Air Duct

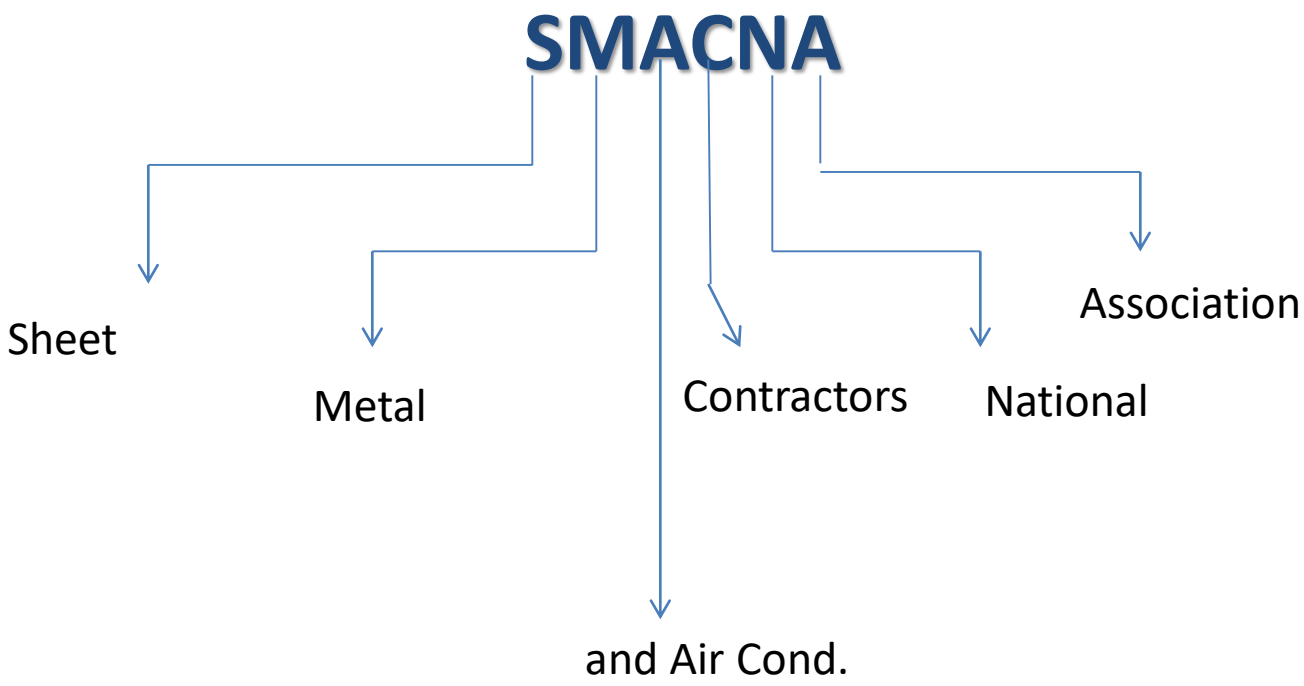
- Supply Air Duct
- Return Air Duct
- Fresh Air Duct
- Exhaust Air Duct

Material of Air Duct

- Galvanized Steel Duct

- Stainless Steel Duct

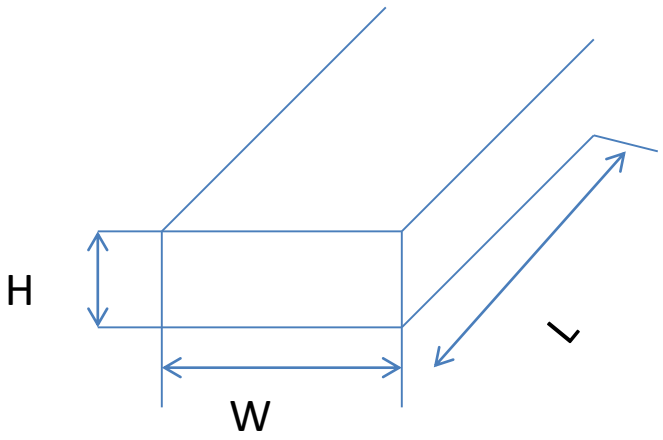
- Textile (Fabric) Duct


SMACNA
Sheet
Metal
and Air Cond.
Contractors
National
Association

Air Duct Design (Sizing)

1. False Ceiling Height

2. Aspect Ratio



Aspect Ratio $\frac{W}{H}$ <= (1 : 4)

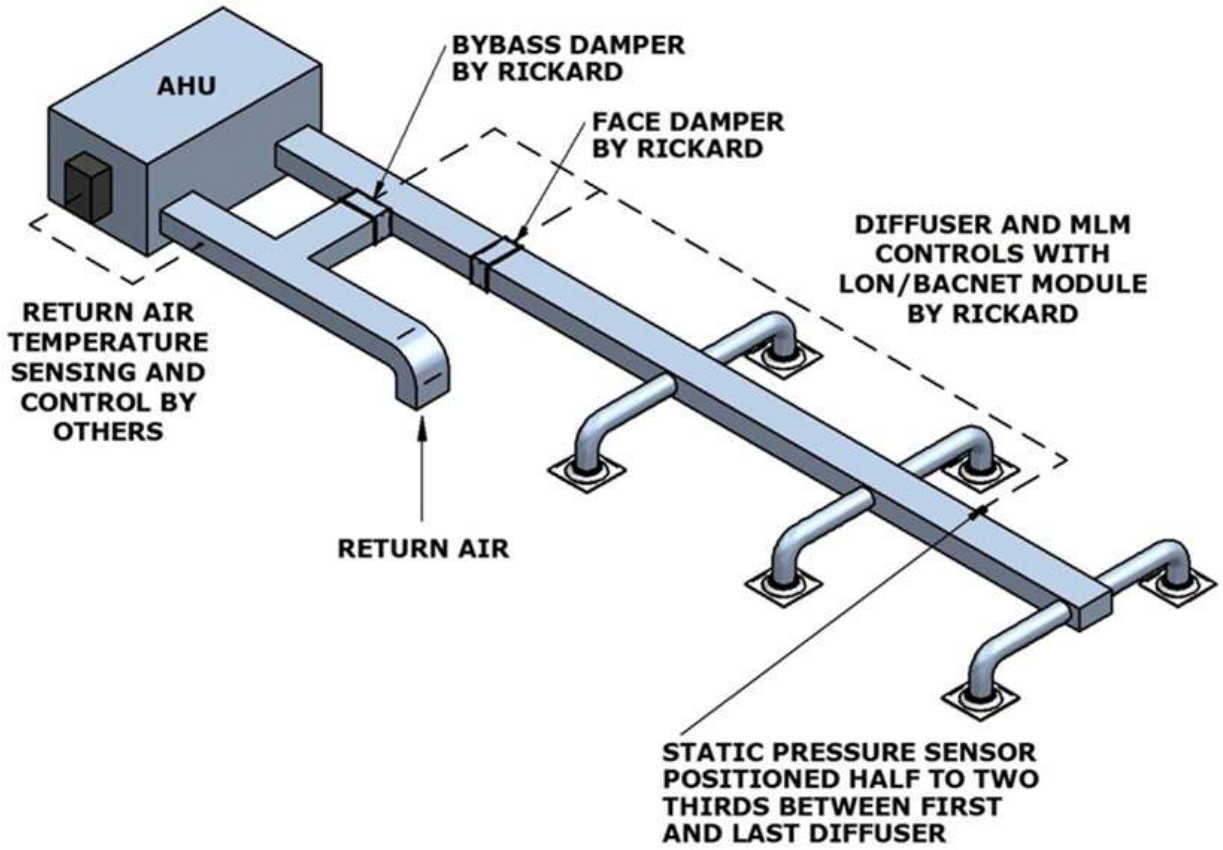
3. Air Velocity

– *For Example*

• استديو	500 : 350	قدم/د
• مكان سكن	650	قدم/د
• غرف العمليات	900	قدم/د
• مصنع	1200	قدم/د

