HVAC DUCT CONSTRUCTION STANDARDS 102

May, 2010

Presented by:

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Technical Services

HVAC DCS 102 TOPICS

- Proper tie rod use
- Procedures for “new” TDC/TDF tables
- How to fab “Large” duct (over 120”)
- How to convert to aluminum construction
- Duct liner installation
- Double walled duct

Tie Rods

- Steel Rod
  - Threaded (all thread) or partial
  - Plain
- Conduit
  - RC
  - EMT (most common type)
- Steel Pipe
- Steel Strap (positive pressure only)
  - 1 in. x 1/8 in.
- Angles (rare)

Tie Rod Attachment

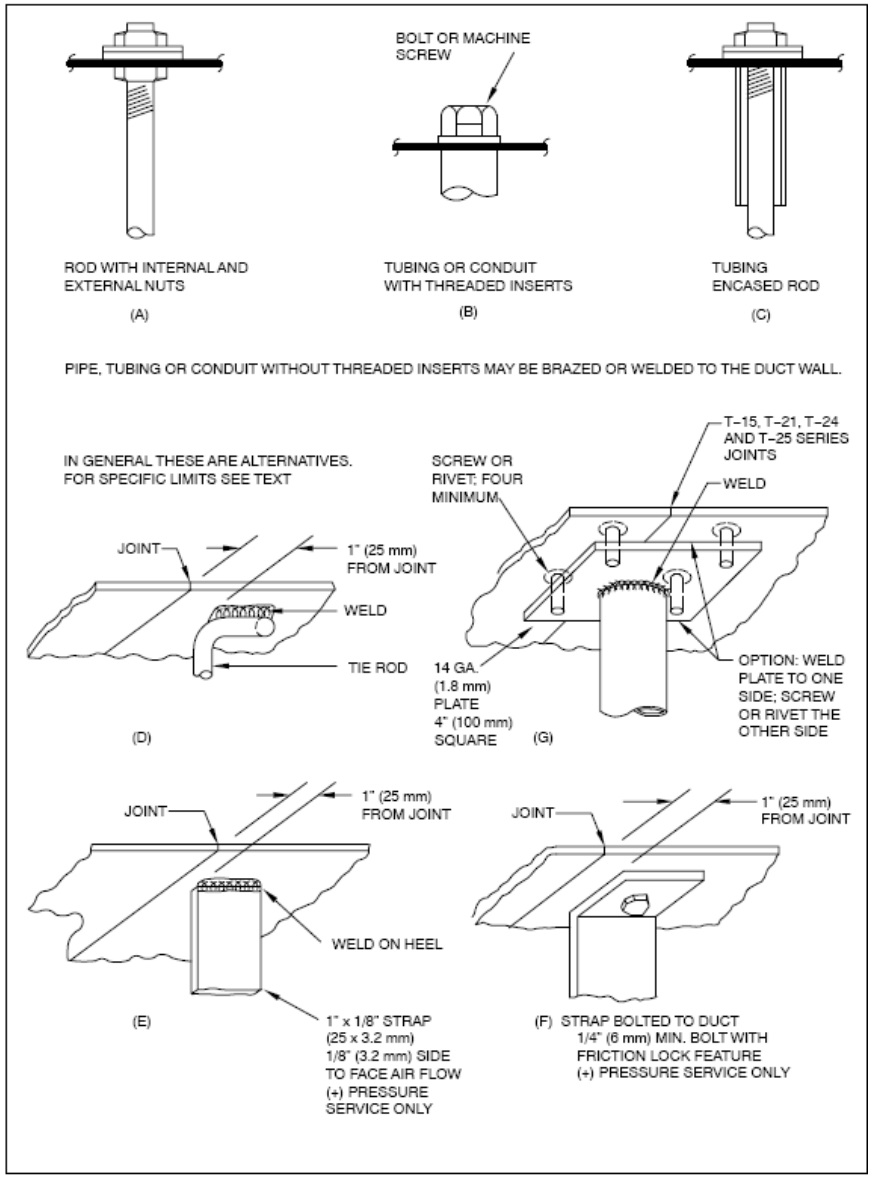
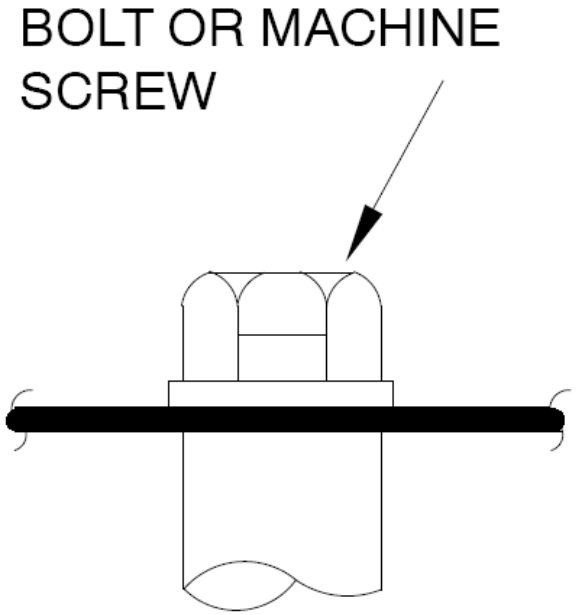


FIGURE 2–5 TIE ROD ATTACHMENTS

- Figure 2-5
- Page 2.82

Tie Rod Attachment



- Figure 2-5
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PIPE, TUBING OR CONDUIT WITHOUT THREADED INSERTS MAY BE BRAZED OR WELDED TO THE DUCT WALL.

Tie Rod Attachment

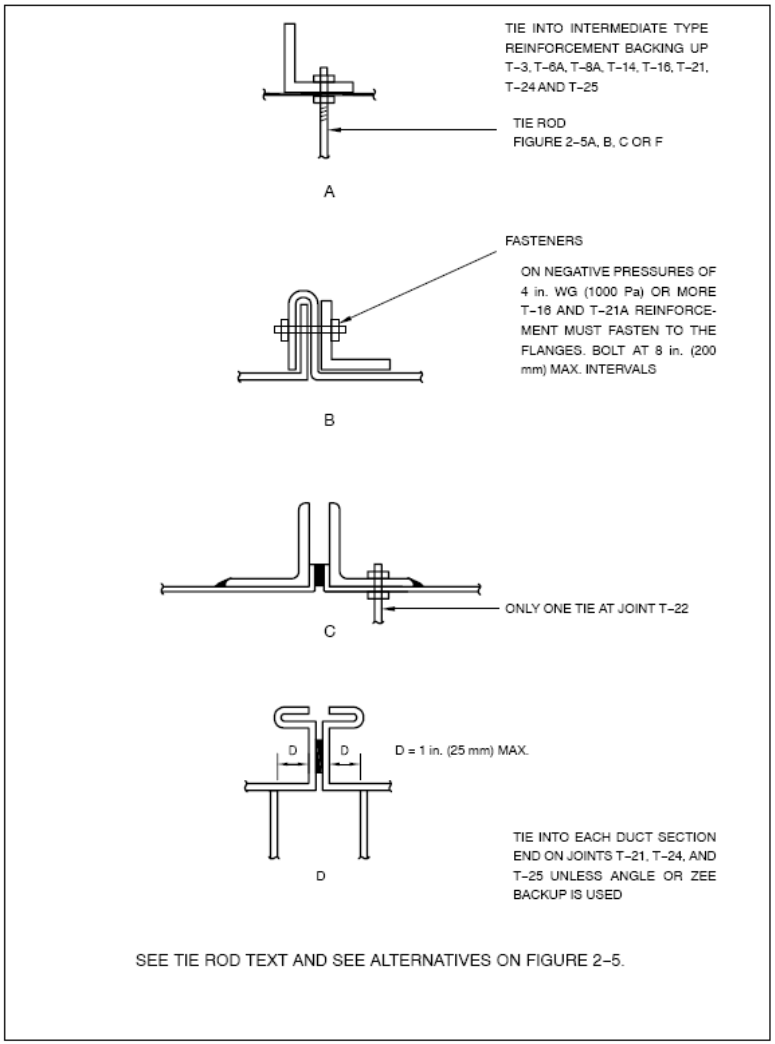

FIGURE 2–6 TIE ROD ATTACHMENTS

- Figure 2-6
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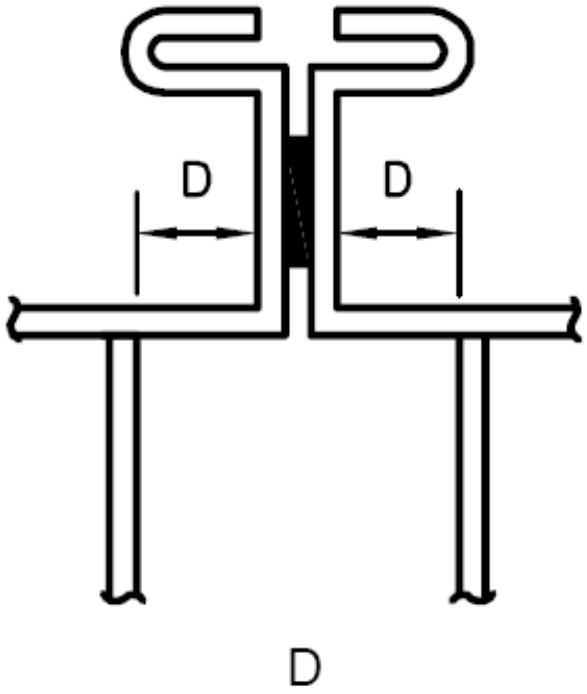
Tie Rod Attachment

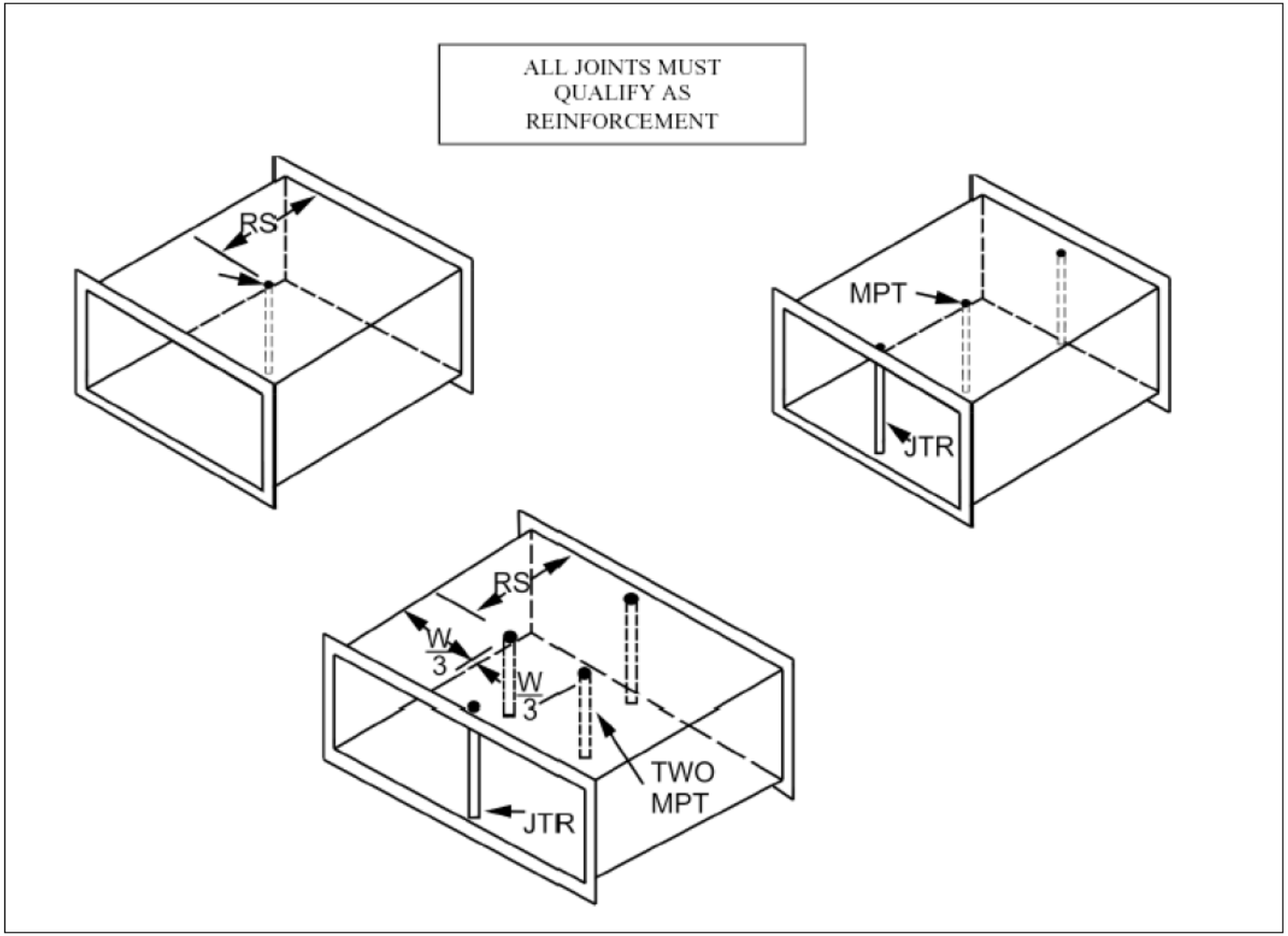
- Figure 2-6
- Page 2.83



D = 1 in. (25 mm) MAX.

