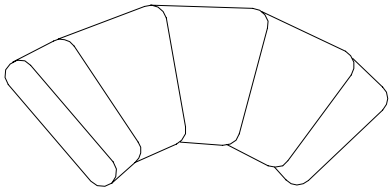


NOTES FOR ALL FITTINGS:
1. STITCH WELD ON 4” (101 MM) CENTERS
2. SPOT WELD ON 2” (50.8) CENTERS
3. SCREW ON 4” (101 MM) CENTERS
4. TACK WELD ON 4” (101 MM) CENTERS AND SEAL

FIGURE 3–6 CONICAL TEES

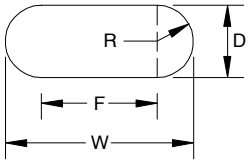


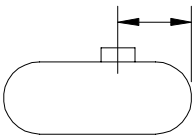
JOINTS AND CONNECTIONS ARE SIMILAR TO ROUND DUCT SIZE
REINFORCEMENTS AS FOR RECTANGULAR DUCT OF F DIMENSION ATTACH
REINFORCEMENT TO DUCT AT ENDS AND 12" (305 MM) MAX. SPACING

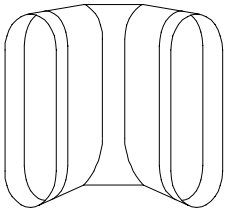


HARD BEND

F = W–D = FLAT WIDTH
W = MAJOR DIMENSION
SEE TABLE 3–15

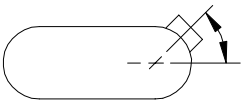




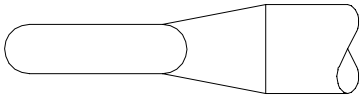


EASY BEND

FABRICATE FITTINGS AND
CONNECTIONS AS FOR
ROUND DUCT



BRANCH TAKE OFF



CONICAL TAKE OFF

FIGURE 3–7 FLAT OVAL DUCTS

3.5 FLEXIBLE AIR DUCT INSTALLATION STANDARDS

S3.19 Unless otherwise designated, the term "flexible air duct" is used for all ducts classified by UL as either flexible air ducts or air connectors.

S3.20 These provisions apply to ducts used for indoor comfort heating, ventilating, and air conditioning service. They do not apply to service for conveying particulates, corrosive fumes and vapors, high temperature air, corrosive or contaminated atmosphere, etc.

S3.21 It is presumed that project specifications define the specific materials, pressure limits, velocity limits, friction rate, thermal conductivity, acoustical ratings, and other attributes.

S3.22 When ducts must conform to NFPA Standard 90A or 90B, flexible ducts must be tested in accordance with Underwriters Laboratories *UL Standard for Safety for Factory-Made Air Ducts and Connectors,* UL-181, and must be installed in accordance with the conditions of their UL listing. Separate installation limitations for air connectors and flexible air ducts are identified in NFPA Standard 90A or 90B.

Refer to UL Standard 181 for details.

S3.23 The minimum length of flexible duct should be used.

S3.24 Bends shall be made with not less than 1 duct diameter centerline radius. Ducts should extend a few inches beyond the end of a sheet metal connection before bending. Ducts should not be compressed.

S3.25 Ducts shall be located away from hot equipment such as furnaces and steam pipes to avoid excess temperature exposure.

S3.26 Illustrations of accessories, sleeves, and collars are representative of classes of items. The use of components not precisely identical to these is acceptable.

S3.27 If the application guidelines dictated by the flexible duct manufacturer are more stringent than the specifications in this manual, those of the manufacturer shall govern.

3.6 SPECIFICATION FOR JOINING AND ATTACHING FLEXIBLE DUCT

S3.28 The provisions for sealing ducts specified on Section 1.4 apply. Adhesives shall be chemically compatible with materials they contact.

S3.29 The ends of ducts shall be trimmed square before installation.

S3.30 Collars to which flexible duct is attached shall be a minimum of 2 in. (51 mm) in length. Sleeves used for joining two sections of flexible duct shall be a minimum of 4 in. (102 mm) in length.

S3.31 Collars and sleeves shall be inserted into flexible duct a minimum of 1 in. (25 mm) before fastening.

S3.32 Metallic flexible duct shall be attached with at least three #8 sheet metal screws equally spaced around the duct's circumference. Ducts larger than 12 in. (305 mm) in diameter shall have at least five #8 sheet metal screws. Screws shall be located at least 1/2 in. (13 mm) from the duct end.

S3.33 Non metallic flexible duct shall be secured to the sleeve or collar with a draw band. If the duct collar exceeds 12 in. (305 mm) in diameter the draw band must be positioned behind a bead on the metal collar.

S3.34 Insulation and vapor barriers on factory-fabricated ducts shall be fitted over the core connection and shall also be secured with a draw band.

3.7 SPECIFICATION FOR SUPPORTING FLEXIBLE DUCT

S3.35 Flexible duct shall be supported at the manufacturer's recommended intervals but at least every 5 ft (1.5 m). Maximum permissible sag is a ½ in. per foot (41.7 mm/m) of spacing between supports. A connection to another duct or to equipment is considered a support point.

S3.36 Hanger or saddle material in contact with the flexible duct shall be wide enough so that it does not reduce the internal diameter of the duct when the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less

than 1 in. (25 mm) wide. Narrower hanger material may be used in conjunction with a sheet metal saddle that meets this specification. This saddle must cover one-half the circumference of the outside diameter of the flexible duct and fit neatly around the lower half of the duct's outer circumference.

S3.37 Factory-installed suspension systems that are integral to the flexible duct are acceptable for hanging when the manufacturer's recommended procedures are followed.

S3.38 Hangers shall be adequately attached to the building structure.

S3.39 To avoid tearing the vapor barrier, do not support the entire weight of the flexible duct on any one hanger during installation. Avoid contacting the flexible duct with sharp edges of the hanger material. Damage to the vapor barrier may be repaired with approved tape. If the internal core is penetrated, replace the flexible duct or treat the tear as a connection.

S3.40 Terminal devices connected by flexible duct shall be supported independently of the flexible duct.