Application	Controlling factor: noise generation main ducts	Controlling factor: duct friction			
		Main ducts		Branch ducts	
		Supply	Return	Supply	Return
Residence	3 (600)	5 (1000)	4 (800)	3 (600)	3 (600)
Apartments Hotel bedrooms Hospital bedrooms	5 (1000)	7.5 (1500)	6.5 (1300)	6 (1200)	5 (1000)
Private offices Directors rooms Libraries	6 (1200)	10 (2000)	7.5 (1500)	8 (1600)	6 (1200)
Theatres Auditoriums	4 (800)	6.5 (1300)	5.5 (1100)	5 (1000)	4 (800)
General offices High class restaurants High class stores Banks	7.5 (1500)	10 (2000)	7.5 (1500)	8 (1600)	6 (1200)
Average store Cafeterias	9 (1800)	10 (2000)	7.5 (1500)	8 (1600)	6 (1200)
Industrial	12.5 (2500)	15 (3000)	9 (1800)	11 (2200)	7.5 (1500)

4. Sizing of Air Outlet



Duct Design Methods

1. Equal Friction Method
2. Equal Velocity Method
3. Static Region Method

- **Equal Friction Method**

  - For Supply Air Duct $\Delta P = 0.08$ in W.G/100 ft
  - For Return Air Duct $\Delta P = 0.06$ in W.G/100 ft
  - For Fresh/Exhaust Air Duct $\Delta P = 0.1$ in W.G/100 ft

Thickness of Duct

Duct Pressure Class		Operating Pressure
(in.)	(Pa)	
½" wg	125	Up to ½" wg
1" wg	250	Over ½" up to 1" wg
2" wg	500	Over 1" up to 2" wg
3" wg	750	Over 2" up to 3" wg
4" wg	1000	Over 3" up to 4" wg
6" wg	1500	Over 4" up to 6" wg
10" wg	2500	Over 6" up to 10" wg

الجدول 1.1 تصنيف الضغط

DUCT DIMENSION	PRESSURE CLASS (In W.G.)						
	Positive or Negative						
	½"	1"	2"	3"	4"	6"	10"
8" dn	26	26	26	24	24	24	22
9, 10"	26	26	26	24	22	20	18
11, 12"	26	26	24	22	20	18	16
13, 14"	26	24	22	20	18	18	
15, 16"	26	22	20	18	18	16	
17, 18"	26	22	20	18	16		
19, 20"	24	20	18	16			
21, 22"	22	18	16	16			
23, 24"	22	18	16	16			
25, 26"	20	18					
27, 28"	18	16					
29, 30"	18	16					
31–36"	16						