TIE INTO EACH DUCT SECTION END ON JOINTS T–21, T–24, AND T–25 UNLESS ANGLE OR ZEE BACKUP IS USED

Tie Rod Layout p 2.98



Mid-Panel Tie Rods

- Do not use in underground/slab apps
- Do not use if air velocity > 2500 fpm
- Do not use where grease or condensation can collect
  - Unless no penetration is made
  - Or penetration is sealed water tight
- If tie rods occur in 2 directions in the same vicinity they must: (applies to JTR and MPT)
  - Be prevented from touching
  - Or be permanently attached

Example 1

- Pressure class is positive 4 in. w.g.
- Dimensions are 36 in. x 24 in.
- 5 ft. joint spacing
- Transverse joint TDC/TDF
- Use tie rod(s) where possible

The Right Table (Pressure Class)

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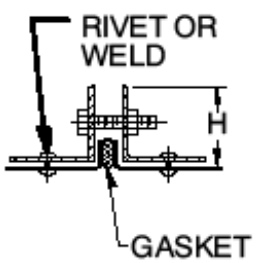
4 in. wg Static Pos. or Neg. / Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number							
		Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
8 in. and under	24 ga.	Not Required		B-26	B-26	B-26	B-26	B-26	B-26
9 – 10 in.	22 ga.			B-24	B-26	B-26	B-26	B-26	B-26
11 – 12 in.	22 ga.		B-24	C-24	C-26	C-26	C-26	B-26	B-26
13 – 14 in.	20 ga.		C-22	C-22	C-24	C-26	C-26	C-26	C-26
15 – 16 in.	20 ga.		D-22	D-22	C-24	C-26	C-26	C-26	C-26
17 – 18 in.	18 ga.		D-22	D-22	D-24	D-26	C-26	C-26	C-26
19 – 20 in.	18 ga.		E-20	E-22	E-24	D-24	D-26	C-26	C-26
21 – 22 in.	18 ga.		E-20	E-20	E-24	E-24	D-26	D-26	C-26
23 – 24 in.	18 ga.		F-20	F-20	E-22	E-24	E-26	D-26	D-26
25 – 26 in.	16 ga.	G-18	G-18	F-20	F-22	E-24	E-26	E-26	D-26
27 – 28 in.	16 ga.	H-18G	G-18	G-20	F-22	F-24	E-26	E-26	D-26
29 – 30 in.	16 ga.	H-18G	H-18G	G-18	G-22	F-24	E-26	E-26	E-26
31 – 36 in.		J-16H	I-16G	H-18G	H-20	G-22	F-24	F-26	E-26
37 – 42 in.			J-16H	I-16G	I-18G	H-20G	G-22	G-24	F-26
43 – 48 in				I-16H	I-18G	I-18G	H-22G	H-24G	G-24

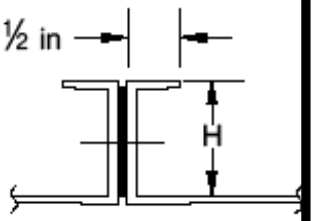
The Right Table (Pressure Class)

Page 2.22

4 in. wg Static Pos. or Neg. Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number — Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
8 in. and under	24 ga.	Not Required		B-26	B-26	B-26	B-26	B-26	B-26
9 – 10 in.	22 ga.			B-24	B-26	B-26	B-26	B-26	B-26
11 – 12 in.	22 ga.		B-24	C-24	C-26	C-26	C-26	B-26	B-26
13 – 14 in.	20 ga.		C-22	C-22	C-24	C-26	C-26	C-26	C-26
15 – 16 in.	20 ga.		D-22	D-22	C-24	C-26	C-26	C-26	C-26
17 – 18 in.	18 ga.		D-22	D-22	D-24	D-26	C-26	C-26	C-26
19 – 20 in.	18 ga.		E-20	E-22	E-24	D-24	D-26	C-26	C-26
21 – 22 in.	18 ga.		E-20	E-20	E-24	E-24	D-26	D-26	C-26
23 – 24 in.	18 ga.		F-20	F-20	E-22	E-24	E-26	D-26	D-26
25 – 26 in.	16 ga.	G-18	G-18	F-20	F-22	E-24	E-26	E-26	D-26
27 – 28 in.	16 ga.	H-18G	G-18	G-20	F-22	F-24	E-26	E-26	D-26
29 – 30 in.	16 ga.	H-18G	H-18G	G-18	G-22	F-24	E-26	E-26	E-26
31 – 36 in.		J-16H	I-16G	H-18G	H-20	G-22	F-24	F-26	E-26
37 – 42 in.			J-16H	I-16G	I-18G	H-20G	G-22	G-24	F-26
43 – 48 in				I-16H	I-18G	I-18G	H-22G	H-24G	G-24

Joint Reinforcement





Reinf. Class	E1*	T-22 Companion Angles H × T	WT LF	T-24 Flanged T (Nom.)	WT LF	T-24a Flanged H × T (Nom.)	WT LF	T-25b Flanged H × T (Nom.)	WT LF
B	1.0	Use E		Use D		Use D		Use D	
C	1.9	Use E		Use D		Use D		Use D	
D	2.7	Use E		26 ga	0.5	1 × 22 ga	0.4	26 ga	0.5
E	6.5	C 1 × ⅛	1.7	24 ga	0.6	Use F		24 ga	0.6
F	12.8	H 1 × ⅛	1.7	22 ga	0.7	1½ × 20 ga	0.6	22 ga	0.7
G	15.8	1¼ × ⅛	2.1	22 ga (R) 20 G	1.0	1½ × 18 ga	0.8	22 ga (R) 20 ga	1.0
H	26.4	C 1½ × ⅛ (+) H 1½ × ⅛	2.6	18 ga	1.1			18 ga	1.1
I	69	1½ × ¼	3.7	20 ga (R)	1.0			20 ga (R)	1.0

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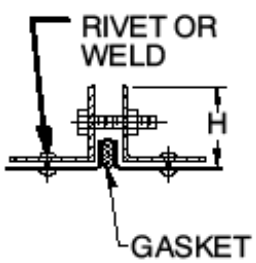
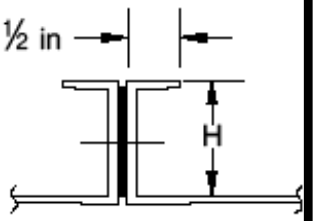
Joint Reinforcement





T-25a Flanged

Reinf. Class	E1*	T-22 Companion Angles H × T	WT LF	T-24 Flanged T (Nom.)	WT LF	T-24a Flanged H × T (Nom.)	WT LF	T-25b Flanged H × T (Nom.)	WT LF
B	1.0	Use E		Use D		Use D		Use D	
C	1.9	Use E		Use D		Use D		Use D	
D	2.7	Use E		26 ga	0.5	1 × 22 ga	0.4	26 ga	0.5
E	6.5	C 1 × ⅛	1.7	24 ga	0.6	Use F		24 ga	0.6
F	12.8	H 1 × ⅛	1.7	22 ga	0.7	1½ × 20 ga	0.6	22 ga	0.7
G	15.8	1¼ × ⅛	2.1	22 ga (R) 20 G	1.0	1½ × 18 ga	0.8	22 ga (R) 20 ga	1.0
H	26.4	C 1½ × ⅛ (+) H 1½ × ⅛	2.6	18 ga	1.1			18 ga	1.1
I	69	1½ × ¼	3.7	20 ga (R)	1.0			20 ga (R)	1.0

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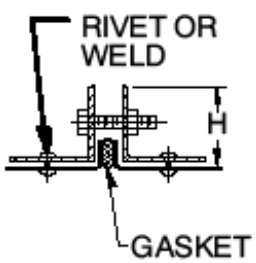
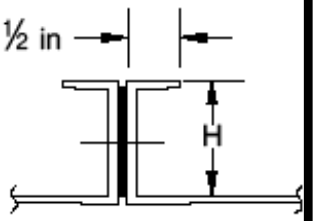
Joint Reinforcement

- The table required H-20
- One option we considered was H-18
  - Valid as H meets the minimum requirement
  - Valid as 18 gage is heavier than 20 gage
- The next option we considered was I-20
  - Valid as I exceeds the requirement of H
  - Valid as 20 gage meets the minimum requirement
- What if we use RS of 2 ½ ft.? (F-26)

Joint Reinforcement





T-25a Flanged

Reinf. Class	E1*	T-22 Companion Angles H × T	WT LF	T-24 Flanged T (Nom.)	WT LF	T-24a Flanged H × T (Nom.)	WT LF	T-25b Flanged H × T (Nom.)	WT LF
B	1.0	Use E		Use D		Use D		Use D	
C	1.9	Use E		Use D		Use D		Use D	
D	2.7	Use E		26 ga	0.5	1 × 22 ga	0.4	26 ga	0.5
E	6.5	C 1 × ⅛	1.7	24 ga	0.6	Use F		24 ga	0.6
F	12.8	H 1 × ⅛	1.7	22 ga	0.7	1½ × 20 ga	0.6	22 ga	0.7
G	15.8	1¼ × ⅛	2.1	22 ga (R) 20 G	1.0	1½ × 18 ga	0.8	22 ga (R) 20 ga	1.0
H	26.4	C 1½ × ⅛ (+) H 1½ × ⅛	2.6	18 ga	1.1			18 ga	1.1
I	69	1½ × ¼	3.7	20 ga (R)	1.0			20 ga (R)	1.0

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Joint Reinforcement

- Can we use mid panel tie rods in place of external reinforcement?
- How many would we need?
- What size should they be?

Mid Panel Tie Rod Schedule

	RS	16 ga	18 ga	20 ga	22 ga	24 ga	26 ga
±½ in. wg	3 ft				To 96(1)	To 84(1)	To 60(1)
	2 ½ ft				To 96(1)	To 84(1)	To 60(1)
	2 ft				To 96(1)	To 84(1)	To 60(1)
±1 in. wg	3 ft		To 96(1)*	To 84(1)*	To 72(1)*	To 60(1)	To 48(1)
				85-96(2)	73-84(2)	61-72(2)	
	2 ½ in.		To 96(1)*	To 84(1)*	To 72(1)*	To 60(1)	To 48(1)
				85-96(2)	73-84(2)	61-72(2)	
	2 ft		To 96(1)*	To 84(1)*	To 72(1)	To 72(1)	To 48(1)
				85-96(2)	73-96(2)		
±2 in. wg	3 ft		To 84(1)*	To 60(1)*	To 48(1)*	To 42(1)	To 36(1)
			To 96(2)	61-84(2)	49-72(2)	43-54(2)	
	2 ½ ft		To 84(1)*	To 72(1)*	To 60(1)*	To 54(1)	To 42(1)
			85-96(2)	73-96(2)	61-84(2)	55-60(2)	
	2 ft		To 96(1)*	To 72(1)*	To 60(1)	To 60(1)	To 42(1)
				73-96(2)	61-96(2)	61-72(2)	
±3 in. wg	3 ft		To 72(1)*	To 54(1)*	To 48(1)	To 42(1)	To 30(1)
			73-84(2)	55-72(2)	49-54(2)		
	2 ½ ft		To 72(1)*	To 60(1)*	To 54(1)*	To 42(1)	To 36(1)
			To 96(2)	61-84(2)	55-72(2)	43-54(2)	
	2 ft		To 84(1)*	To 72(1)*	To 60(1)*	To 54(1)	To 42(1)
			85-96(2)	73-96(2)	61-84(2)	55-72(2)	
±4 in. wg	3 ft	To 84(2)	To 60(1)*	To 54(1)*	To 48(1)	To 36(1)	To 30(1)
			61-72(2)	55-60(2)			
	2 ½ ft		To 72(1)*	To 60(1)*	To 48(1)	To 48(1)	To 36(1)
			73-96(2)	61-72(2)	49-60(2)		
	2 ft		To 84(1)*	To 60(1)*	To 60(1)	To 48(1)	To 42(1)
			85-96(2)	61-96(2)	61-72(2)	49-60(2)	
	3 ft	To 72(2)	To 54(1)*	To 42(1)	To 36(1)	N/A	N/A

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Mid Panel Tie Rod Schedule

	RS	16 ga	18 ga	20 ga	22 ga	24 ga	26 ga
±½ in. wg	3 ft				To 96(1)	To 84(1)	To 60(1)
	2 ½ ft				To 96(1)	To 84(1)	To 60(1)
	2 ft				To 96(1)	To 84(1)	To 60(1)
±4 in. wg	3 ft	To 84(2)	To 60(1)* 61-72(2)	To 54(1)* 55-60(2)	To 48(1)	To 36(1)	To 30(1)
	2 ½ ft		To 72(1)* 73-96(2)	To 60(1)* 61-72(2)	To 48(1) 49-60(2)	To 48(1)	To 36(1)
	2 ft		To 84(1)* 85-96(2)	To 60(1)* 61-96(2)	To 60(1) 61-72(2)	To 48(1) 49-60(2)	To 42(1)

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Tie Rod Load

Static Pressure Class, in. wg									Static Pressure Class, in. wg								
W	RS	½ "	1"	2"	3"	4"	6"	10"	W	RS	½"	1"	2"	3"	4"	6"	10"
	36	25	49	99	148	198	296	494		36	47	94	187	281	374	562	936
	30	21	41	82	124	165	247	412		30	39	78	156	234	312	468	780
37"	28	19	38	77	115	154	231	384	72"	28	36	73	146	218	291	437	728
	24	17	33	66	99	132	198	329		24	31	62	125	187	250	374	624
	22	15	30	60	91	121	181	302		22	29	57	114	172	229	343	572
	20	14	27	55	82	110	165	274		20	26	52	104	156	208	312	520
	36	27	55	109	164	218	328	546		36	51	101	203	304	406	608	1014
	30	23	46	91	136	182	273	455		30	43	85	169	254	338	507	845
	28	21	43	85	127	170	255	425		28	39	79	158				789
42"	24	18	36	73	109	146	218	364	78"	24	34	68	135				676
	22	17	33	67	100	134	200	334		22	31	62	124				620
	20	15	30	61	91	121	182	303		20	28	56	113				563

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Table 2-46

Mid Panel Tie Rod Size

- EMT conduit positive pressure
- ½ in. 900 lbs
- ¾ in. 1,340 lbs
- 1 in. 1,980 lbs
- HVAC DCS p2.80 S1.19.4

The Right Table (Pressure Class)

4 in. wg Static Pos. or Neg. / Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number							
		Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
8 in. and under	24 ga.	Not Required		B-26	B-26	B-26	B-26	B-26	B-26
9 – 10 in.	22 ga.			B-24	B-26	B-26	B-26	B-26	B-26
11 – 12 in.	22 ga.		B-24	C-24	C-26	C-26	C-26	B-26	B-26
13 – 14 in.	20 ga.		C-22	C-22	C-24	C-26	C-26	C-26	C-26
15 – 16 in.	20 ga.		D-22	D-22	C-24	C-26	C-26	C-26	C-26
17 – 18 in.	18 ga.		D-22	D-22	D-24	D-26	C-26	C-26	C-26
19 – 20 in.	18 ga.		E-20	E-22	E-24	D-24	D-26	C-26	C-26
21 – 22 in.	18 ga.		E-20	E-20	E-24	E-24	D-26	D-26	C-26
23 – 24 in.	18 ga.		F-20	F-20	E-22	E-24	E-26	D-26	D-26
25 – 26 in.	16 ga.	G-18	G-18	F-20	F-22	E-24	E-26	E-26	D-26
27 – 28 in.	16 ga.	H-18G	G-18	G-20	F-22	F-24	E-26	E-26	D-26
29 – 30 in.	16 ga.	H-18G	H-18G	G-18	G-22	F-24	E-26	E-26	E-26
31 – 36 in.		J-16H	I-16G	H-18G	H-20	G-22	F-24	F-26	E-26
37 – 42 in.			J-16H	I-16G	I-18G	H-20G	G-22	G-24	F-26
43 – 48 in				I-16H	I-18G	I-18G	H-22G	H-24G	G-24

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Joint Reinforcement

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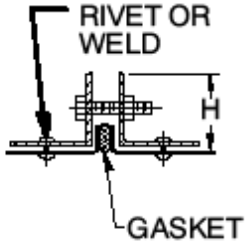
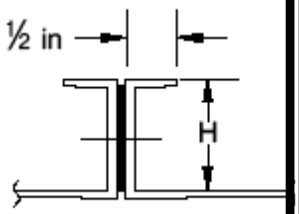
Reinf. Class		T-22 Companion Angles		T-24 Flanged		T-24a Flanged		T-25b Flanged	
				 H = 1⅜ in. (WITH GASKET)		 (WITH GASKET)			
	E1*	H × T	WT LF	T (Nom.)	WT LF	H × T (Nom.)	WT LF	H × T (Nom.)	WT LF
B	1.0	Use E		Use D		Use D		Use D	
C	1.9	Use E		Use D		Use D		Use D	
D	2.7	Use E		26 ga	0.5	1 × 22 ga	0.4	26 ga	0.5
E	6.5	C 1 × ⅛	1.7	24 ga	0.6	Use F		24 ga	0.6
F	12.8	H 1 × ⅛	1.7	22 ga	0.7	1½ × 20 ga	0.6	22 ga	0.7
G	15.8	1¼ × ⅛	2.1	22 ga (R) 20 G	1.0	1½ × 18 ga	0.8	22 ga (R) 20 ga	1.0
H	26.4	C 1½ × ⅛ (+) H 1½ × ⅛	2.6	18 ga	1.1			18 ga	1.1
I	69	1½ × ¼	3.7	20 ga (R)	1.0			20 ga (R)	1.0

Example 1 Solution

- Duct gage is 22
- Joint spacing is 5 feet (56 ¼ in.)
- TDC/TDF for transverse joint
- Intermediate reinforcement (2 ½ feet)
  - 1 MPT
    - ½ in. EMT Conduit
  - Not required on the 24 in. side
- Could use 20 gage and JTR also

Mid Panel Tie Rods

- Negative pressure uses special tables
- Concern is buckling
- Table 2-38 in HVAC DCS for EMT
- P 2.91

				Compression Stress Allowed (PSI)							
				9000	8000	7000	6000	5200	7400	4200	3700
		r_g	L/r_g=	130	140	150	160	170	180	190	200
Dia.	Type										
½ in.	EMT	0.235	LEN.	30 in.	32 in.	34 in.	36 in.	40 in.	42 in.	44 in.	46 in.
			LBS.	792	704	616	528	458	414	370	325
¾ in.	EMT	0.309	LEN.	40 in.	42 in.	46 in.	48 in.	52 in.	54 in.	58 in.	62 in.
			LBS.	1206	1072	938	804	697	630	563	496
1 in.	EMT	0.371	LEN.	48 in.	52 in.	54 in.	58 in.	62 in.	66 in.	70 in.	74 in.
			LBS.	1782	1584	1386	1188	1030	930	831	732
1¼ in.	EMT	0.511	LEN.	66 in.	72 in.	76 in.	82 in.	86 in.	92 in.	96 in.	102 in.
			LBS.	2655	2360	2065	1770	1534	1386	1239	1091
1½ in.	EMT	0.592	LEN.	76 in.	82 in.	88 in.	94 in.	100 in.	106 in.	112 in.	118 in.
			LBS.	3078	2736	2394	2052	1778	1607	1436	1265
2 in.	EMT	0.754	LEN.		106 in.	112 in.	120 in.	128 in.	136 in.	142 in.	150 in.
			LBS.		3480	3045	2610	2262	2044	1827	1609

Table 2–38 Internal EMT Conduit Size (–) Pressure

NOTES:

The table gives maximum length and maximum load; *see* Table 2-34 for assumed loads. Blank spaces are not economical.

EMT Conduit Data				
Dia.	EMT Conduit			Weight
	O.D. in.	t in.	A in^2	lbs/ft
½ in.	0.71	0.042	0.088	0.29
¾ in.	0.92	0.049	0.134	0.45
1 in.	1.16	0.057	0.198	0.65
1¼ in.	1.51	0.065	0.295	0.96
1½ in.	1.74	0.065	0.342	1.11
2 in.	2.2	0.065	0.435	1.41

Mid Panel Tie Rods Neg. Pressure

				Compression Stress Allowed (PSI)							
				9000	8000	7000	6000	5200	7400	4200	3700
		r_g	L/r_g=	130	140	150	160	170	180	190	200
Dia.	Type										
½ in.	EMT	0.235	LEN.	30 in.	32 in.	34 in.	36 in.	40 in.	42 in.	44 in.	46 in.
			LBS.	792	704	616	528	458	414	370	325
¾ in.	EMT	0.309	LEN.	40 in.	42 in.	46 in.	48 in.	52 in.	54 in.	58 in.	62 in.
			LBS.	1206	1072	938	804	697	630	563	496
1 in.	EMT	0.371	LEN.	48 in.	52 in.	54 in.	58 in.	62 in.	66 in.	70 in.	74 in.
			LBS.	1782	1584	1386	1188	1030	930	831	732
1¼ in.	EMT	0.511	LEN.	66 in.	72 in.	76 in.	82 in.	86 in.	92 in.	96 in.	102 in.
			LBS.	2655	2360	2065	1770	1534	1386	1239	1091
1½ in.	EMT	0.592	LEN.	76 in.	82 in.	88 in.	94 in.	100 in.	106 in.	112 in.	118 in.
			LBS.	3078	2736	2394	2052	1778	1607	1436	1265
2 in.	EMT	0.754	LEN.		106 in.	112 in.	120 in.	128 in.	136 in.	142 in.	150 in.
			LBS.		3480	3045	2610	2262	2044	1827	1609

Table 2–38 Internal EMT Conduit Size (–) Pressure

Tie Rod Loads

- Table 2-46 p. 2.100 is for mid panel tie rods (100% load)
- Table 2-34 p. 2.84 is for tie rods used to back up joints or external reinforcement (75% Load)

- 1 in. w.g. = 5.2 lbf/ft^2

Tie Rod Loads

- Given information:
  - 48” wide, RS = 28” (TDC/TDF) @ 4 in. w.g.
- Area = 48” x 28” = 1344 in^2
- Convert to ft^2 1344/144 = 9.33 ft^2
- 4 in. w.g. x 5.2 lbs/ft^2/in. w.g. x 9.33 ft^2
- 194 lbf
- If backing up a joint or external reinforcement 194 lbf x .75 = 146 lbf

An Easier Way?

- Newest addition are the TDC/TDF tables
- Tables based on
  - Pressure class
  - Joint length

Example 1 (revisited)

- 4 in. w.g.
- TDC/TDF
- 5 ft. joint spacing
- 36 in. x 24 in.

4 in. wg Static Pos. or Neg.	5 ft Joints			5 ft Joints w/2 ½ ft Reinf. Spacing				
				Joints/Reinf.			Int. Reinf.	
Duct Dimension	Min ga	Joint Reinf.	Alt. Joint Reinf.	Min ga	Joint Reinf.	Alt. Joint Reinf.	Tie Rod	Alt. Reinf.
8	26	N/R	N/R	Use 5 ft Joints				
	26	N/R	N/R					
	26	N/R	N/R					
13 – 14 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
15 – 16 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
17 – 18 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
19 – 20 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
21 – 22 in.	24	N/R	N/R	26	N/R	N/R	MPT	D
23 – 24 in.	22	N/R	N/R	26	N/R	N/R	MPT	D
25 – 26 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
27 – 28 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
29 – 30 in.	20	N/R	N/R	24	N/R	N/R	MPT	E
31 – 36 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
37 – 42 in.	18	JTR	(2) H	22	JTR	(2) C	MPT	G
				20	N/R	N/R	MPT	G
43 – 48 in.	18	JTR	(2) H	20	JTR	(2) E	MPT	H
				18	N/R	N/R	MPT	H

4 in. wg Static Pos. or Neg.	5 ft Joints			5 ft Joints w/2 ½ ft Reinf. Spacing				
				Joints/Reinf.			Int. Reinf.	
Duct Dimension	Min ga	Joint Reinf.	Alt. Joint Reinf.	Min ga	Joint Reinf.	Alt. Joint Reinf.	Tie Rod	Alt. Reinf.
8	26	N/R	N/R	Use 5 ft Joints				
	26	N/R	N/R					
	26	N/R	N/R					
13 – 14 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
15 – 16 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
17 – 18 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
19 – 20 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
21 – 22 in.	24	N/R	N/R	26	N/R	N/R	MPT	D
23 – 24 in.	22	N/R	N/R	26	N/R	N/R	MPT	D
25 – 26 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
27 – 28 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
29 – 30 in.	20	N/R	N/R	24	N/R	N/R	MPT	E
31 – 36 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
37 – 42 in.	18	JTR	(2) H	22	JTR	(2) C	MPT	G
				20	N/R	N/R	MPT	G
43 – 48 in.	18	JTR	(2) H	20	JTR	(2) E	MPT	H
				18	N/R	N/R	MPT	H

4 in. wg Static Pos. or Neg.	5 ft Joints			5 ft Joints w/2 ½ ft Reinf. Spacing				
				Joints/Reinf.			Int. Reinf.	
Duct Dimension	Min ga	Joint Reinf.	Alt. Joint Reinf.	Min ga	Joint Reinf.	Alt. Joint Reinf.	Tie Rod	Alt. Reinf.
8	26	N/R	N/R	Use 5 ft Joints				
	26	N/R	N/R					
	26	N/R	N/R					
13 – 14 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
15 – 16 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
17 – 18 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
19 – 20 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
21 – 22 in.	24	N/R	N/R	26	N/R	N/R	MPT	D
23 – 24 in.	22	N/R	N/R	26	N/R	N/R	MPT	D
25 – 26 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
27 – 28 in.	22	N/R	N/R	24	N/R	N/R	MPT	E
29 – 30 in.	20	N/R	N/R	24	N/R	N/R	MPT	E
31 – 36 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
37 – 42 in.	18	JTR	(2) H	22	JTR	(2) C	MPT	G
				20	N/R	N/R	MPT	G
43 – 48 in.	18	JTR	(2) H	20	JTR	(2) E	MPT	H
				18	N/R	N/R	MPT	H