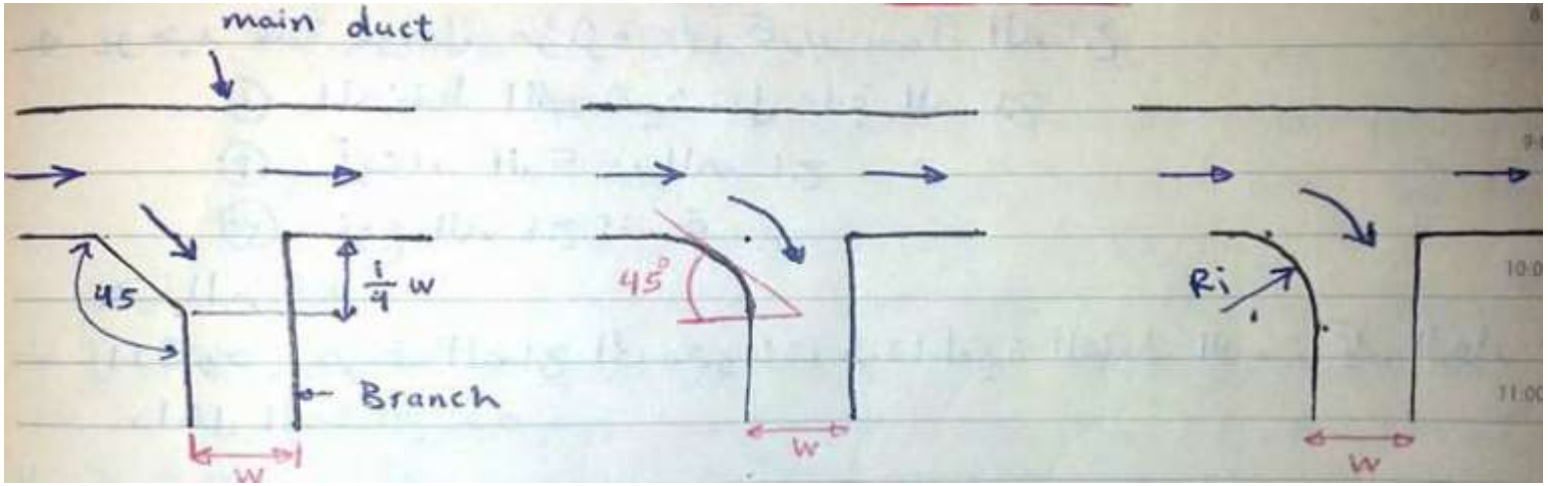
Reinforcement is Required

Gage	Thickness in Inches			Weight				Thickness in Millimeters		
	Min.	Max.	Nom.	Min lb/sf	Nom. lb/sf	Max. lb/sf	Nom. kg/m^2	Min.	Max.	Nom.
33	.0060	.0120	.0090	.2409	.376	.486		.1524	.3048	.2286
32	.0104	.0164	.0134	.4204	.563	.665		.2642	.4166	.3404
31	.0112	.0172	.0142	.4531	.594	.698		.2845	.4369	.3607
30	.0127	.0187	.0157	.5143	.656	.759	3.20	.3188	.4783	.3988
29	.0142	.020	.0172	.5755	.719	.820		.3569	.5169	.4369
28	.0157	.0217	.0187	.6367	.781	.881	3.81	.3950	.5550	.4750
27	.0172	.0232	.0202	.6979	.844	.943		.4331	.5931	.5131
26	.0187	.0247	.0217	.7591	.906	1.004	4.42	.4712	.6312	.5512
25	.0217	.0287	.0247	.8407		1.167		.5274	.7274	.6274
24	.0236	.0316	.0276	.9590	1.156	1.285	5.64	.6010	.8010	.7010
23	.0266	.0346	.0306	1.0814		1.408		.6772	.8772	.7772
22	.0296	.0376	.0336	1.2038	1.406	1.530	6.86	.7534	.9534	.8534
21	.0326	.0406	.0336	1.3263		1.653		.8296	1.0296	.9296
20	.0356	.0436	.0396	1.4486	1.656	1.775	8.08	.906	1.106	1.006
19	.0406	.0506	.0456	1.6526		2.061		1.028	1.288	1.158
18	.0466	.0566	.0516	1.8974	2.156	2.305	10.52	1.181	1.441	1.311
17	.0525	.0625	.0575	2.1391		2.546		1.331	1.591	1.461
16	.0575	.0695	.0635	2.342	2.656	2.832	12.96	1.463	1.763	1.613
15	.0650	.0770	.0710	2.6481		3.138		1.653	1.953	1.803
14	.0705	.0865	.0785	2.8725	3.281	3.525	16.01	1.794	2.204	1.994
12	.0854	.1014	.0934	3.4804		4.133		2.162	2.5823	2.372
12	.0994	.1174	.1084	4.0516	4.531	4.786	22.11	2.523	2.983	2.753
11	.1143	.1323	.1233	4.6605		5.394		2.902	3.362	3.132
10	.1292	.1472	.1382	5.2675	5.781	6.002	28.21	3.280	3.740	3.510
9	.1442	.1622	.1532	5.8795		6.614		3.661	4.121	3.891
8	.1591	.1771	.1681	6.4874	6.875	7.222		4.040	4.500	4.270

الجدول 1.2.أ جدول مقاس الفولاذ المجلفن

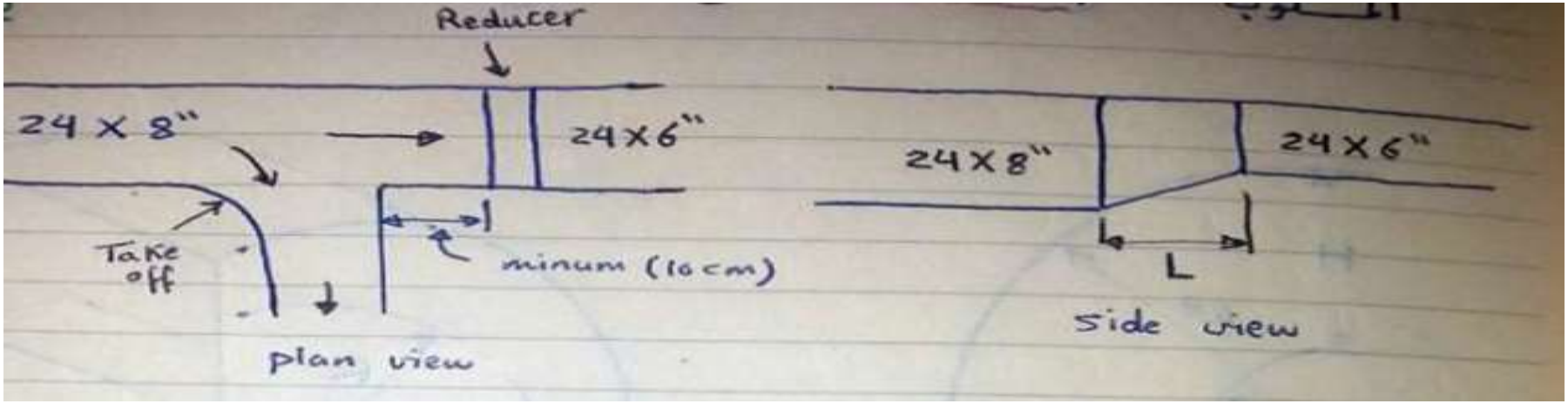
Duct Fitting

- Take Off



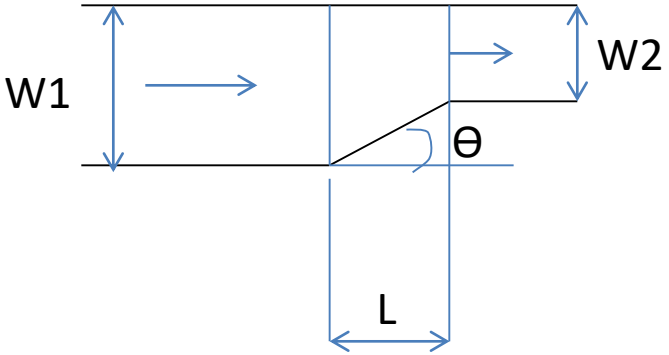
- Ri = 10 cm ---------- W <= 14’’
- Ri = 15 cm ---------- 14’’ < W <= 24’’
- Ri = 20 cm ---------- 24’’ < W <= 32’’
- Ri = 25 cm ---------- W > 32’’