Example 1 (revisited) Solution

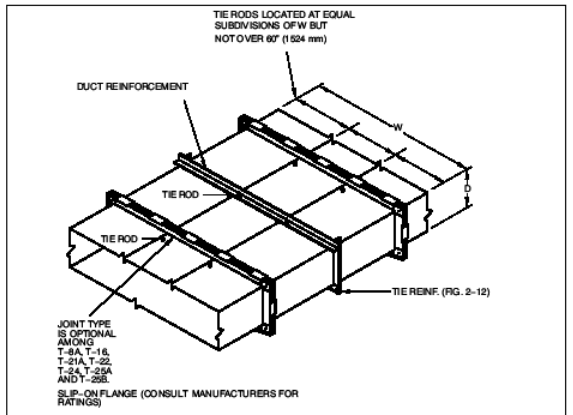
- Option 1
  - 20 gage
  - JTR on 36 in. side
  - No additional reinforcement on 24 in. side
- Option 2
  - 22 gage
  - MPT for 36 in. side
  - No additional reinforcement on 24 in. side

Example 1 (revisited) Solution

- Option 3
  - 20 gage
  - (2) E class reinforcements at the joints for 36 in. side
  - No additional reinforcement on 24 in. side
- Option 4
  - 22 gage
  - F class reinforcement at the mid-panel for 36 in. side
  - No additional reinforcement on 24 in. side

Duct over 120 inches

- Figure 2-13 in HVAC DCS
- Use standard tables for sizes < 120 in.
- P 2.117



Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
Reinf. Size	It	It	It	It	Jt	Kt	Lt
Reinf. Spacing ft (m)	2 ½ ft (0.75 m)	2 ½ ft (0.75 m)	2 ½ ft (0.75 m)	2 ½ ft (0.75 m)	2 ½ ft (0.75 m)	2 (0.60 m)	2 (0.60 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

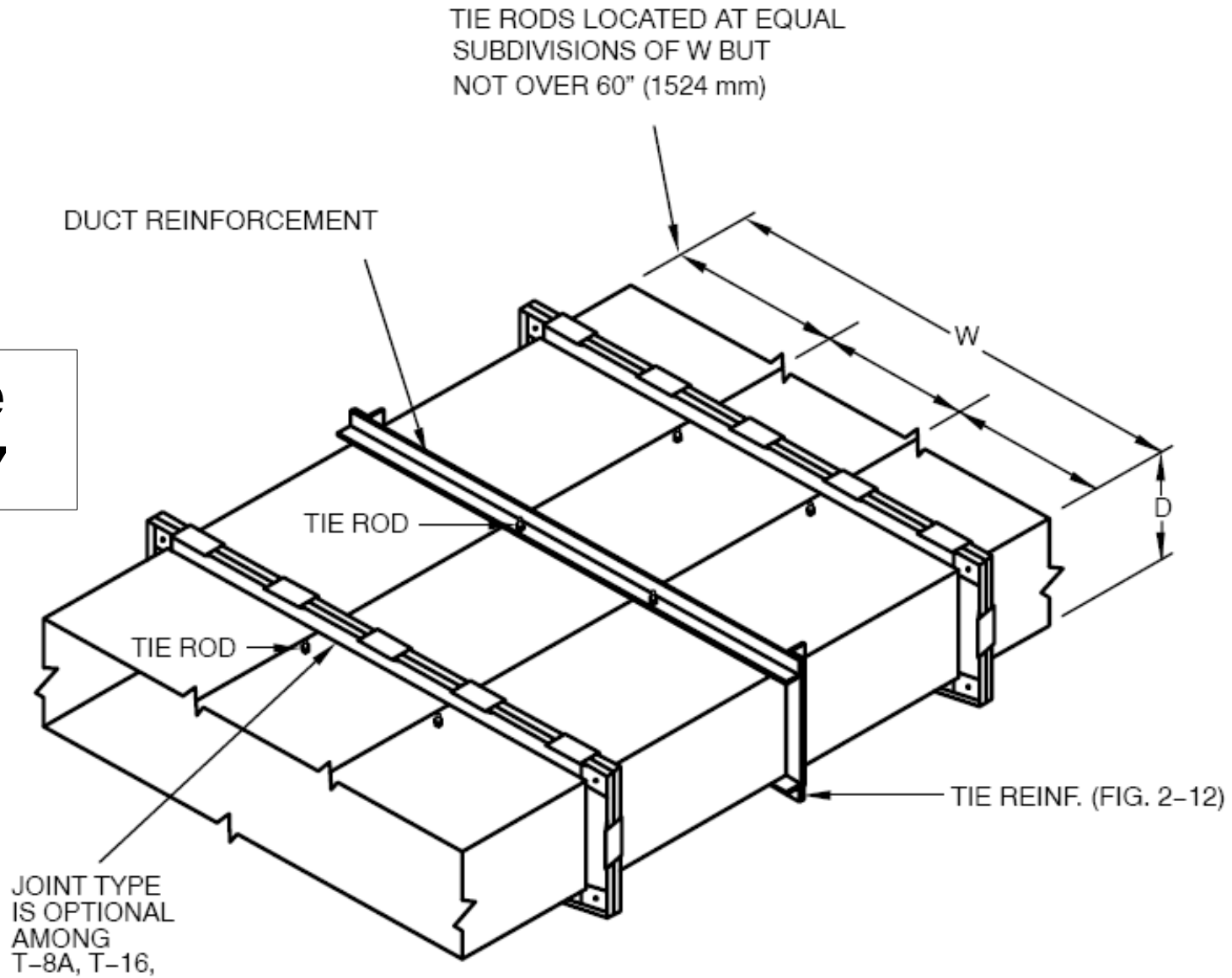
Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

a. See tie rod text.

b. See Reinforcement Attachment in Figure 2-12.

c. See Figure 5-7 for large duct supports. Duct over 100 in. (2540 mm) width may require other internal supports for shape retention.

FIGURE 2–13 DUCT OVER 120 IN. (3000 MM) WIDE


TIE RODS LOCATED AT EQUAL
SUBDIVISIONS OF W BUT
NOT OVER 60" (1524 mm)
DUCT REINFORCEMENT
W
D
TIE ROD
TIE ROD
TIE REINF. (FIG. 2–12)
JOINT TYPE
IS OPTIONAL
AMONG
T–8A, T–16,
T–21A, T–22,
T–24, T–25A
AND T–25B.
SLIP–ON FLANGE (CONSULT MANUFACTURERS FOR
RATINGS)

Duct over 120 inches

Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
Reinf. Size	It	It	It	It	Jt	Kt	Lt
Reinf. Spacing ft (m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 (0.60 m)	2 (0.60 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Page 2.117

Example 2

- Duct is 140 x 70 inches at negative 2 in. w.g.

Duct over 120 inches

Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
Reinf. Size	It	It	It	It	Jt	Kt	Lt
Reinf. Spacing ft (m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 (0.60 m)	2 (0.60 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Page 2.117

Duct over 120 inches

- You need 2 tie rods across the width at every joint and at every reinforcement.
- 140/60 = 2.33 (round down) to 2
- Need 3 at widths beyond 180”
- 140/(2+1) = 140/3 = 46 5/8” spacing
- The joint length will be 5 ft. (56 inches using TDC/TDF) and the reinforcement spacing will be 2 ½ ft (28 inches using TDC/TDF).

Duct over 120 inches

- Determine the tie rod load:
- Tip- You can figure the load on a duct of half of the width using Table 2-46 and then double the load.
- 140/2 = 70 inches
- RS = 28 inches

Duct over 120 inches

		Static Pressure Class, in. wg						
W	RS	½"	1"	2"	3"	4"	6"	10"
	36	47	94	187	281	374	562	936
	30	39	78	156	234	312	468	780
72"	28	36	73	146	218	291	437	728
	24	31	62	125	187	250	374	624
	22	29	57	114	172	229	343	572
	20	26	52	104	156	208	312	520

Duct over 120 inches

- The load is 146 lbs (load for 70 inches) x 2 = 292 lbs for 140 inches
- The load per tie rod is 292 lbs/2 = 146 lbs
  - (75% - Rule)

What size does the tie rod need to be?

- If we use EMT conduit check Table 2-38

What size reinforcement is a class I

- Check Tables 2-29 or 2-30

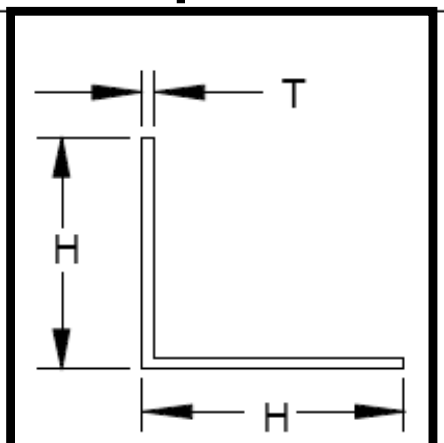
Mid Panel Tie Rods Neg. Pressure

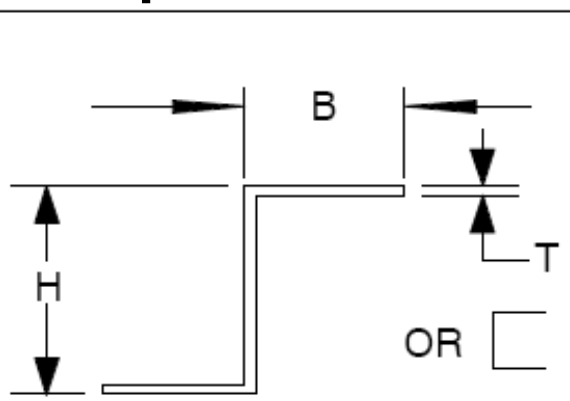
				Compression Stress Allowed (PSI)							
				9000	8000	7000	6000	5200	7400	4200	3700
		r_g	L/r_g=	130	140	150	160	170	180	190	200
Dia.	Type										
½ in.	EMT	0.235	LEN.	30 in.	32 in.	34 in.	36 in.	40 in.	42 in.	44 in.	46 in.
			LBS.	792	704	616	528	458	414	370	325
¾ in.	EMT	0.309	LEN.	40 in.	42 in.	46 in.	48 in.	52 in.	54 in.	58 in.	62 in.
			LBS.	1206	1072	938	804	697	630	563	496
1 in.	EMT	0.371	LEN.	48 in.	52 in.	54 in.	58 in.	62 in.	66 in.	70 in.	74 in.
			LBS.	1782	1584	1386	1188	1030	930	831	732
1¼ in.	EMT	0.511	LEN.	66 in.	72 in.	76 in.	82 in.	86 in.	92 in.	96 in.	102 in.
			LBS.	2655	2360	2065	1770	1534	1386	1239	1091
1½ in.	EMT	0.592	LEN.	76 in.	82 in.	88 in.	94 in.	100 in.	106 in.	112 in.	118 in.
			LBS.	3078	2736	2394	2052	1778	1607	1436	1265
2 in.	EMT	0.754	LEN.		106 in.	112 in.	120 in.	128 in.	136 in.	142 in.	150 in.
			LBS.		3480	3045	2610	2262	2044	1827	1609

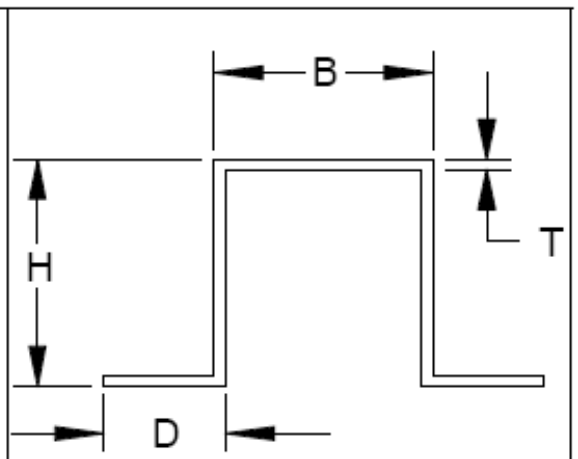
Table 2–38 Internal EMT Conduit Size (–) Pressure

Example 2 mid-panel reinforcement

Page 2.70







Reinf. Class		Angle		Channel or Zee		Hat Section	
	E1*	H × T (MIN)	WT LF	H × B × T (MIN)	WT LF	H × B × D × T (MIN)	WT LF
A	0.43	Use C		Use B		Use F	
H	26.4	1 ½ × 3/16 2 × ⅛	1.78 1.65	1 ½ × ¾ × ⅛	1.31	1 ½ × 1 ½ × ¾ × 18 ga 2 × 1 × ¾ × 20 ga	1.08 0.90
I	69	C 2 × 3/16 2 ½ × ⅛	2.44 2.10	2 × 1 ⅛ × 12 ga 3 × 1 ⅛ × 16 ga	1.60 1.05	2 × 1 × ¾ × 16 ga	1.44
J	80	H 2 × 3/16 C 2 × ¼ 2 ½ × ⅛ (+)	2.44 3.20 2.10	2 × 1 ⅛ × ⅛	1.85	2 × 1 × ¾ × 12 ga 2 ½ × 2 × ¾ × 18 ga	2.45 1.53

Duct over 120 inches

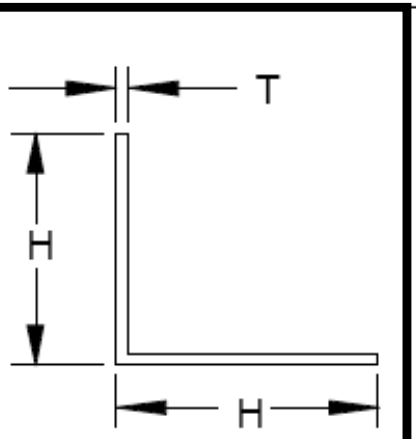
- Check the short side using the tables for duct less than 120 inches.
- In this case since we are using TDC/TDF we can use those specific tables.
- Table 2-17 on page 2.46

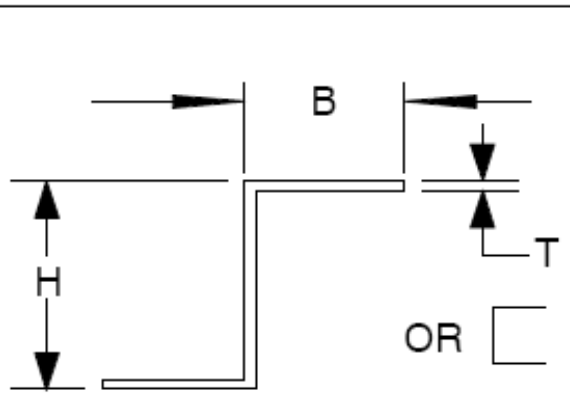
Duct over 120 inches

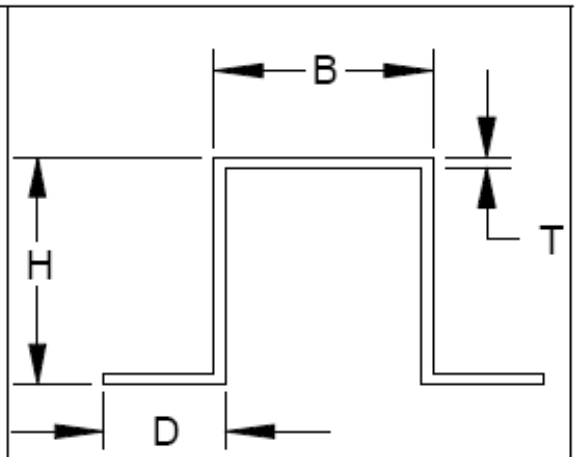
2 in. wg Static Pos. or Neg.	5 ft Joints			5 ft Joints w/2 ½ ft Reinf. Spacing				
				Joints/Reinf.			Int. Reinf.	
Duct Dimension	Min ga	Joint Reinf.	Alt. Joint Reinf.	Min ga	Joint Reinf.	Alt. Joint Reinf.	Tie Rod	Alt. Reinf.
10 in. and under	26	N/R	N/R					
49 – 54 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
	18	N/R	N/A					
55 – 60 in.	20	JTR	(2) H	22	JTR	(2) C	MPT	G
61 – 72 in.	18	JTR	(2) H	20	JTR	(2) E	MPT	H

Example 2 mid-panel reinforcement

Page 2.70







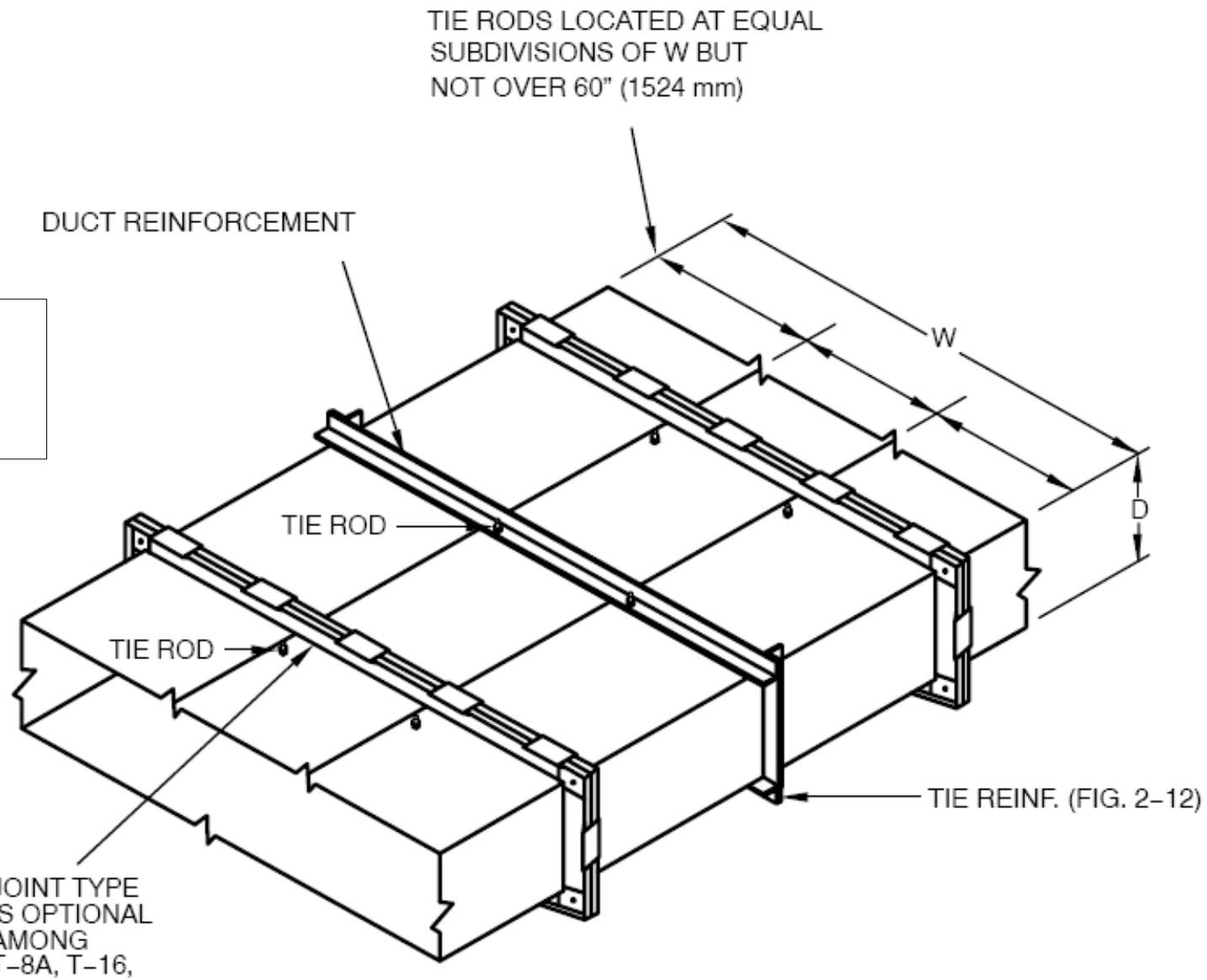
Reinf. Class		Angle		Channel or Zee		Hat Section	
	E1*	H × T (MIN)	WT LF	H × B × T (MIN)	WT LF	H × B × D × T (MIN)	WT LF
A	0.43	Use C		Use B		Use F	
H	26.4	1 ½ × 3/16 2 × ⅛	1.78 1.65	1 ½ × ¾ × ⅛	1.31	1 ½ × 1 ½ × ¾ × 18 ga 2 × 1 × ¾ × 20 ga	1.08 0.90
I	69	C 2 × 3/16 2 ½ × ⅛	2.44 2.10	2 × 1 ⅛ × 12 ga 3 × 1 ⅛ × 16 ga	1.60 1.05	2 × 1 × ¾ × 16 ga	1.44
J	80	H 2 × 3/16 C 2 × ¼ 2 ½ × ⅛ (+)	2.44 3.20 2.10	2 × 1 ⅛ × ⅛	1.85	2 × 1 × ¾ × 12 ga 2 ½ × 2 × ¾ × 18 ga	2.45 1.53

Example 2 solution

- The duct will be 18 gage
- The joints will be TDC/TDF
- The joint length is 56 inches
- The 140 inch side will be supported by 1” EMT conduit spaced 46 5/8” across the width and will be at each side of the joint and backing up the mid-panel reinforcement.
- The mid-panel reinforcement for the 140 inch side will be 2 ½ x 2 ½ x 1/8 and will be tied using 1 x 1 x 12 gage

Example 2 solution

- The 70 inch side will be reinforced using only external reinforcement
- The reinforcement will be 2 x 2 x 1/8 and installed on both sides of each joint
- This reinforcement will not be tied
- No mid-panel reinforcement is required


TIE RODS LOCATED AT EQUAL
SUBDIVISIONS OF W BUT
NOT OVER 60" (1524 mm)
DUCT REINFORCEMENT
W
D
TIE ROD
TIE ROD
TIE REINF. (FIG. 2–12)
JOINT TYPE
IS OPTIONAL
AMONG
T–8A, T–16,
T–21A, T–22,
T–24, T–25A
AND T–25B.
SLIP–ON FLANGE (CONSULT MANUFACTURERS FOR
RATINGS)

Aluminum Construction

- Start off using steel construction
- Convert to aluminum using the tables on page 2.124
  - Table 2-50 gage conversion (panel/joint)
  - Table 2-51 dimensions for joint connector
  - Table 2-52 for reinforcement
  - **Tie rods are acceptable but information on aluminum tie rods is not included in the manual. User must qualify there use

Example 3

- 3 in. w.g. (positive or negative)
- 24” x 20”
- Aluminum construction required

- Start with steel then convert…

Example 3

3 in. wg Static Pos. or Neg. Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number — Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
10 in. and under	24 ga.	Not Required		B-26	B-26	B-26	B-26	B-26	B-26
11 – 12 in.	24 ga.			B-26	B-26	B-26	B-26	B-26	B-26
13 – 14 in.	22 ga.			C-24	C-24	C-26	C-26	B-26	B-26
15 – 16 in.	22 ga.			C-24	C-24	C-26	C-26	C-26	C-26
17 – 18 in.	20 ga.		D-24	D-24	C-24	C-26	C-26	C-26	C-26
19 – 20 in.	18 ga.		D-22	D-22	D-24	D-24	C-26	C-26	C-26
21 – 22 in.	18 ga.		E-22	E-22	D-24	D-24	D-26	C-26	C-26
23 – 24 in.	18 ga.		E-20	E-22	E-24	E-24	D-26	D-26	C-26

Page 2.20

Example 3

- Unreinforced
  - 18 gage works for steel
  - Converts to 0.071 inch commercial size

Page 2.124

RECTANGULAR ALUMINUM DUCT
ADAPTED FROM 3 IN. WG (750 PA) OR LOWER

Galv. Steel ga (mm) nominal	28 (0.48)	26 (0.55)	24 (0.70)	22 (0.78)	20 (1.00)	18 (1.31)	16 (1.61)
Min. Alum. equivalent* (mm)	0.023 (0.58)	0.027 (0.69)	0.034 (0.86)	0.043 (1.09)	0.052 (1.32)	0.067 (1.70)	0.083 (2.11)
Commercial size (mm)	0.025 (0.60)	0.032 (0.80)	0.04 (1.00)	0.05 (1.27)	0.063 (1.60)	0.071 (1.80)	0.09 (2.29)
Lbs wt/Sf. Alum.	Consult Appendix page A.5 for Weights						

Table 2–50 Thickness Adjustments

Example 3

- Reinforced based on 6 ft joint

- Steel conversion…
  - 24 in. reinforced every 2 ft C-26
  - 20 inch reinforced every 3 ft C-26
- Transverse joint?
  - T-10 slip on 24
  - Plain drive on the 20??
  - Plain drive conversion has not been tested
  - Back up flat drive/slip with external reinforcement as required

Example 3

3 in. wg Static Pos. or Neg. Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number							
		Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
10 in. and under	24 ga.	Not Required		B-26	B-26	B-26	B-26	B-26	B-26
11 – 12 in.	24 ga.			B-26	B-26	B-26	B-26	B-26	B-26
13 – 14 in.	22 ga.			C-24	C-24	C-26	C-26	B-26	B-26
15 – 16 in.	22 ga.			C-24	C-24	C-26	C-26	C-26	C-26
17 – 18 in.	20 ga.		D-24	D-24	C-24	C-26	C-26	C-26	C-26
19 – 20 in.	18 ga.		D-22	D-22	D-24	D-24	C-26	C-26	C-26
21 – 22 in.	18 ga.		E-22	E-22	D-24	D-24	D-26	C-26	C-26
23 – 24 in.	18 ga.		E-20	E-22	E-24	E-24	D-26	D-26	C-26

Page 2.20

Example 3

- 26 gage works for steel (panel)
  - Converts to 0.032 inch commercial size for aluminum

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RECTANGULAR ALUMINUM DUCT
ADAPTED FROM 3 IN. WG (750 PA) OR LOWER

Galv. Steel ga (mm) nominal	28 (0.48)	26 (0.55)	24 (0.70)	22 (0.78)	20 (1.00)	18 (1.31)	16 (1.61)
Min. Alum. equivalent* (mm)	0.023 (0.58)	0.027 (0.69)	0.034 (0.86)	0.043 (1.09)	0.052 (1.32)	0.067 (1.70)	0.083 (2.11)
Commercial size (mm)	0.025 (0.60)	0.032 (0.80)	0.04 (1.00)	0.05 (1.27)	0.063 (1.60)	0.071 (1.80)	0.09 (2.29)
Lbs wt/Sf. Alum.	Consult Appendix page A.5 for Weights						

Table 2–50 Thickness Adjustments

Example 3

- Transverse Joint (Class C)
  - Adjust gage per Table 2-50
  - Adjust dimensions per Table 2-51

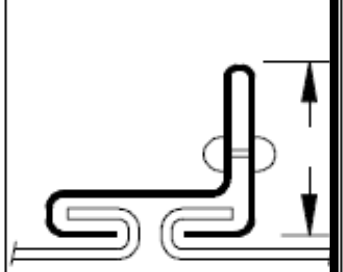
Galv. Rigidity Class	A	B	C	D	E	F	G	H	I	J	K	L
Alum. dim. per Galv. Class	C	E	E	F	H	I	I	K	**	**	**	**

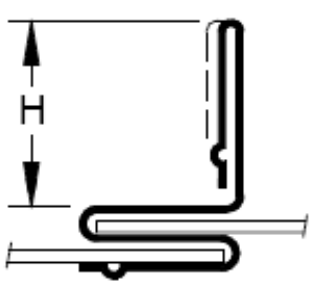
Table 2–51 Dimension Adjustments

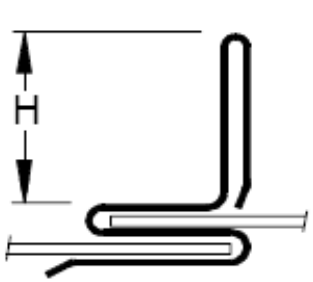
**Calculate an effective I_x = 3 x that used for steel.