Reducer



Reducer

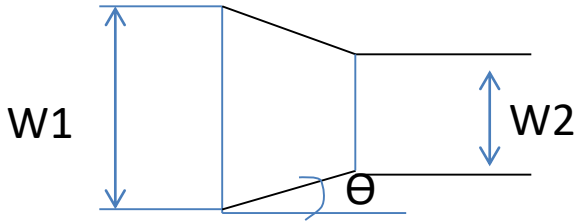
Single Act



$L_{min.}$ = 30 cm

Θ = 30°

Double Act

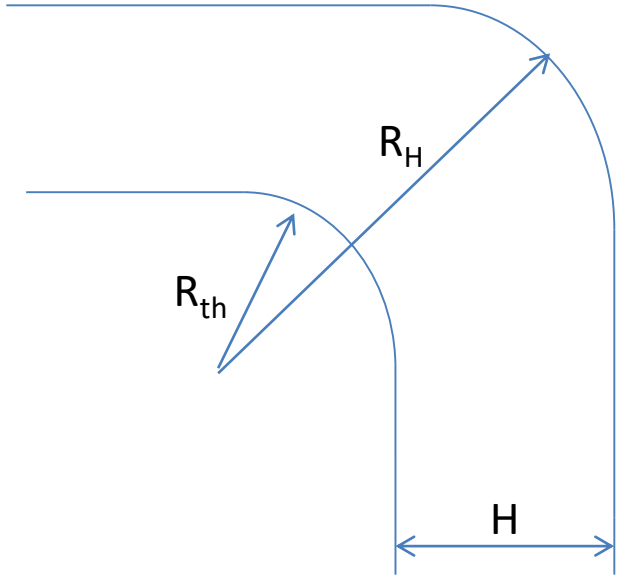


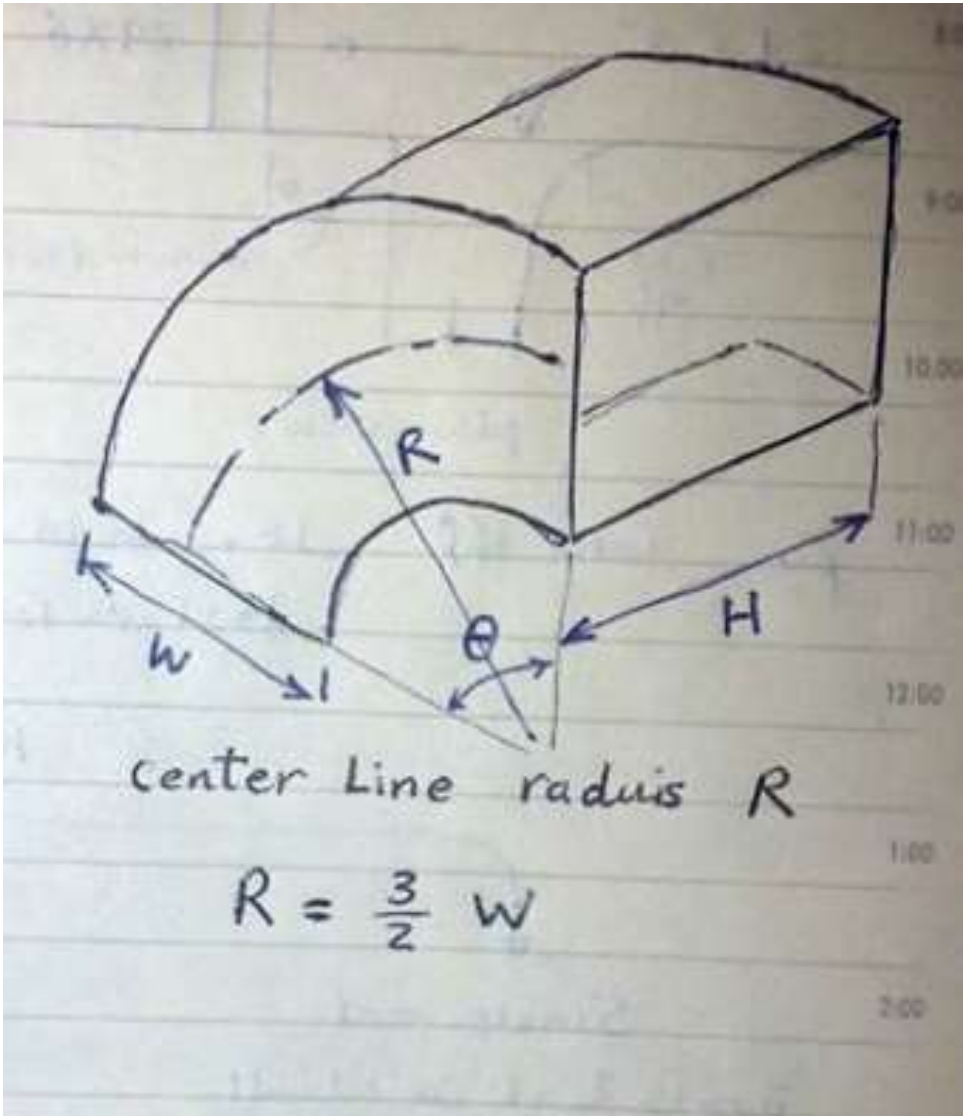
$L_{min.}$ = 30 cm

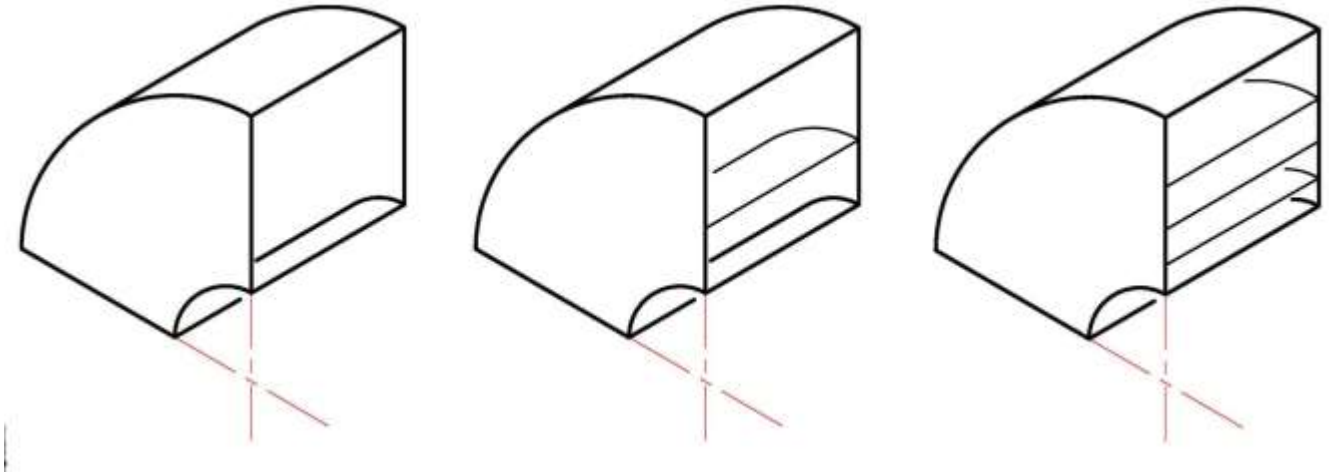
Θ = 15°

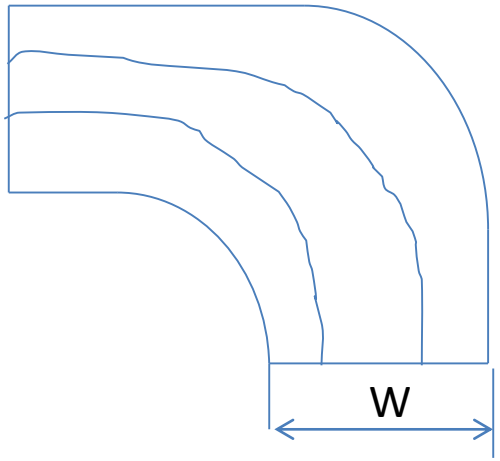
Elbow

- R_{th} = Throat Radius
- R_H = Heel Radius
- $R_H = R_{th} + H$
- R_{th} = 6’’ <u>if</u> H < 18’’
- R_{th} = 10’’ <u>if</u> H >= 18’’




R
H
θ
W
center Line raduis R
R = 3/2 W





If W = 10’’ …… Non.

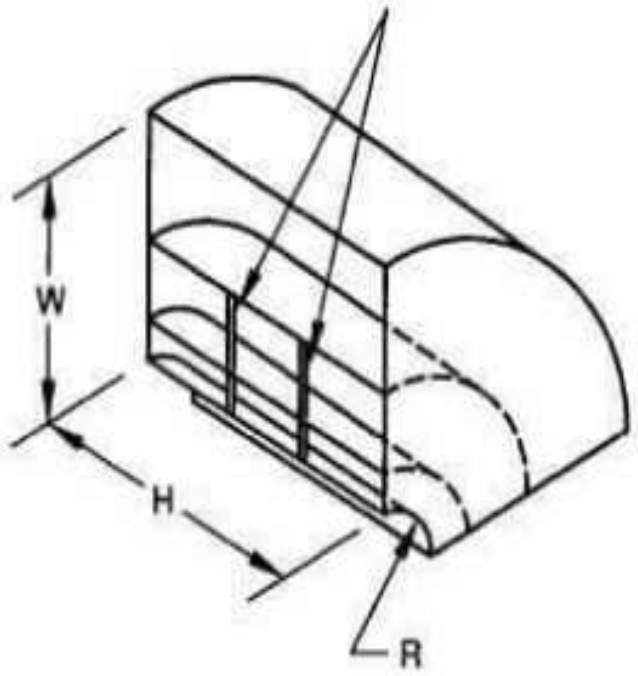
W = 12 : 16’’ …… 1

W = 16 : 24’’ …… 2

W= 24 : 30’’ …… 3

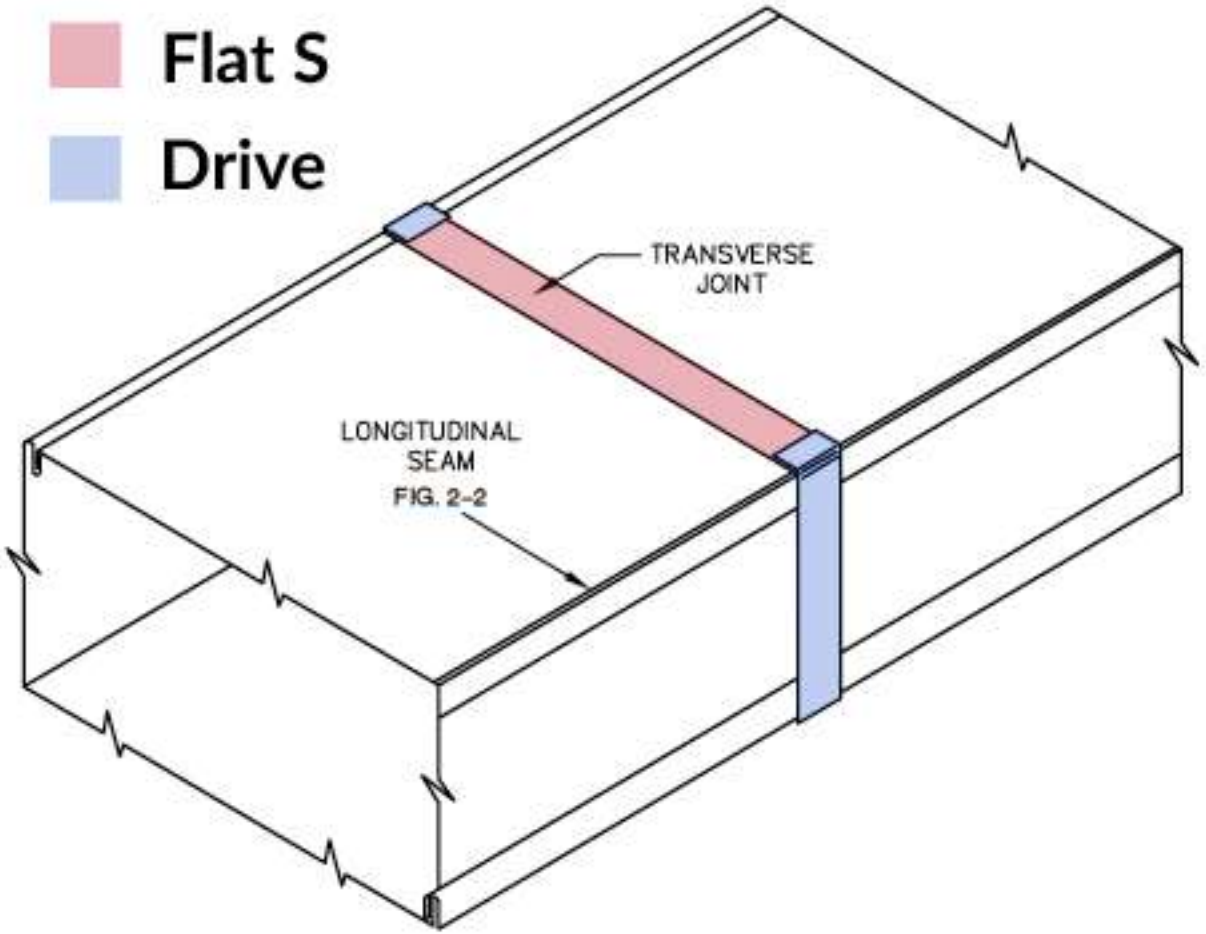
LOSS COEFFICIENTS FOR USE OF 1, 2, OR 3 VANES DEPENDS ON ASPECT RATIO (H/W) AND A CURVE RATIO (CR) WHICH DEFINES VANE LOCATION IN TERMS OF THROAT RADIUS. THIS DATA IS IN THE 1990 SMACNA DUCT DESIGN MANUAL TABLE 14-10 (G) AND IN THE ASHRAE HANDBOOK.

1/4" (6.4 mm) TIE RODS ON INLET & OUTLET WELDED TO VANES AND INSIDE FACE OF ELBOW



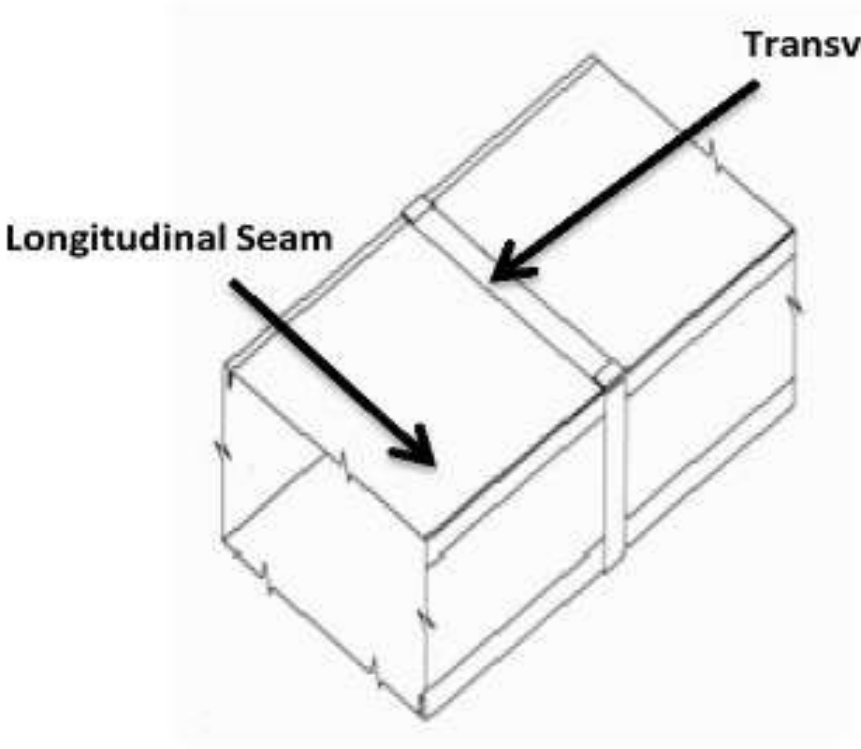
ELBOW DEPTH H REQUIRED (mm)	NUMBER OF TIE RODS
0 - 12" (305)	NONE
13 - 20" (330 - 508)	1
21 - 48" (533 - 1219)	2
49 - 64" (1243 - 1626)	3
65 - 80" (1651 - 2032)	4