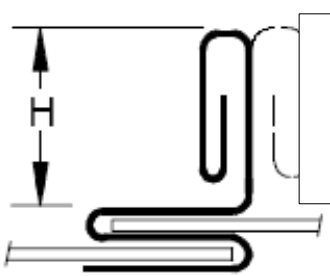
Example 3

Page 2.74

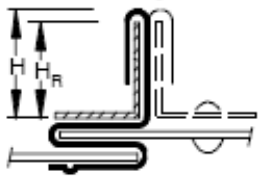








T-13



Reinf. Class		T-2 Standing Drive Slip		T-10 Standing S		T-11 Standing S		T-12 Standing S		T-14 Standing S	
	EI*	H × T	WT LF	H × T	WT LF	H × T	WT LF	H × T	WT LF	H × T + HR	WT LF
A	0.43	Use B		Use B		½ × 26 ga	0.5	Use B		Use D	
B	1.0	1 ⅛ × 26 ga	0.4	1 × 26 ga	0.6	½ × 22 ga 1 × 26 ga	0.6	1 × 26 ga	0.7	Use D	
C	1.9	1 ⅛ × 22 ga	0.6	1 × 22 ga	0.8	1 × 22 ga	0.8	1 × 24 ga	0.8	Use D	
D	2.7	1 ⅛ × 18 ga	0.8	1 ⅛ × 20 ga 1 × 22 ga (+)	0.9	1 × 20 ga 1 × 22 ga (+)	0.9	1 ½ × 22 ga	1.0	1 ⅝ × 24 ga 1 ½ × ⅛ Bar	1.4
E	6.5			1 ⅛ × 18 ga	1.0	1 × 18 ga (+)	1.0	1 × 18 ga 1 ½ × 20 ga	1.2	Use F	

Example 3

- 22 gage works for steel (panel)
  - Converts to 0.050 inch commercial size for aluminum

Page 2.124

RECTANGULAR ALUMINUM DUCT
ADAPTED FROM 3 IN. WG (750 PA) OR LOWER

Galv. Steel ga (mm) nominal	28 (0.48)	26 (0.55)	24 (0.70)	22 (0.78)	20 (1.00)	18 (1.31)	16 (1.61)
Min. Alum. equivalent* (mm)	0.023 (0.58)	0.027 (0.69)	0.034 (0.86)	0.043 (1.09)	0.052 (1.32)	0.067 (1.70)	0.083 (2.11)
Commercial size (mm)	0.025 (0.60)	0.032 (0.80)	0.04 (1.00)	0.05 (1.27)	0.063 (1.60)	0.071 (1.80)	0.09 (2.29)
Lbs wt/Sf. Alum.	Consult Appendix page A.5 for Weights						

Table 2–50 Thickness Adjustments

Example 3

- The joint will be a T-10
  - It will be 0.050 inches thick
  - It will be 1 1/8 inches tall
  - Use this on all sides
- If you use the flat drive on the short…
  - It does not count as a reinforcement
  - Use external reinforcement

Example 3

- What about intermediate reinforcement?
  - Use Table 2-52 to convert from steel to aluminum
  - “C” in steel is 1 x 1 x 16 ga
  - “C” in aluminum is 1 ¼ x 1 ¼ x 1/8

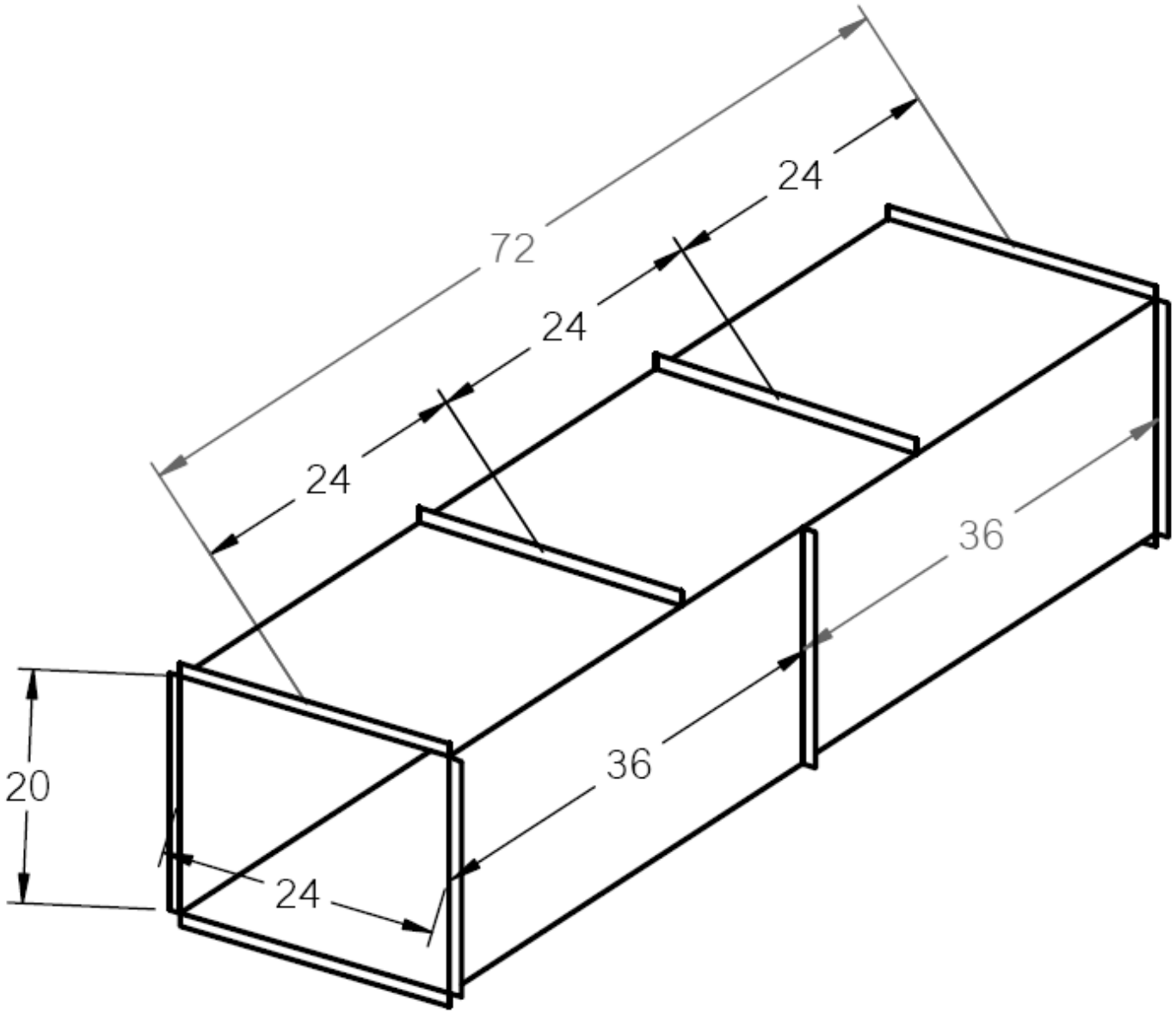
Example 3

Steel Angle Size In. (mm)	Cod	Equivalent Alum.*** Angle Size, In.	Steel Bar	Alum. Bar***
1 × 1 × 16 ga (25 × 25 × 1.61)	C	1¼ × 1¼ × ⅛ (31.8 × 31.8 × 3.2)	1 × ⅛ (25 × 3.2)	1½ × ⅛ or 1¼ × 3⁄16 (38. 1 × 38.1 or 31.8 × 4.8)
1 × 1 × ⅛ (25 × 25 × 3.2)	D	1½ × 1½ × ⅛ (38.1 × 38.1 × 3.2)	1½ × ⅛ (38.1 × 3.2)	1½ × ⅛ or 1¼ × 3⁄16 (38.1 × 38.1 or 31.8 × 4.8)
1¼ × 1¼ × ⅛ (31.8 × 31.8 × 3.2)	E	1¾ × 1¾ × ⅛ (44.5 × 44.5 × 3.2)		
1½ × 1½ × ⅛ (31.8 × 31.8 × 3.2)	F	2½ × 2½ × ⅛ (63.5 × 63.5 × 3.2)		

Example 3 solution

- The duct will be fabricated from .032 aluminum
- The T-10 will be fabricated from .050 aluminum and will be 1 1/8 inches tall
- The 24” side will be reinforced with 2 1¼ x 1¼ x 1/8 (RS = 2 ft)
- The 20” side will be reinforced with 1 1¼ x 1¼ x 1/8 (RS =3 ft)