Duct Connection



DRIVE SLIP
T-1

HEMMED "S" SLIP
T-6



Joint Options

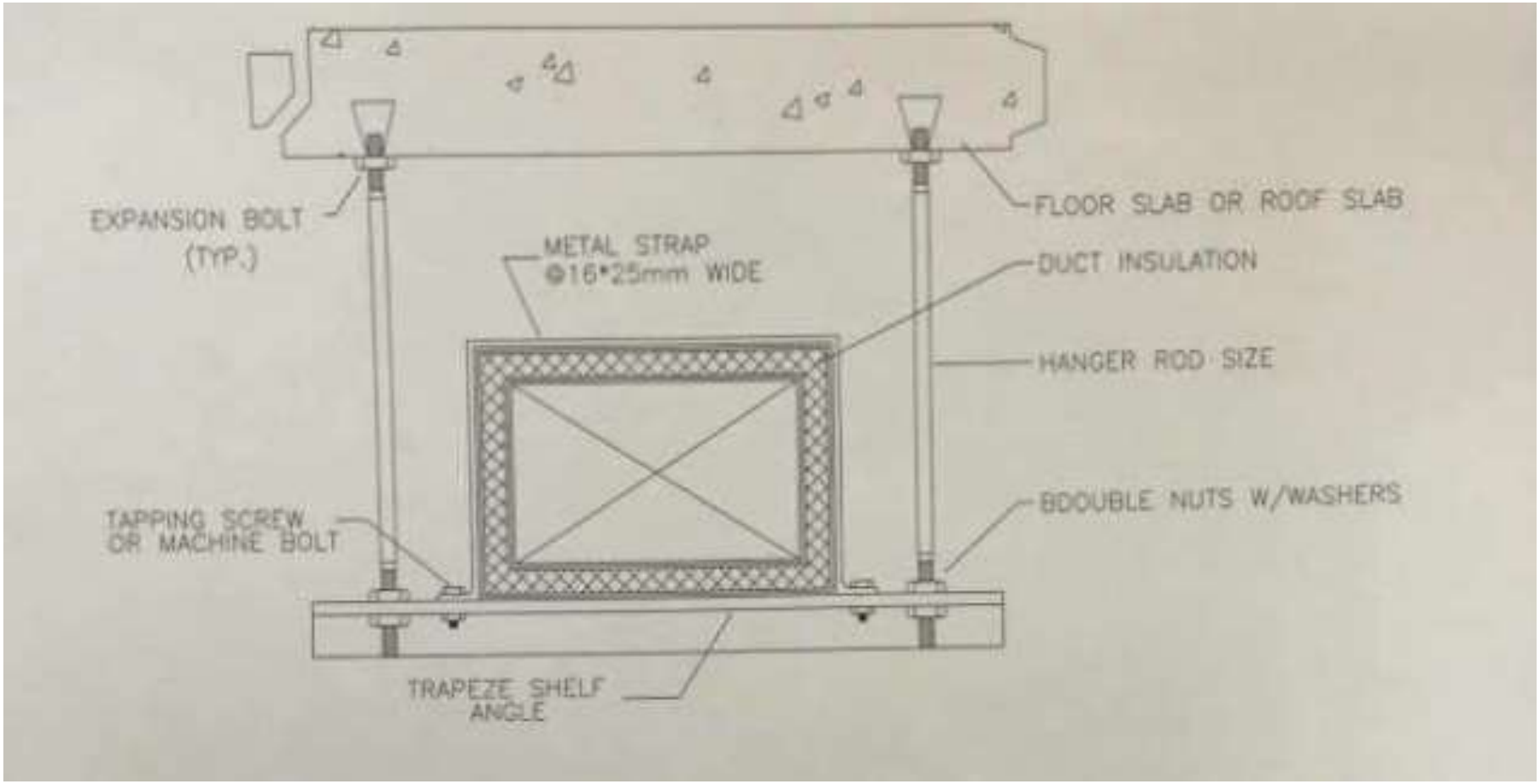
Drive Slip T1

Plain S Slip T-5

Hemmed S Slip T-6

Double S Slip T-8

Duct Supports
Hangers



أكبر بعد للمجرى (بوصة)	قطر قضيب التعليق (مم)	زاوية التعليق (مم × مم × مم)	المسافة بين العلاقات (متر)
حتى ٢٠	٨	٢ x ٢٥ x ٢٥	٣
٢١ إلى ٣٢	١٠	٢.٥ x ٣٥ x ٣٥	٢.٥
٣٣ إلى ٤٠	١٠	٣ x ٣٥ x ٣٥	٢.٥
٤١ إلى ٦٠	١٢	٣ x ٤٠ x ٤٠	٢
أكبر من ٦١	١٢	٥ x ٥ x ٥٠	١.٥

Vibration Isolators
Canvas

Volume Control Damper
VCD

Parallel Blade Damper

Opposed Blade Damper

Fire Damper F.D

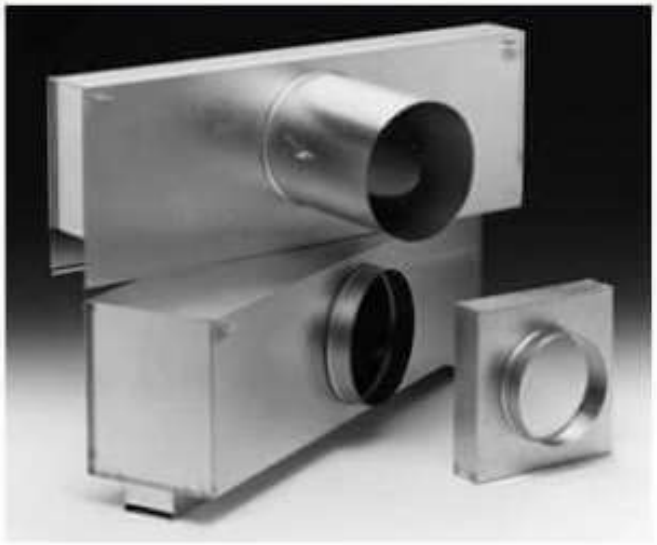
Smoke Damper

Plenum Box

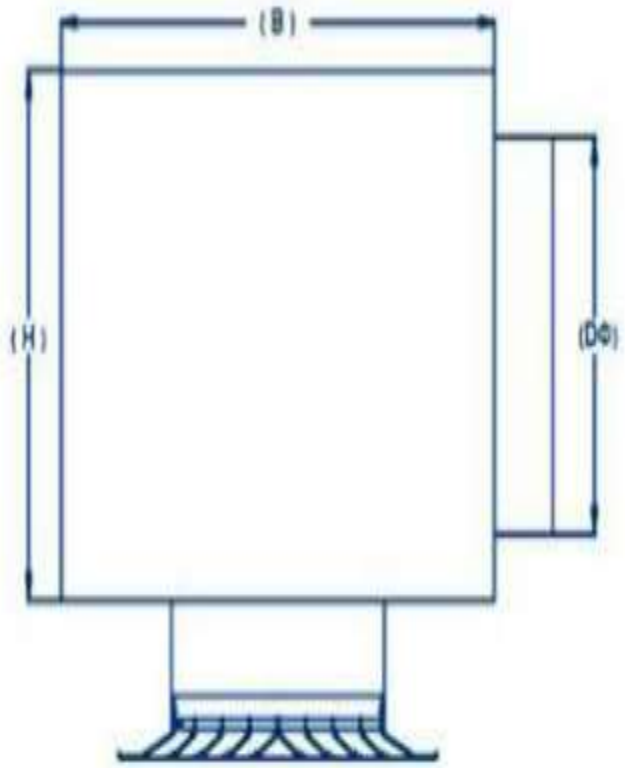
Plenum Box

- *Plenums.*

Plenums are the central distribution and collection units for an HVAC system.



Nominal Dimension (m.m)	H	B	DΦ
150x150	200	250	150
225x225	300	330	250
300x300	350	400	300
370x370	400	500	350
450x450	450	550	400