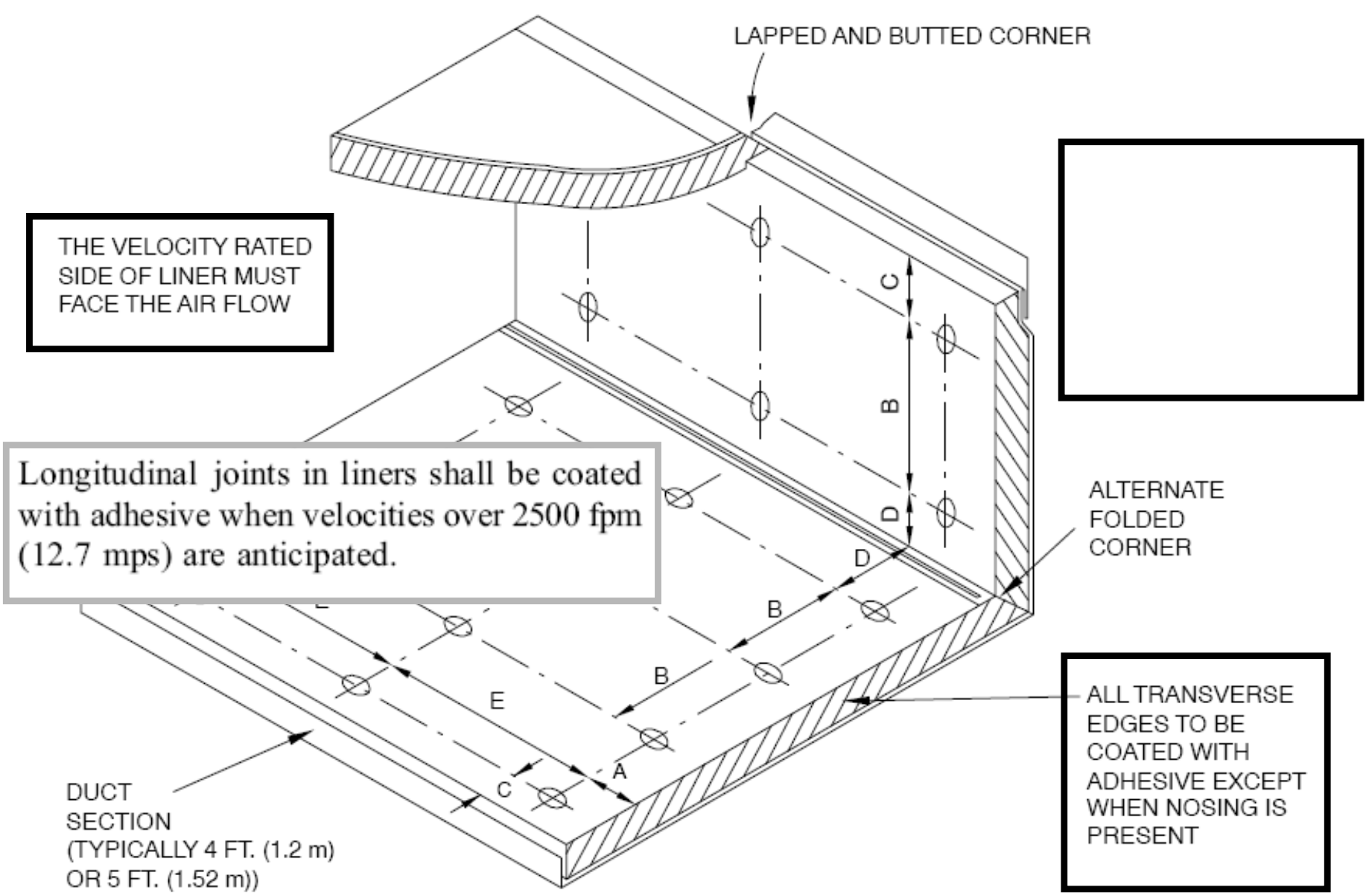
Example 3 Solution



Aluminum Construction

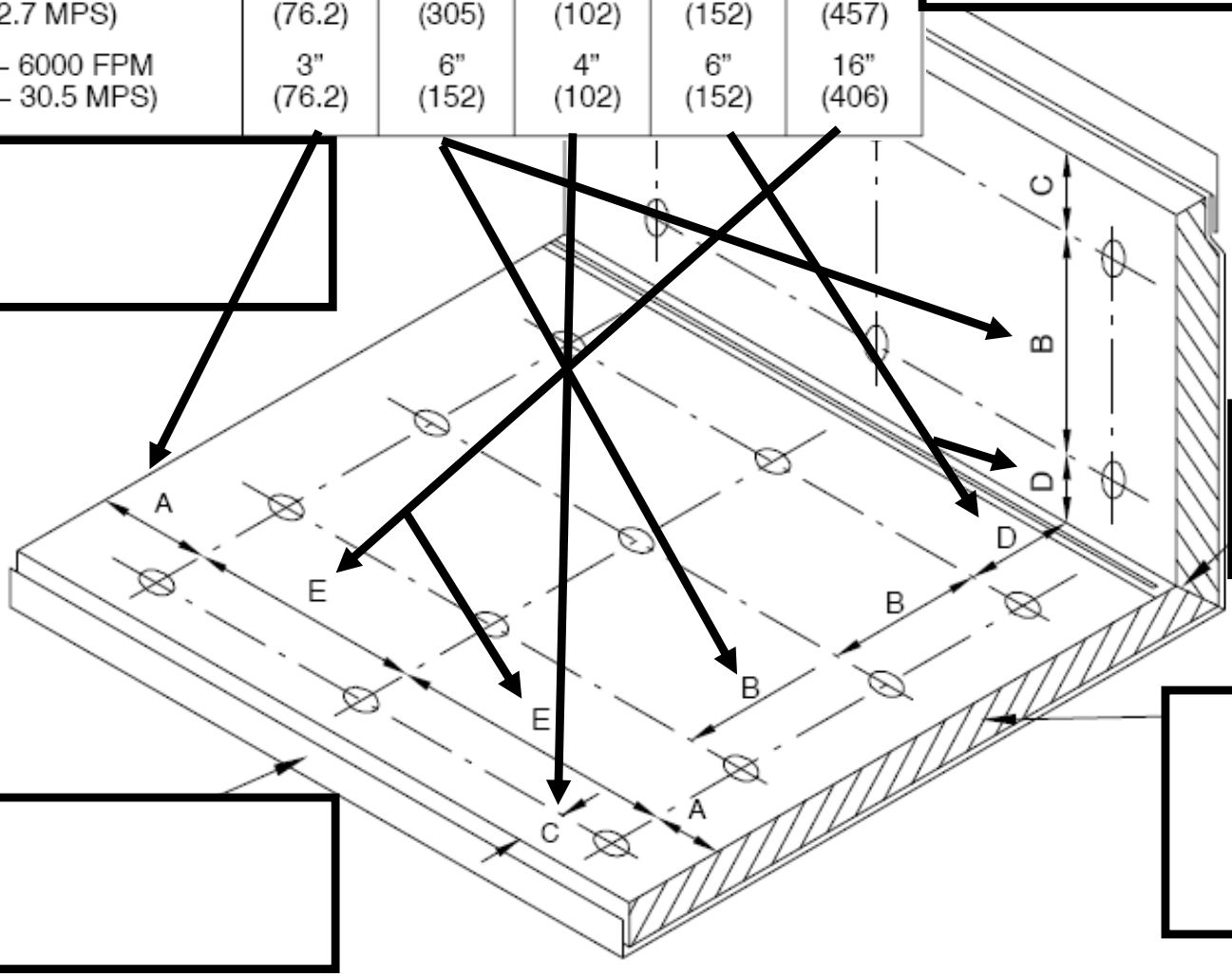
- Comments
  - Bumping the thickness by 2 gages is not acceptable use the tables
  - The tables are limited to 3 in. w.g.
  - Formed on flanges (TDC/TDF) use panel thickness and external angle
  - Adjusting the flange gages is not enough
  - Bottom line as long as EI works you should be OK (DCS 101)

Lined Duct


LAPPED AND BUTTED CORNER
THE VELOCITY RATED SIDE OF LINER MUST FACE THE AIR FLOW
Longitudinal joints in liners shall be coated with adhesive when velocities over 2500 fpm (12.7 mps) are anticipated.
ALTERNATE FOLDED CORNER
ALL TRANSVERSE EDGES TO BE COATED WITH ADHESIVE EXCEPT WHEN NOSING IS PRESENT
DUCT SECTION (TYPICALLY 4 FT. (1.2 m) OR 5 FT. (1.52 m))
A
B
C
D
E

Lined Duct

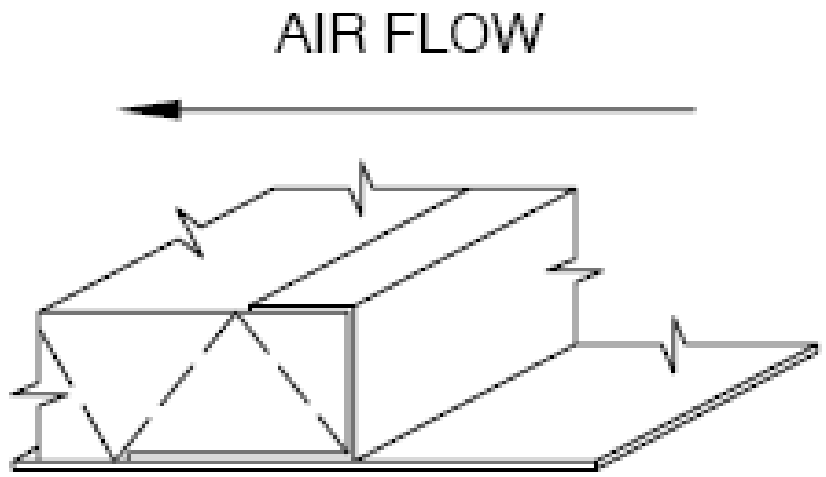
Velocity *	Dimensions				
	A	B	C	D	E
0 – 2500 FPM (0 – 12.7 MPS)	3" (76.2)	12" (305)	4" (102)	6" (152)	18" (457)
2501 – 6000 FPM (12.7 – 30.5 MPS)	3" (76.2)	6" (152)	4" (102)	6" (152)	16" (406)



PLACE PINS 3" (76 mm) ALONG EACH SIDE OF A BUTTED LONGITUDINAL LINER SEAM THAT IS AWAY FROM A CORNER

Lined Duct

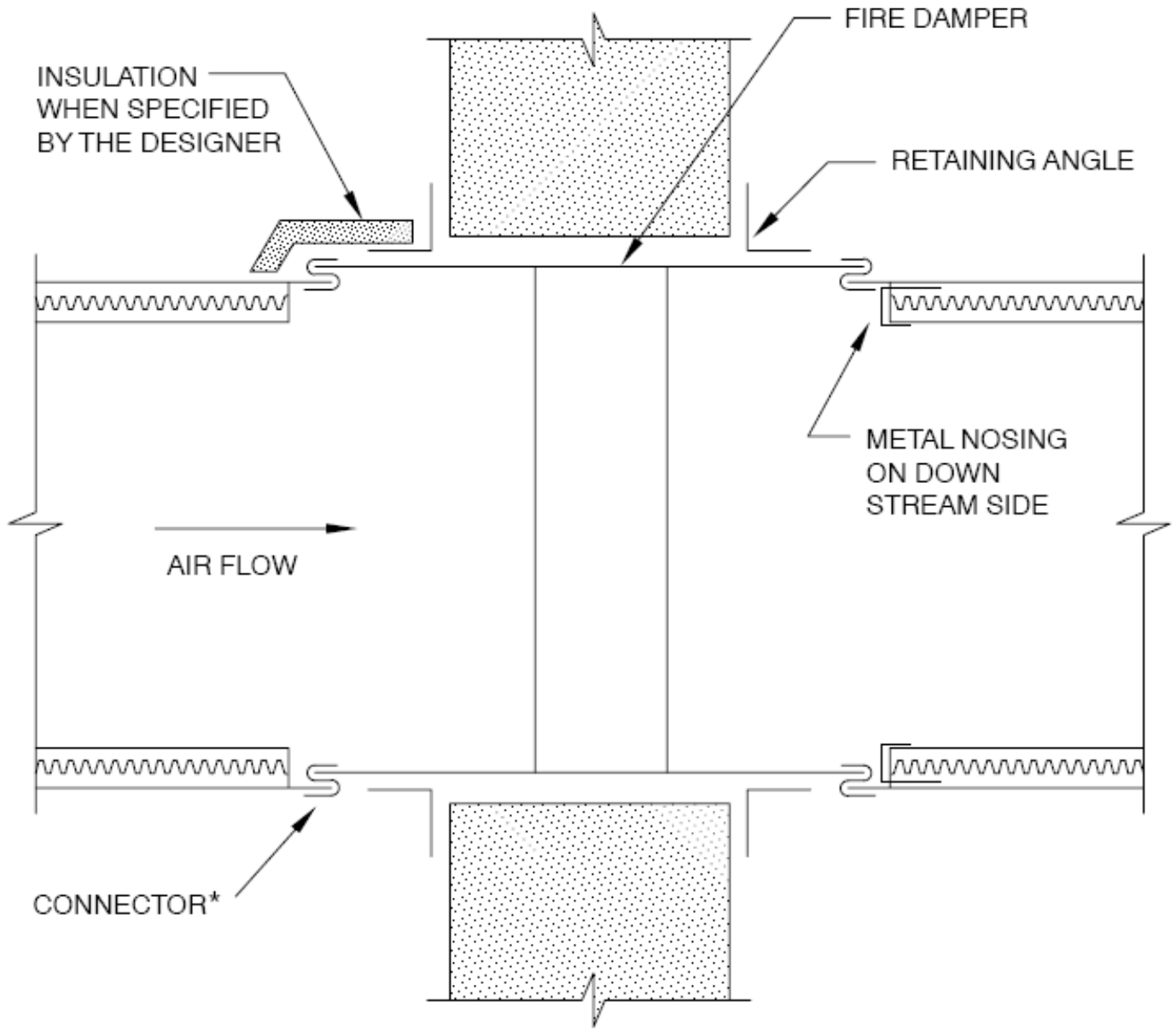
- Metal Nosing MUST be used when
- Liner is preceded by unlined metal
- On ALL leading edges when the velocity is over 4000 fpm



DETAIL – A

METAL NOSING
CHANNEL OR ZEE

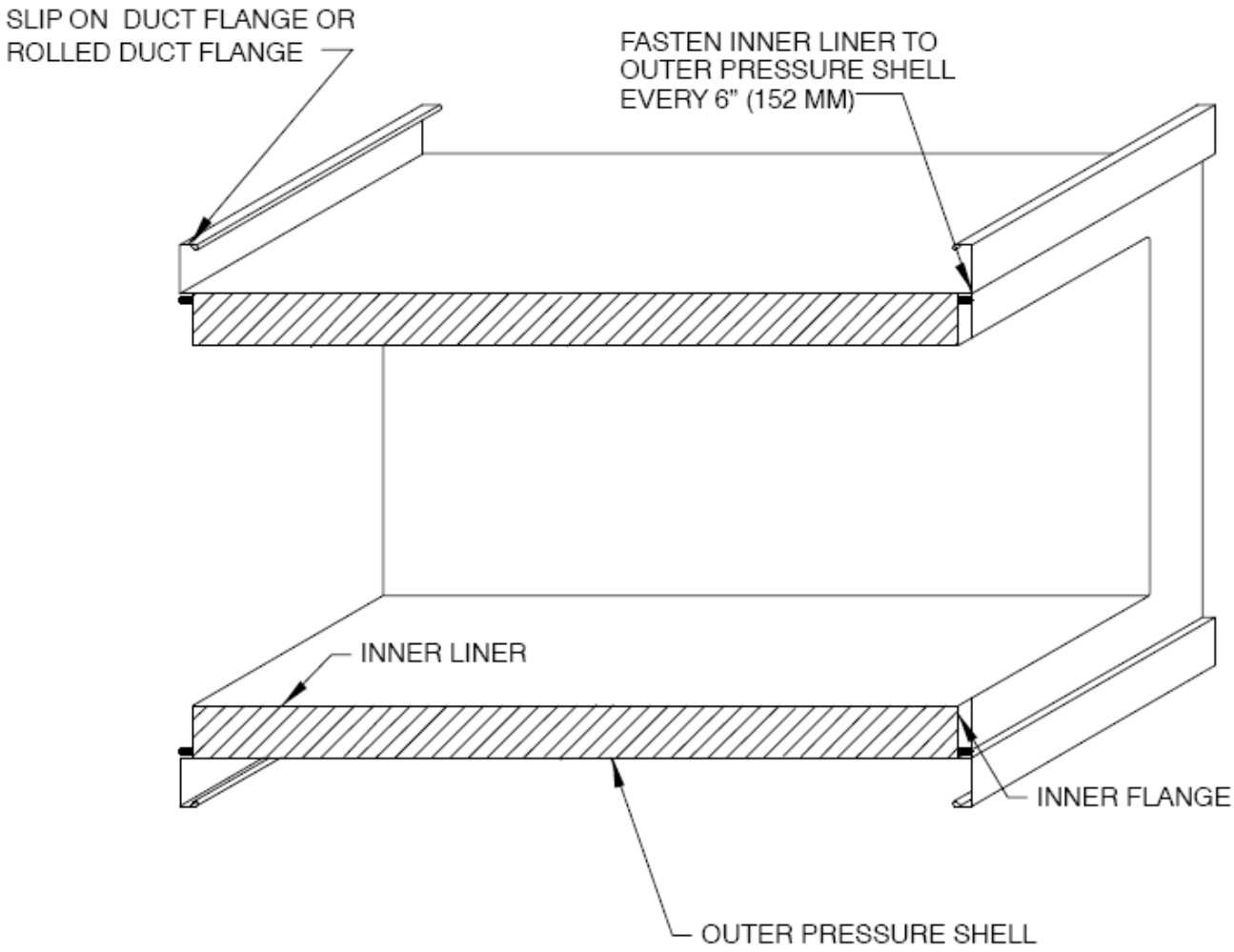
Lined Duct


FIRE DAMPER
INSULATION
WHEN SPECIFIED
BY THE DESIGNER
RETAINING ANGLE
METAL NOSING
ON DOWN
STREAM SIDE
AIR FLOW
CONNECTOR*