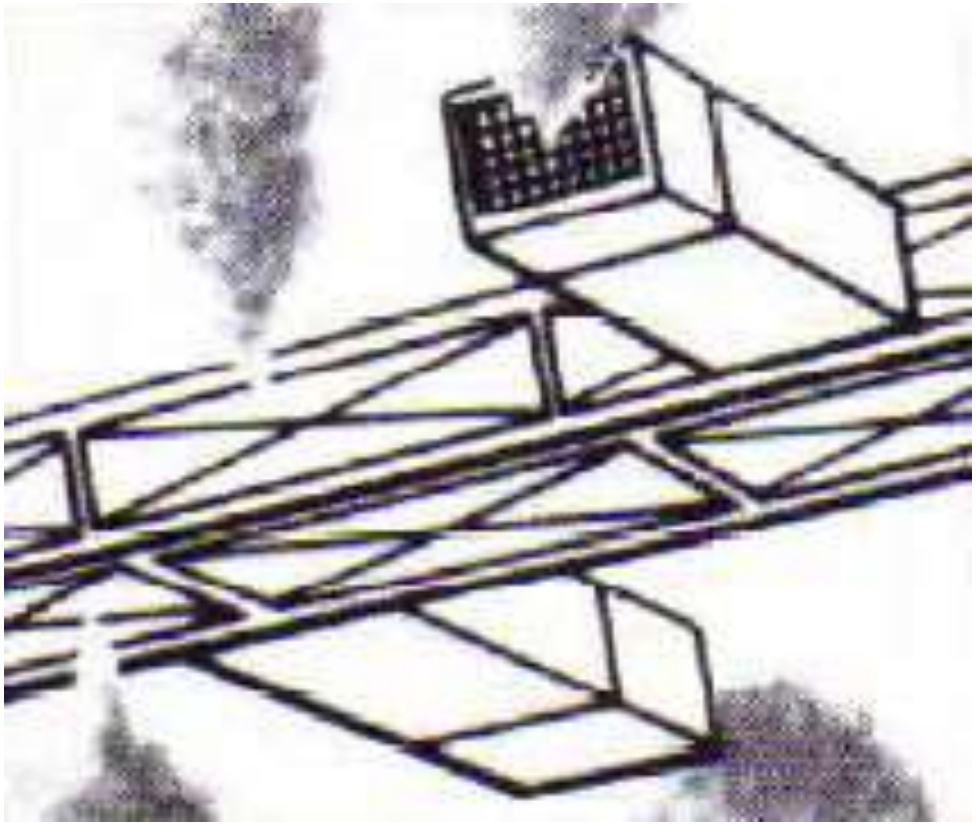


Flexible Duct

Flex. Duct Size (Inch)	Design Air Flow (CFM)
5	50
6	75
7	110
8	160
9	225

Duct Leakage Test

1. Smoke Test

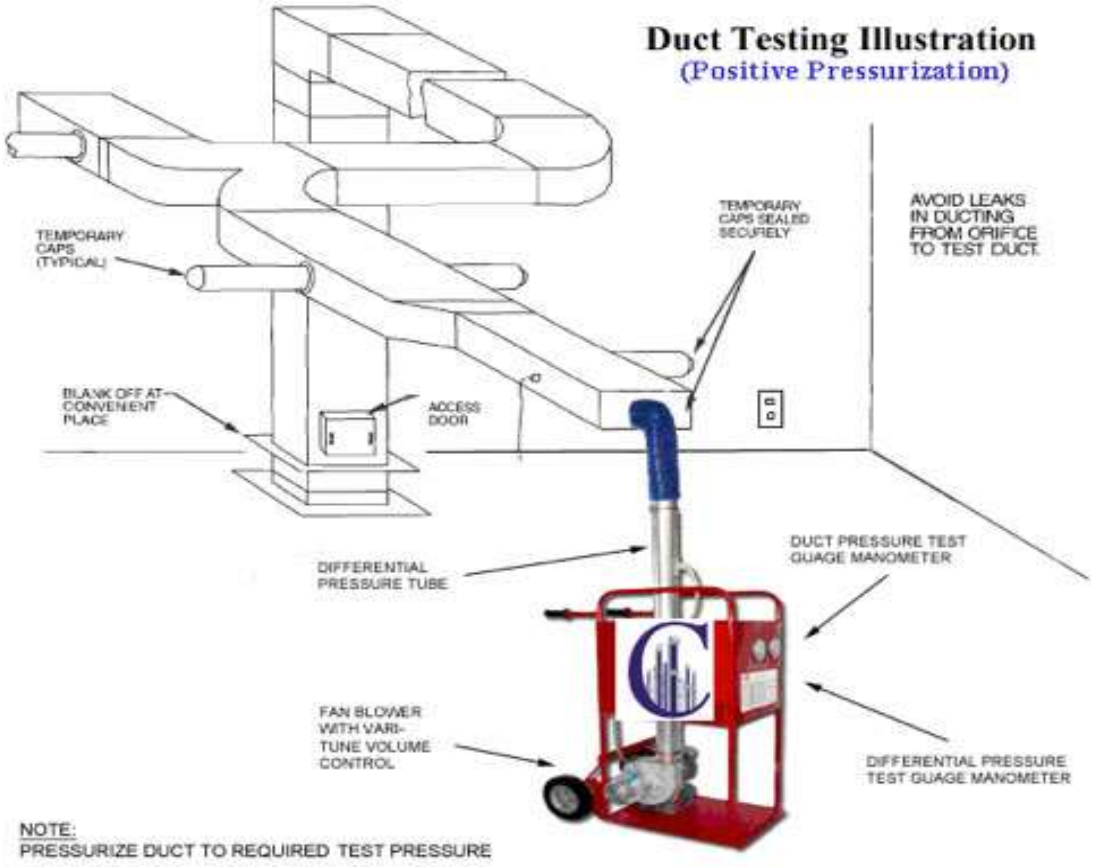


Duct Leakage Test

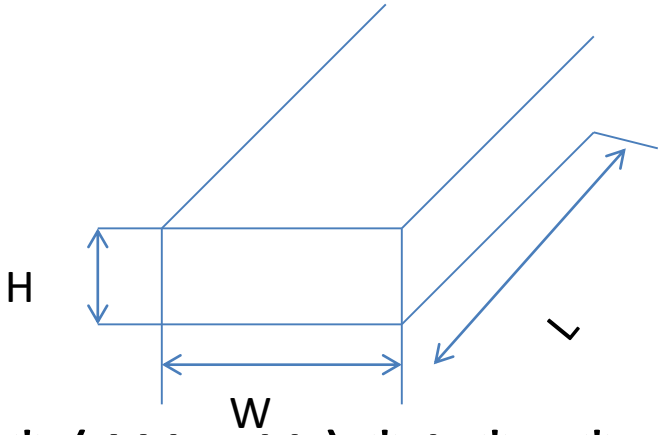
2. Light Test

Duct Leakage Test

3. Pressure Test



Duct Weight



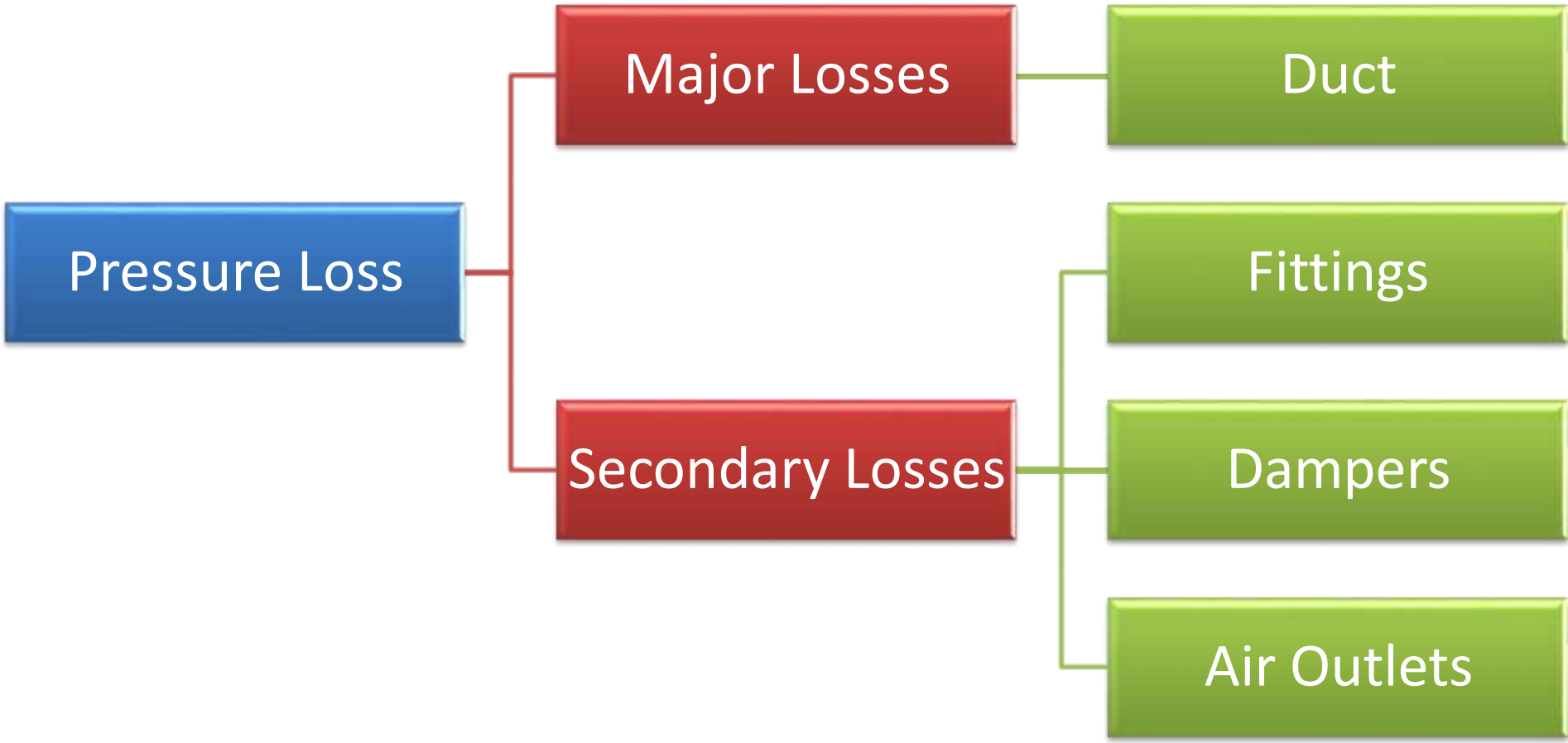
- Weight = 2 * (W + H) * L * t * ρ
- W :Duct Width
- H :Duct Depth
- L :Duct Length
- t :Duct Thickness
- ρ :Density = 7850 kg/m^3
- Weight (Kg) = 0.4 (W + h) * L * t

Insulation Weight

- Insulation Area (m^2) = 0.05 (w + h) * L

- عدد لفات العزل المستخدمة = $\frac{\text{مساحة العزل}}{\text{مساحة اللفة الواحدة}}$
- $\frac{\text{عدد لفات العزل}}{\text{وزن الصاج بالطن}}$ = 6 : 7.5 لفة لكل طن

Static Pressure Calculation



- $\frac{\Delta P}{L}$ = (.01 / 100) * longest duct length (ft)

- Equivalent length of take off = 5 ft.

- / / // // elbow = 10 ft.

- // // // reducer= 15 ft.

- // // // branches= 20 : 25 ft.

- **ESP = (longest duct length + tot. equiv. length of fittings) * (0.1/100) + (press. drop through volume damper, fire damper, air outlets) = …….. In . WG Water**

- **= …… in w.g * 1.25 (safety factor) = …… in w.g**