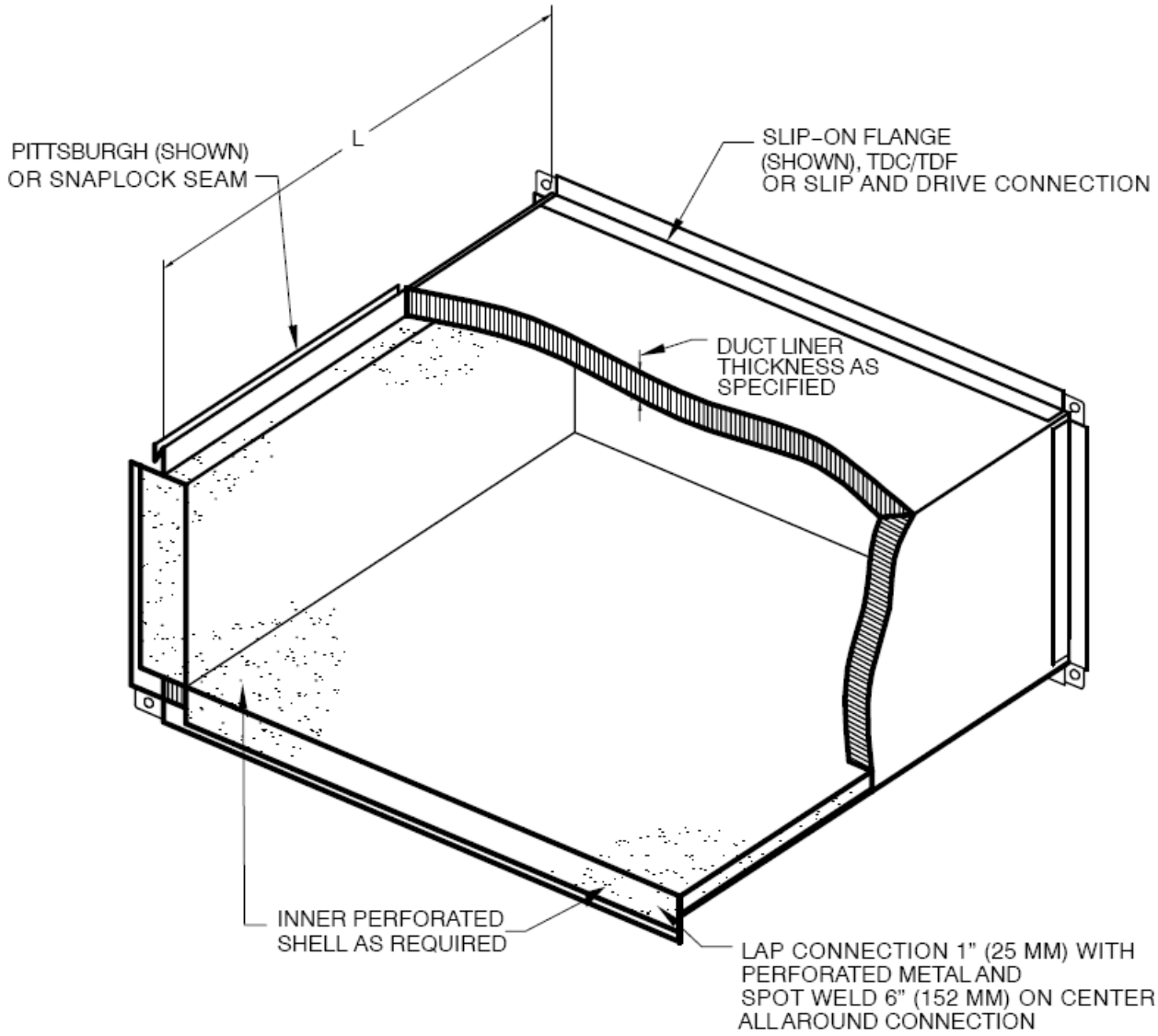
Double Wall

- Has inner liner usually 22 gage and perforated
- Solid liner or vapor barriers have a negative impact on sound attenuation
- No need to pin or glue liner with double wall
- Outer shell is the pressure shell
- Consider weight when selecting hangers

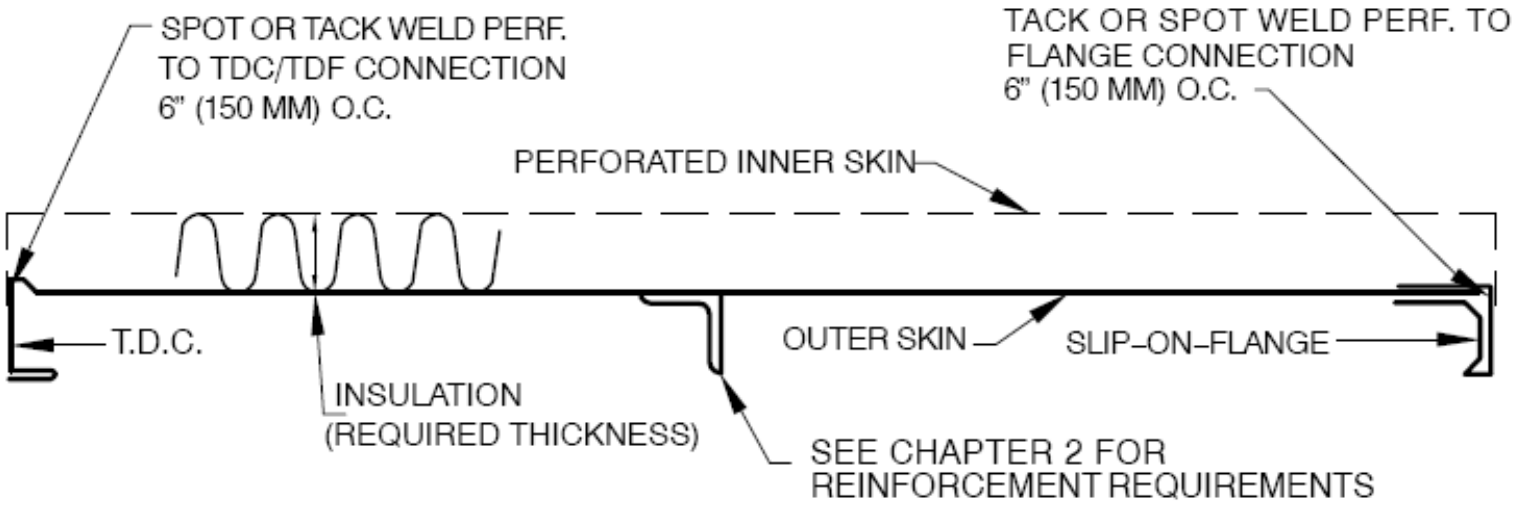
Double Wall

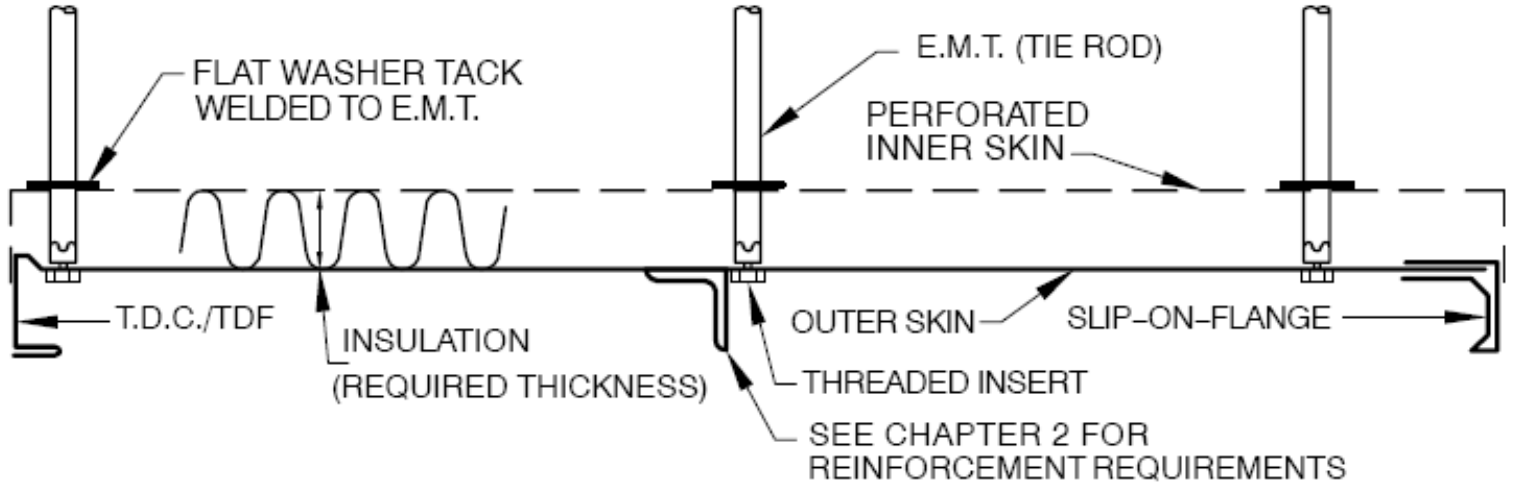

SLIP ON DUCT FLANGE OR
ROLLED DUCT FLANGE
FASTEN INNER LINER TO
OUTER PRESSURE SHELL
EVERY 6" (152 MM)
INNER LINER
INNER FLANGE
OUTER PRESSURE SHELL

Double Wall


L
PITTSBURGH (SHOWN)
OR SNAPLOCK SEAM
SLIP–ON FLANGE
(SHOWN), TDC/TDF
OR SLIP AND DRIVE CONNECTION
DUCT LINER
THICKNESS AS
SPECIFIED
INNER PERFORATED
SHELL AS REQUIRED
LAP CONNECTION 1" (25 MM) WITH
PERFORATED METAL AND
SPOT WELD 6" (152 MM) ON CENTER
ALL AROUND CONNECTION

Double Wall


SPOT OR TACK WELD PERF.
TO TDC/TDF CONNECTION
6" (150 MM) O.C.
TACK OR SPOT WELD PERF. TO
FLANGE CONNECTION
6" (150 MM) O.C.
PERFORATED INNER SKIN
T.D.C.
INSULATION
(REQUIRED THICKNESS)
OUTER SKIN
SLIP-ON-FLANGE
SEE CHAPTER 2 FOR
REINFORCEMENT REQUIREMENTS


FLAT WASHER TACK
WELDED TO E.M.T.
E.M.T. (TIE ROD)
PERFORATED
INNER SKIN
T.D.C./TDF
INSULATION
(REQUIRED THICKNESS)
OUTER SKIN
SLIP-ON-FLANGE
THREADED INSERT
SEE CHAPTER 2 FOR
REINFORCEMENT REQUIREMENTS

Lined/Double Wall

- The dimensions are for the “net free area” not metal to metal or outer dimensions
- The primary function of duct liner is to attenuate sound
- Designer must provide for condensation control – Through metal!!!

HVAC DCS 103

- Round Duct
  - Terms and construction options
  - Spiral & Longitudinal Seam
- Flat Oval Duct
- Hanger Selection
- Casing Fabrication

Questions?

Technical Inquiries:

www.smacna.org

- Click on technical services (left side)
- Click on technical inquiries (center)

http://www.smacna.org/technical/index.cfm?fuseaction=inquiry